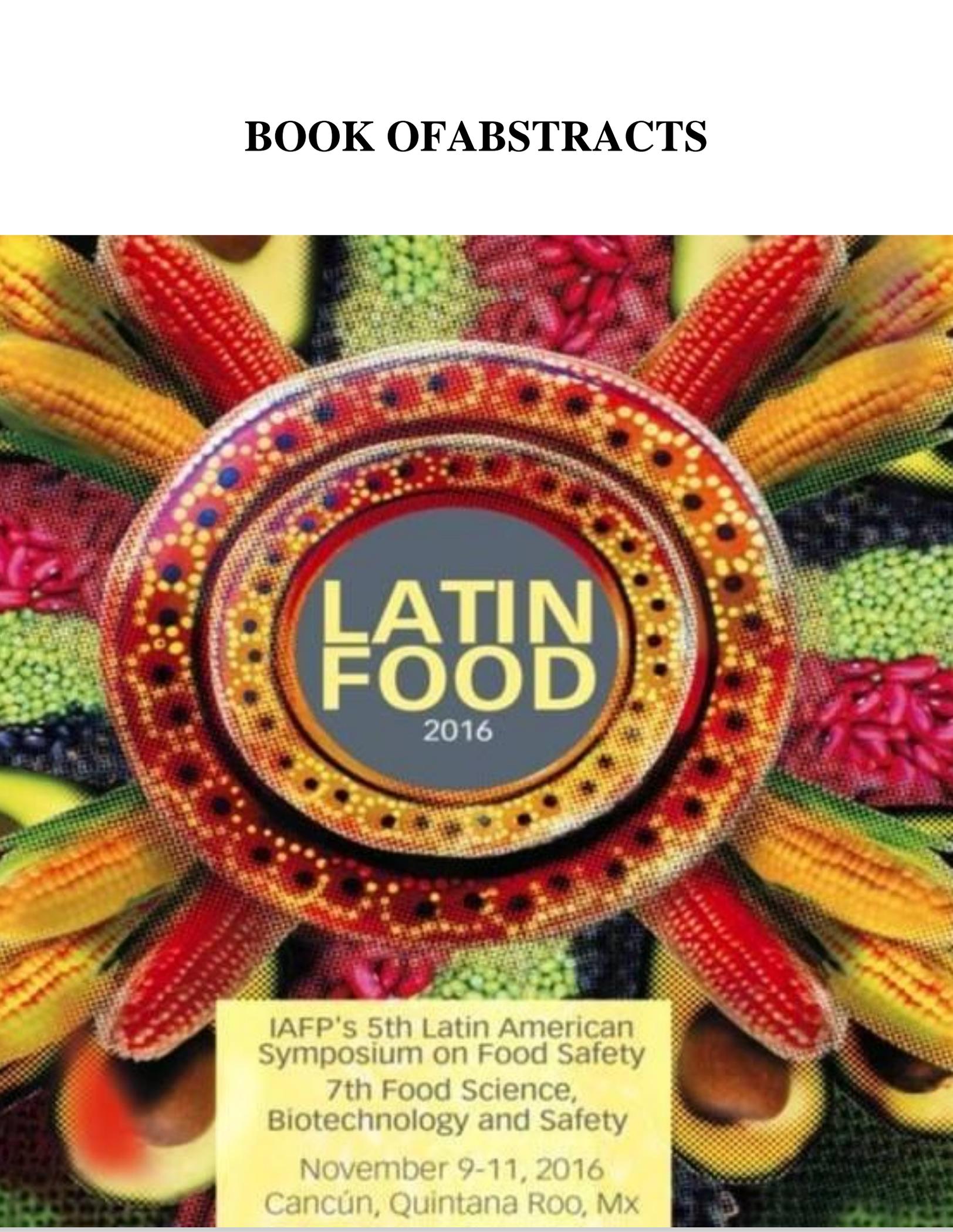


BOOK OF ABSTRACTS



**LATIN
FOOD**
2016

IAFP's 5th Latin American
Symposium on Food Safety
7th Food Science,
Biotechnology and Safety

November 9-11, 2016
Cancún, Quintana Roo, MX

**Latin
Food 2016**

IAFP's 5th Latin American Symposium in Food Safety
7th Food Science, Biotechnology and Safety Meeting



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**IAFP's 5th Latin American Symposium in Food Safety
7th Food Science, Biotechnology and Safety Meeting**



**Asociación Mexicana de Ciencias
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Welcome

The Mexican Association for Food Protection and the Mexican Association for Food Science are professional associations in the area of food science including food biotechnology and food safety. Both associations are joining efforts to organize Latin Food 2016, where international professionals from Industry and Academia, with particular expertise in food science and/or food safety will meet from November 9-11 in Cancun, Mexico. Attendees from Argentina, Australia, Brazil, Chile, China, Colombia, Costa Rica, Ecuador, France, Germany, India, Iran, Ireland, Israel, Italy, Japan, Mexico, Pakistan, Panama, Spain, United Kingdom and the United States of America, among other countries, will be participating in nearly 700 scientific presentations.

Cancun located on the beautiful Caribbean Sea, is one of the world's top destinations. Visitors may wish to spend some discretionary time in Mexico enjoying the white sands and warm waters characteristic of this venue before, during, or after the meeting. Many spectacular archeological zones, natural sanctuaries, and eco parks on Mexico's Yucatan Peninsula are within easy driving distance.

We would like to invite you to join us for this Meeting!

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I. EMERGING TECHNOLOGIES

Effect of osmotic dehydration with or without vacuum pulses in guava shells in osmotic solutions of glucose-sucrose.

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The effect of osmotic dehydration of guava shells (*Psidium guajava* L.) at two temperatures (30 and 50 °C) with or without vacuum pulses and three types of osmotic solution (glucose, sucrose and a mix of glucose-sucrose) was evaluated by calculating the water loss (WL), solids gain (SG) weight reduction (WR), $\Delta WL/\Delta SG$, mass transfer coefficients (Ka, Ks), color changes (ΔE) and hardness changes. Guava shells were blanched and osmotically dehydrated during 2 hours at atmospheric pressure or with vacuum pulses (10 cm Hg for 3 min) in periods of 15 min, to subsequently being drain, packed and stored under refrigeration by triplicate, mean values and standard deviation were calculated. The results shown that the mass transfer coefficients (Ka, Ks) were higher for the trials of osmotic dehydration applying vacuum pulses and using glucose as osmotic solution, at a temperature of 30°C, because of the use of pressures below atmospheric facilitate the water outlet from the product. Glucose, being of lower molecular weight than sucrose, can more easily migrate into the guava tissue. ΔE presented the greater variations by using sucrose-glucose as osmotic solution at a temperature of 50 °C. WL increased with temperature and vacuum. The greater SG was obtained by using sucrose. The highest relationship ($\Delta WL/\Delta SG$) was obtained with glucose at 30°C at vacuum during the first 60 minutes and glucose at and 50 °C at atmospheric pressure at the end of the process. The better osmotic conditions found were: glucose at 50 °C for colour and with any kind of solution for hardness.

Keywords: guava shells, osmotic dehydration, vacuum pulses, colour changes

Effect of microwave pre-treatment on the water loss and oil uptake during deep-fat frying of potato strips

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In recent years, many researches have focused on the development of low fat fried food products, due to greater awareness of nutrition of consumers. The aim of this study was to evaluate the effect of microwave pre-treatment (200, 400 and 600 W) on moisture loss, oil absorption and physical changes during frying of potato strips. Rectangular strips of potato (variety Alpha), of 0.5x0.5x4.0 cm were cut, and were subjected to microwave pre-treatment and subsequently the strips were fried at 140, 160 and 180 °C at different time intervals (0-5 min). The results showed that microwave pretreatment increased the water loss constant in comparison with control samples, The ANOVA shows that the temperature and pretreatment level had a significant influence ($P=0.05$) in the final fat content. The comparison of means test Tukey indicates that there are significant differences ($P=0.05$) between the different powers used in the microwave, showing that with the power of 600 W occurs less oil absorption. The lowest oil-uptake levels were observed when potato strips were microwave pre-treated with a microwave power of 600 W, being the oil content of 0.091, 0.124 and 0.099 kg/kg db at the frying temperatures of 140, 160 and 180 °C, respectively. In conclusion, a brief microwave pre-treatment of potato strips allowed potato products with lower levels of oil with respect to commercial samples, also this pretreatment did not affect the color of potato strips as compared with the control.

Keywords: *Solanum tuberosum*, convective drying, Fat, Moisture content.

Influence of Microwave on Lignin Degradation and Content of Cellulose and Hemicellulose of the Seed of *Crescentia alata*.

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This study aims to evaluate the effect of microwave pretreatment on lignin degradation and an increment in the content of hemicellulose and cellulose in *Crescentia alata* seeds. To carry out the methodology was used a response surface factorial desing 3^2 to evaluate the effect of the factors time and temperature at three levels each on three response variables on percentage of delignification and increasing evaluated surface area percentage of hemicellulose and cellulose to favor enzymatic attack, the design was evaluated in the centurión statgraphic program. For this research *Crescentia alata* seeds were used, which were washed, dried, shelled and crushed; 5 g of sample were taken for each treatment, in which water was added in a solid/liquid ratio 1:2, and placed in a microwave at 400 W at different different time and temperature. Samples were transferred to 50 mL Falcon tubes which were centrifuged at 4000 rpm for 30 min, once the phases were separated, the cake was dried in an oven at 70 °C until constant weight for further evaluation by FTIR. The quantitative absorption spectrometry analysis was based on the Bouguer Beer Lambert law. The obtained results with a 5 % significance indicate that the time and temperature have a positive effect on achieving up to 36 % delignification at 100 min and 70 °C, while was able to increase the surface area of hemicellulose and cellulose up to 14 % at 100 min and 50 °C where time only had a positive effect. These results favor the enzymatic attack by using commercial hydrolytic enzymes. Microwaving has been used for the preparation of active ingredients because its main advantage is selective heating, this method provides an alternative as a pretreatment in oil seeds to extract oil using commercial hydrolytic enzymes and thus increasing oil yield.

Keywords: Microwave, FTIR, Enzymes

Application of Ultrasound during Immersion Freezing of Water

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The aim of this investigation was to evaluate the effect of power ultrasound during the immersion freezing of distilled water. 30 ml was the sample's volume. The ultrasonic equipment used was a titanium probe with a diameter of 1.4 cm (Hielscher, UP200s) operating at a frequency of 25 kHz, giving an acoustic power density of 105 W/cm² and sonic radiation pulse ranging from 0.2 to 1 second. Two sonic radiation pulses were used: 0.4 and 0.8 seconds along with two acoustic power densities: 42 W/cm² and 105 W/cm². The coolant was an ethylene glycol-water solution (50%:50% in volume) and it was tempered to -29±2°C using a probe type chiller (Polyscience, IP-35). The samples were frozen in a 6 L capacity adiabatic container. The samples' temperature variations were recorded with T-type thermocouples connected to a data acquisition software (LabView National Instruments). Freezing time was set to 1 hour and the ultrasonic power was applied uninterruptedly for 50 min since recirculation started. For each treatment three replications were realized. No significant differences were found in the cooling rate (P>0.05) but when 42 W/cm² intensity and 0.4 seconds cycle were used, the initial freezing point was the lowest: -3.5°C (P<0.05) and the cooling rate was the highest: 0.0727 min⁻¹ (P=0.05). It was also noted that the application of ultrasound increases the crystallization time (P<0.05) up to 35.6 min when intensity of 105 W/cm² and 0.8 s cycles were used. These results show that at lower sonication intensities the wave loses strength causing delays in the initialization of crystallization and crystal growth. Nonetheless, these intensities may ease the molecule arrangement over the ice nuclei by cause of micro streams formed just after cavitation occurs. Moreover, long sonication times generate a heterogeneous cavitation field and existing areas where the waves start to accumulate and can no longer move, becoming a heat transfer resistance because excess of acoustic energy starts to absorb as heat provoking a raise in the medium and sample's temperatures. For their viability, these results allow us to consider the application of ultrasonic power on the freezing of meat.

Keywords: Ultrasound, Immersion freezing, Sonocrystallization.

Evaluation of Functional Properties of Partially Skimmed Milk Treated By Thermosonication

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Bovine milk containing different milkfat levels was pretreated by selected thermosonication (TS) treatments as a means of incorporating whey proteins from a whey protein concentrate (WPC-80) that functional-wise serves as potential substitutes of milk fat. Bovine milk was skimmed, standardized at 1 and 2 g fat /100 g milk, later adding 1.33% and 0.67% WPC-80, respectively. Each mixture was subjected to TS treatments coupling high intensity ultrasound (US) (24 KHz, 400W theoretical power) at selected processing temperatures (50, 55 and 60°C) and exposure times (2, 4 and 6 min) with a LTLT pasteurization (63°C, 30 min) according to a randomized complete design with three replicates. Whole milk (3 g fat /100 g milk) was LTLT pasteurized and used as a control. Physicochemical parameters (pH, titrable acidity, color) and functional properties (water holding capacity, WH, gel strength, GS) were determined. All tests were run in triplicate. Two-way ANOVA and Tukey's Honestly Significant Difference test were used for multiple comparisons using a level of significance of 0.05. Selected reduced milkfat formulations (1%) and US treatments (50°C, 2 min) did not exhibit significant ($p < 0.05$) differences in all physicochemical properties, WHC and GS when compared to those of control treatment. In this sense, WPC-supplemented milk treated by TS seems to be a promising tool for developing reduced fat dairy products.

Keywords: Thermosonication, Low-fat milk, WPC)

Oil extraction from *Moringa oleifera* seeds

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Essential oils are lipid-based aromatic substances found in virtually all plants. In the case of the *Moringa oleifera*, it has been reported that the oil content in its seed is 35% v/w. Antioxidant activity has been attributed to the *Moringa oleifera* seed oil; in this seed this property is directly attributed to the polyphenols, mainly gallic acid, quercetin and kaempferol; Also, there are reports on the antimicrobial activity against bacteria (*Pasteurella multocida*, *Escherichia coli*, *Bacillus subtilis* and *Staphylococcus aureus*), fungi (*Fusarium solani solani*) and Rhizopus strains. The methods for obtaining essential oils determine their potential uses. The type of solvent used can contaminate or limit the ways in which oils are used depending on the solvent's toxicity and the process used for its disposal. In this paper two methods for extracting oil from seeds of *Moringa oleifera* were tested: soxhlet and ultrasound using ethanol as a solvent. In the ultrasound method, ethanol was evaporated using a rotary evaporator. In total, 16 oil extractions were performed, 8 for each method. Yield was quantified according to the following formula $Y = (V / M) * 100$ where Y: yield (%), V: volume of essential oil (ml) and M: mass of the plant material (g). Data was statistically analyzed finding significant difference ($P < 0.01$) between the two extraction methods having a 3.4% (b) yield from ultrasound and 12.9% (a) for soxhlet.

Keywords: *Moringa oleifera*, seed oil, extraction methods.

Influence of High-Intensity Ultrasound Application on the Proteomic Profile of Chicayota Seed (*Cucurbita Argyrosperma Sororia*)

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In recent years, the development of functional ingredients to be incorporated in foods has been widely investigated. Extraction of bioactive peptides from vegetal sources is of great interest since these low-cost and easily accessible raw materials have a high nutritional value. The seeds of Chicayota (*Cucurbita argyrosperma sororia*), a wild pumpkin consumed in rural communities of South-Central Mexico, are an important source of protein. The application of high-intensity ultrasound (US) is an innovative, effective and innocuous pretreatment method for the release of bioactive peptides from both vegetal and animal matrices, thanks to the cavitation-induced physical and chemical effects which may modify complex protein molecules. The main goal of this work was to evaluate the effect of high-intensity ultrasound application on the proteomic profile of Chicayota seed. Proximate chemical analysis was carried out along with electrophoretic characterization of total and storage protein in Chicayota seed flour by means of one-dimensional and two-dimensional sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE). Ultrasonic treatment of protein solutions was carried out by an ultrasonic homogenizer (Sonics & Materials Inc., 20 kHz, 130 W, diameter probe: 6 mm) at constant temperature (70°C), implementing different processing times (0, 5, 10, 15 y 20 min). After the US-assisted treatment, an electrophoretic characterization of total and storage protein was carried out in order to observe possible changes induced to the protein structure by the US application. The total protein content of Chicayota seed was determined as 30.17%. The seed showed to be rich in linoleic and oleic acid. The amino acids with the highest content found were leucine and cysteine. Glutelins and 11S globulins were the most abundant protein fractions observed. Preliminary results show that the application of US-assisted treatment at 70°C caused gradual changes in protein structure as a function of treatment time. In conclusion, the application of US-assisted pretreatment constitutes a relatively quick and easy way of protein structure modification, making it an emerging technology of great interest for the process of obtainment and incorporation of Chicayota seed peptides into functional foods.

Keywords: Emerging technologies, Ultrasound-assisted pretreatment, Peptides

Effect of starch modification in the properties of an edible film based on the mixture chitosan–starch

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The growing consumer demand for microbiologically safe food, and longer life, has directed the industry to develop new food processing strategies, where the concept of edible films (EF) emerges as alternative to this problem. EF may comprise lipids, carbohydrates, proteins or their mixture. Among the carbohydrates studied to produce EF are starch, cellulose derivatives, chitosan (CH) and alginate. The CH films are clear, strong, flexible, and show good barrier to oxygen, and antimicrobial effect. Starch is renewable, abundant and cheap, and is able to form EF. However, it shows high water vapor permeability (WVP), and poor mechanical properties. To improve resistance to pH, temperature and to avoid retrodegradation, starch has been subjected to various chemical modifications. The aim of this work was to develop an EF based on the mixture CH and modified starch (waxy: WS, acetylated: AS, and oxidized: OS) and establish the relationship between structural and physical properties, using nanotechnology. For edible films, a solution of CH (1% w/v), lactic acid (0.5% v/v), and solutions with three different starches (3% w/v) in distilled water were prepared. Starch-CH (1:1) mixtures were mixed and glycerol was added as plasticizer in the ratio CH:glycerol (1:1). Mechanical properties were evaluated using a nanoindenter, WVP was determined by gravimetric analysis, and the topography of EF by atomic force microscopy. Chemical interactions were analyzed by Raman spectroscopy. Results showed that the presence of CH in starch films improved barrier properties for all three starches used, EF prepared with AS-CH showed the lowest WVP [$1.11 \pm 0.03 \times 10^{-9}$ g/(s m Pa)], as well as barrier properties. CH addition affected EF topography, resulting in smoother surfaces, being the OS-CH the smoothest ($R_q = 3.20 \pm 0.41$ nm). For mechanical properties, CH addition made more flexible and less hard EF, being the most elastic and least harsh that produced with OS-CH film (hardness = 2.30 ± 0.19 MPa, Young's modulus = 0.11 ± 0.06 GPa).

Keywords: edible films, chitosan, modified starch

Optimization of Steam Jet Cooking Corn Starch and Its Effect on Quality and Shelf Life of the Mexican Plum Sauce (Chamoy).

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Steam jet cooking (JC) is a rapid a continuous process that generates high shear stress during starch gelatinization. The optimization of (JC) on corn starch and its impact on quality and shelf life of products based on starch were studied. Response surface methodology was used with a central composite design. The factors used were the processing temperature and slurry's concentration of solids. The regression models of variable viscosity index (Nmm), hardness (N) and damaged starch (%) were obtained. As starch-based product Mexican Plum Sauce (Chamoy) was chosen. Design of one factor (method of gelatinization) totally random was used to assess the physical quality (pH, total soluble solids, viscosity, texture and color) and chemical (acidity) of chamoy. Design of the same factor but with repeated measures was used to determine shelf life according to the viscosity, water holding capacity and texture. ANOVA was performed using comparison of means by Tukey method with a significance of 5%. The optimization results show a positive linear behavior of solids concentration for the three variables. The temperature factor had a linear behavior in variable of starch damage and a quadratic behavior in hardness and viscosity variables, being the dominant factor in this process. The optimal conditions were temperature 88 ° C and 11.7% solids concentration, which maximizes hardness and viscosity of the slurry and minimize the percentage of damaged starch. Gelatinized starch by JC resulted significantly different with respect to TM in all variables however, images scanning electron microscope of gelatinized starch sample show no difference in the degree of damage in the granule. Consistent with these results, the physical and chemical quality and shelf life of chamoy showed no statistical difference between the two methods of gelatinization showing that the jet system cooker allows to get starch-based products with the same quality or even better than those obtained in TM but in less time and low production cost.

Keywords: steam jet cooking, corn starch gelatinization, shelf life, starch-based products.

Effect of Pre-treatment With α -tocopherol on Quality of Bell Pepper (*Capsicum annuum*) during Storage at -18°C -Thawed and Storage at 4°C

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The aim this study was to evaluate the effect of blanching pre-treatment with tocopherol nanocapsules and the freeze-thaw process during the storage of bell pepper at -28°C and 4°C on the quality parameter and shelf life. To carry out the study, red bell pepper was selected without mechanical damage, fungi and pitting. Peppers were washed, disinfected and cut into pieces of $2 \times 2 \times 0.7$ cm, which were blanching by dipping in colloidal dispersions with α tocopherol (200 mg / kg) at $50^{\circ}\text{C}/5$ min and quickly cooled by immersion in water at $4^{\circ}\text{C}/2$ min, then drain and were packaged in polyethylene bags with 100 g of product. Samples were frozen at -28°C , and stored frozen at -18°C during 7, 14, 18 and 25 days, later the samples were thawed and stored at 4°C during 2, 5 and 7 days. The changes in physicochemical parameters and enzymatic behavior were monitored. The bell pepper treated with nanocapsules showed better characteristics in firmness with initial values of 4.06 N and 2.5 N at the end of storage time, while emulsion had 2 N and control with the largest loss of firmness with 1.5 N. The α -tocopherol incorporate in colloidal systems had a greater influence in the maintenance of red color in bell pepper. On the other hand, the pH, acidity titratable remained unchanged in samples with tocopherol inside ranges of the NOM. Furthermore, the loss of ascorbic acid was minimum for samples with tocopherol of 115 mg/100 g initial to 110 mg/100g. The α -tocopherol showed better control of peroxidase activity with values of 5 to 10 U/g respect to control with 35 U/g. The treatment with nanocapsules of α -tocopherol is an alternative that preserved the quality attributes of bell pepper during freezing-thawing-refrigerated storage prolonging the shelf life.

Keywords: α -tocopherol, bell pepper, frozen, thawing, refrigerated

Effect of Inulin and Cactus Mucilage in the Immersion Liquid on the Quality Characteristics of Fresh-Cut Pineapple.

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The hydro conservation of fresh-cut fruit is an alternative that helps to maintain the quality attributes and increase the shelf life. The objective this work was evaluate the effect of use an immersion liquid based on cactus mucilage, inulin or mucilage/inulin, in the preservation of physicochemical, color and textural properties of fresh cut pineapple MD2 (*Ananas comosus* var *comosus*) at 8 °C for 28 days. Pineapples were selected based on maturity stage (mature 1/2), free of mechanical damage and microbial growth. The effect of composition of liquid (0.2 % mucilage, 2 % inulin and mixture of these, 0.2 % mucilage and 1.8 % inulin) were studied and compared with control samples without treatment. The results showed that the immersion in liquid of fresh-cut pineapple contribute to maintain the luminosity with values 71 to 68 without having a significant difference between treatments, with slight discoloration during storage time of 97 to 80 °hue, emphasizing that the control showed the highest values decrease from 95 to 62. For weight loss for the different treatments was approximately of 5 % compared with the control showed a weight loss of 8 % respect the initial conditions. Minimal changes were observed in pH and titratable acidity for all treatments. The firmness in the treatments had mucilage and the mixture mucilage-inulin was retarded a greater extent compared with the control treatment or inulin, having values of 3.5 to 1.2 N. In general, the treatment that presented the best results for all parameters evaluated was the mixture of mucilage-inulin.

Keywords: inulin, hydro-conservation, pineapple, fresh-cut

Preparation and Characterization of β -carotene/Shellac and β -carotene/Ethyl Cellulose Nanocapsules Using Rotor-Stator and Ultrasonic Homogenization.

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The aim of this work was to prepare and characterize nanocapsules containing β -carotene using two different types of polymers (shellac and ethyl cellulose) and two types of stabilizers; polyvinyl alcohol (PVA) and Pluronic[®] F-127 (P-127). Shellac nanoparticles were prepared by the solvent displacement method, while ethyl cellulose nanoparticles were obtained by the emulsion-diffusion method using for both methods two different devices of homogenization (rotor-stator and ultrasound systems). A concentration of β -carotene 50 mg/L was used to prepare the nanocapsules. Nanoparticles obtained were characterized by their particle size (PS), polydispersity index (PDI) and zeta potential (ζ), and micrographs were obtained by SEM. The nanoparticles prepared with shellac had a PS 244.4 nm and 264.2 nm using PVA and P-127 respectively fabricated with a rotor-stator system at 4000 RPM. While the ones obtained by ultrasonic homogenization at 100 W of power had a PS of 292.2 nm and 181.4 nm with PVA and P-127 respectively. The IPD was less than 0.25 for all systems prepared with shellac, indicating a narrow distribution. The ζ were lower than -25 mV indicating that stable colloidal systems were obtained. Furthermore, the nanoparticles prepared using the ethyl cellulose and rotor-stator system presented PS of 419.3 nm and 305.5 nm with PVA and P-127 respectively. In contrast with the use of ultrasonic homogenizing a statistically significant decrease in the PS was found, obtaining a diameter of 116.8 nm with PVA and 94.2 nm using P-127 and translucent dispersions were observed. The IPD in all cases were less than 0.20 indicating a narrow size distribution. Respect to ζ , the effect of stabilizers was evident, the nanocapsules prepared with PVA had a ζ of -15.8 mV and -13.0 mV when were prepared with rotor-stator and ultrasonic homogenization respectively, while with P-127 the ζ were of -25.9 mV and -24.1 mV using rotor-stator and ultrasound respectively. SEM morphological evaluation showed structures below 500 nm. Therefore, nanoparticles can be obtained with polymers such as shellac and ethyl cellulose using devices of homogenization as rotor-stator and ultrasound, to create nanoparticulate systems that have an application in the functionalization and food preservation.

Keywords: Nanocapsules, nanoparticles, shellac, ethyl cellulose, β -carotene

Effect of Ultrasound on Yield and Physicochemical Properties of Pectin from Tomatillo or husk green tomato (*Physalis ixocarpa* Brot.)

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Pectins are widely used in the food industry, and considered as an additive, thickener or stabilizer given its capacity. The aim of this study was to evaluate the effect of ultrasound on yield and physicochemical properties of pectin of husk green tomato or tomatillo (*Physalis ixocarpa* Brot.). Pectin extraction of tomatillo was conducted by acid hydrolysis (HCl 0.1N) applying ultrasound (US), where the variables studied were: the application time and amplitude of ultrasound (US), and pectin extracted without US was used as a control. Parameters evaluated for pectin evaluation for both methods were: yield, uronic acids and degree of esterification. The results were analyzed in Minitab 17.0 software using analysis of variance (ANOVA) through Dunnett test to compare treatment means with the control mean, with a significance level of $p < 0.05$. Pectin yield for the different treatments, presented significant differences and the conditions of ultrasound time of 20 min and amplitude of 70% an increase of yield of 17.76% was obtained. According to the statistical analysis both the temperature and time of application of ultrasound have an effect on yield. For degree of esterification, significant differences for treatments at 50% amplitude and 10 minutes and sample processed at 70% and 10 minutes, were observed, however, all samples were classified as high methoxyl pectin. Uronic acids content was not influenced by the application of ultrasound as the samples did not presented significant difference compared to control. Thus ultrasound seems to be an efficient tool for increasing the extraction yield without affecting pectin properties.

Keywords: pectin, *Physalis ixocarpa* Brot, ultrasound.

Evaluation of Solvent Type on Ultrasound Assisted Extraction of Betalains Extracts from *Beta vulgaris* L.

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Beta vulgaris L (beetroot) is a plant that has an important betalain content, which can be extracted by ultrasound technology. The main objective of the present study was to evaluate the solvent type on quality of extracts by ultrasound assisted extraction. The influence of process parameters on physicochemical, colorimetric characteristics and betalain content, such as amplitude (40 and 80%), time (2 and 10 minutes) and ethanol concentration (0, 20, 40, 60, 80 and 96%) as well as McIlvaine buffer were evaluated. Data were analyzed performing a one-way analysis of variance (ANOVA) and differences among means were determined using a Tukey test with a level of significance of $p < 0.05$. The statistical package Minitab version 17 was used. The results showed that the soluble solids were significantly increased as the concentration of ethanol was higher, at the same time the pH of the extracts was higher, resulting in a negative impact on the stability of betalains. The use of buffer allowed the obtaining of extracts that retained the characteristic color of beetroot, which affected the results of betalain content, that indicate that the samples processed at any concentration of ethanol significantly decreased their values (96%) compared to samples processed in buffer, which can be attributed to nucleophilic attack by the ethanol. Based on the above results, it can be concluded that the use of ethanol as a solvent in the ultrasound assisted extraction for betalains from beetroot, is not favorable, however, the McIlvaine buffer allowed the efficient extraction of betalains from the red beetroot.

Keywords: Ultrasound, beetroot, betanin

Ultrasound Effect on Functional and Rheological Properties of Sweet Potato Starch

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Starch is an additive widely used in food industry to confer different physicochemical properties. However, in general it needs to be modified by chemical, enzymatic or physical processes. The major component of sweet potato is starch which can account up to around 70% of the dry matter and offers the opportunity of large starch production at low cost. The objective of this study was to evaluate the effect of different ultrasound conditions such as amplitude level and processing time on functional and rheological properties of orange-fleshed sweet potato starch. Starch was isolated from sweet potato and dried at 45 °C. Sweet potato starch was suspended in distilled water to obtain a concentration of 10 % (w/v). The suspensions were treated with a Hielscher UP200Ht ultrasound processor using a 40 mm diameter probe tip. The ultrasound treatment was performed at a constant frequency of 26 kHz with 50 and 90% amplitude levels and processing time of 2 and 4 min. Content of amylose and amylopectin of starch treated with ultrasound and control sample were evaluated. Rheological parameters and functional properties (solubility, swelling power, water absorption capacity and fat absorption) of sweet potato starch suspension were also evaluated. The analysis of variance (ANOVA) and mean comparison test (Tukey's test) at the 5% significance level were performed using Statistica 7.0 software. The results showed that the ultrasound treatment had no significant effect on amylose and amylopectin content. The effect of ultrasound on solubility and fat absorption capacity starch was not statistically significant. After treatment with ultrasound, values of swelling power and water absorption capacity measured for all starches increased. All gels exhibited non-Newtonian behaviour, with dilatant properties. Storage modulus was higher than loss modulus to the entire frequency range ($G' > G''$). The ultrasound treatment offers the opportunity to modify the properties of native starch, thus give greater application in the food industry.

Keywords: ultrasound, starch, rheological parameters, functional properties

Effect of a Solid Lipid Nanoparticles-Xanthan Gum Coatings on Metabolic Changes in Guava (*Psidium guajava L.*) During Ripening.

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The objective of this work was to evaluate the effect of solid lipid nanoparticles-xanthan gum (SLN/XG) coatings on the changes of ascorbic acid (AA), oxygen consumption (O₂) and pectin methylesterase activity (PME) in guava ripening. Mature green guavas “Media china” (116 ° hue angle) were chosen for this study. SLN were obtained by hot homogenization method and then blended with XG to prepare film-forming dispersions. The SLN concentrations used in the coatings based on wax content were 65 and 75 g/L, they were compared with control samples. The film-forming systems were applied by dipping and storing the guavas at 10 °C and 85% RH for 37 days, all samples were transferred at 25°C for 5 days to evaluation chilling injury in climacteric fruits. The SLN film-forming systems were stable when particle size was in the range of 222-257 nm with polydispersity index > 0.3 and the zeta potential (ζ) was >|30| mV. The best results were obtained with SLN concentration of 65 g/L since at this concentration, guavas showed the lowest range of AA loss (13%), also, presented the lower oxygen consumption with an average of 12.75 mL O₂/ kg h, suggesting the formation of a modified atmosphere that limits the O₂ transfer, which is the primarily responsible of guava ripening. Besides at this concentration, guava cell wall hydrolysis monitored by PME activity was delayed showing an activity maximum peak at day 20. High content of SLN (75 g/L) produce physiological damage in guavas, thus the AA loss was 42%, the average oxygen consumption for this samples was 15 mL O₂/ kg h and the activity maximum peak for PME showed up at day 20 but the green color of this samples did not change during the storage. According to the results, SLN/XG coatings with 65 g L⁻¹ of SLN act as a gas exchange barrier, preserving the shelf life of guavas for almost 5 weeks.

Keywords: coatings, solid lipid nanoparticles, guava fruit, ascorbic acid, pectin methylesterase

Effect of Carrageenan and Milk Proteins on the Sonocrystallization of Lactose.

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Cheese whey is a by-product obtained from the cheese making industry. This by-product is the primary source of high-value products such as whey protein concentrates and lactose. The evaporation of the cheese whey before its spray drying generate a supersaturation of lactose. This supersaturated solution of lactose readily crystallizes when the solution is cooled and seeded with lactose crystals. However, the crystallization of lactose is a very slow process (up to 72 hours) that can be affected by the presence of high amounts of whey proteins, and other polymers such as hydrocolloids (used for moisture retention on cheese). Therefore, the aim of this work was to evaluate the effect of the carrageenan and ultrasound on the crystallization rate of lactose in a model solution. A factorial design was used to assess the effect of carrageenan, whey proteins and ultrasound on lactose crystallization. The effect of carrageenan was explored at three different concentrations: 0, 150 and 300 mg L⁻¹; whereas the effect of protein was assessed at two levels: 0 and 0.64% (0 and 7 g⁻¹ of WPC). Also, three different ultrasound energy densities were applied: 0, 9, and 50 J mL⁻¹. In total, 18 treatments were performed, and each treatment was carried out in triplicate. Data collected were subject to analysis of variance and multiple mean comparisons with the software Minitab 16. The main variables and their interactions have a significant effect at a confidence level of 0, 95. The crystallization of lactose significantly increased by application of ultrasound at a low energy density of 9 J mL⁻¹, the presence of protein and carrageenan (150 mg L⁻¹). These variables develop a significant number of nuclei, which generates plenty of crystals. When the solution was exposed to ultrasound, it was observed that the crystallization had not finished yet.

Keywords: Whey, Carrageenan, Sonocrystallization.

Enzyme-Assisted Extraction of Fructans from Sotol (*Dasyilirion spp.*)

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Nowadays the increasing interest in the application of complex carbohydrates contained in plants like Agavaceas and Nolinaceas, as sotol (*Dasyilirion spp.*), has conducted to explore efficient methods of extraction that minimize the damage of that carbohydrates as fructans, which are usually extracted using hot water due to the elevated temperature increases the solubility of these compounds, but at the same time it could cause structural damages. Additional, this process consume significant amounts of energy, so more sustainable options must be adopted. Alternative techniques such as enzyme-assisted extraction could lead to the release of biocompounds into the extraction medium under sustainable method. The aim of this study was to evaluate the effect of enzyme concentration and fresh sotol concentration on simple and complex carbohydrates extraction. Sotol heads were cut, crushed and submitted to enzymatic maceration using Pectinex® Ultra SP-L at 30 °C in a buffer solution of sodium acetate at pH 4.5. This was performed at different enzyme concentrations (0.0, 25.7, 87.8, 150.0 and 175.7 U/ mL) and at different fresh sotol concentration (4.5, 8.0, 16.5, 25.0 and 28.5 g/ 100mL). Extraction kinetics were performed taking samples periodically until 8 h of incubation and the rate extraction constants (K) of reducing sugars were determined. The final extracts (8 h) were analyzed in reducing sugars (RS), total sugars (TS) and fructans (F) content as well as carbohydrate profile and fructans degree of polymerization (DP) by HPAEC-PAD. Experiments were carried out under a second order rotatable central composite design and the results were analyzed using response surface methodology. The increase in both, enzyme and fresh sotol concentration caused a raise ($P < 0.05$) in the release of RS, which was related to the behavior shown by K values. While F and DP were mainly affected by fresh sotol concentration, obtaining the highest values at lower sotol concentration with intermediate enzyme concentration of 87.8 U/mL. DP was significant affected by sotol concentration and the values range from 5.479 to 16.18. Enzyme-assisted extraction represents an alternative technique for the extraction of fructans from sotol with DP values to diverse applications for food industry.

Keywords: Fructans, Sotol (*Dasyilirion spp.*), Enzyme-Assisted Extraction, Degree of Polymerization

Comparative Study of Effect from Ohmic Heating and Conventional Heating On Sensory, Physicochemical And Microbiological Parameters In Aguamiel *Agave salmiana*

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Agave is an important plant in Mexico with a widely diversity. *Agave* contains a sap called aguamiel, and it is used to produce alcoholic drinks like mescal, pulque and others, and as a functional beverage for producers. But it has been found that after aguamiel is harvested, begins the fermentation process and shelf life is reduced, for that, aguamiel is pasteurized after harvest, but during the heating process it leads to loss of essential nutrients. Therefore, emerging technologies as ohmic heating (OH) have advantages over conventional methods. The aim of the study is to evaluate the effect of OH in the sensory, physicochemical and microbiological properties in aguamiel and to compare to a traditional method. The samples of aguamiel were collected in Guadalupe Victoria locality in Saltillo Coahuila, Mexico. The samples were stored at 4°C. The conventional heating (pasteurization) conditions were 95°C for 5 s, and the OH were 20 and 30 V/cm to achieve temperatures of 60 and 80 °C. The microbial analysis were carried out by the official Mexican standards for total count of coliform (NOM-113 and 210) and yeast (NOM-111). The physicochemical analysis were carried out in aguamiel raw and treated with triplicated, and FAUANL software was used to statistical analyzes. The results showed that aguamiel have a large amount of bacteria and exceeds the number of colonies according to the NOM-113 and Nom-210 for *E. coli*. It was found coliforms (2.4×10^2 CFU/ml), *E. coli* (1.5×10^3 CFU/ml) and mold and yeast (countless). But in the treated samples no colony was found in all plates. Aguamiel contains 82.6% of moisture, 6.6 pH, 0.1 g/L protein, 18.8 °Brix total soluble solids and 231 g/L total sugars with 30.1 g/L of reducing sugars. Also was found an increased in reducing sugars with low pH on treated samples. While in the color was a change, to transparent-opaque to yellow-brown and might be caused for the maillard reaction during the thermal process. It can be concluded that thermal treatment (95 °C, 5 s) have an important impact on microbial reduction, but during the process did not adversely affect the chemical composition of aguamiel.

Keywords: Aguamiel, *Agave*, pasteurization, emerging technologies, ohmic heating.

Chemical characterization of *Agave durangensis* leaves

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The *Agave durangensis* is used principally to produce mezcal, leaves are the waste resulting from this process of production, because they only use the center of the agave, these wastes don't have any application and are considered as contaminants. The objective of this research was to characterize the *Agave durangensis* leaves in regard to content of carbohydrates and phenolic compounds. *Agave durangensis* leaves were collected in the area of Nombre de Dios, Durango. They were dehydrated for 10 days at room temperature, reducing their size to 2 cm, subsequently they were subjected to different pretreatments: thermic (121°C/60 min), ultrasound (42 KHz, 132W, 30 y 60 min), using as control *Agave* leaves without pretreatment. Subsequently leaves were blended to 420 µm particle size, 2 types of extraction were made: 80°C Aqueous and 85% Acetone to characterize carbohydrates, phenolic acids and flavonoids. They were quantified using UPCL/ESI-MS equipment. Sugars were quantified in aqueous extracts (glucose, saccharose, fructose and galactose), fructooligosaccharides (FOS) also (fructofuranocilnystose, kestose and nystose) which present prebiotic potential. Significant differences were found in the content of these carbohydrates, causing a decrease when they are subject to pretreatments, the content of FOS for A. control 8.9mg/g, T/Thermic 5.0mg/g, T/UL 30 min 3.6mg/g and T/UL 60min 0.9mg/g. Majority phenolic acids were: ascorbic acid, 3,4 di-o caffeolquinic, caftaric acid, 4-o caffeolquinic, they were modified by different treatments, resulting ultrasound with significant difference. The principal percentages flavonoids quantified were: Rhamnoside kaempferol, kaempferol 3-o glucoside, kaempferol glucuronide, Quercetin-rhamnoside, o-glucuronide Quercetin, kaempferol 3-o glucoside coumaroyl and Rutin, the effect of pretreatments favored the availability with ultrasound in 60 min time. Making the characterization the residual potential was observed (*Agave durangensis* leaves), owing to several phenolic compounds quantification, which are used in pharmaceutical or food industries as excipients or principal actives of products with prebiotic potential, antimicrobial and antioxidant.

Keywords: *Agave durangensis*, Agro industrial waste, FOS, Phenolic compounds.

Melon Seed Oil Extraction Assisted By Pretreatment Steam Explosion

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Melon belongs to the family *Cucurbitaceae* and it is cultivated in all tropical regions of the world. Seeds containing this fruit are considered agroindustrial waste, it has been reported that these seeds contain fatty acids, mostly extracted by the method of solid: liquid extraction (Soxhlet). Conventional methods for extraction already established need the implementation of new technologies to assist them and allow them to have higher yields of extraction. Steam explosion (SE) is proposed as an alternative for the arrangement of the metabolites of primary interest, therefore the objective of this study is to evaluate the extraction of melon seed oil assisted by SE. The operating condition in SE was 180 ° C, 10 Bar for 12 min dried for 1.5 h at 80 ° C, subsequently it carried out grinding and sieving. The extraction was carried out by Soxhlet with hexane evaluating the particle size (710, 500, 355 and 300 µm) and the ratio S: L (1:5, 1:6.25, 1:8.33 and 1:12.5) in samples SE and control samples without SE (CWSE). The oil obtained was characterized by physicochemical assays and the fatty acid profile was obtained by GC, all assays were carried out in triplicate. The statistic used was a univariate ANOVA with statistical software Minitab version 17. The results indicate that the higher extraction yield was obtained with 355 µm size and the ratio S: L of 1: 12.5 for SE (34.51±0.19 % W/W) and CWSE (32.13±0.58 % W/W); the lipid profile obtained by SE contains: Oleic acid (39.5%), Stearic Acid (18.2%), Cis-10- Heptadecenoic acid (9.8%) and Cis-10- Pentadecenoic acid (10.9%) and CSEV oil has: Oleic acid (26.2%), Stearic Acid (9.9%), Cis-10 Pentadecanoic acid (7.4%) and Cis-10- Pentadecenoic acid (6.0%). It can be concluded that obtaining melon seed oil is increased by applying the pre-treatment SE and extraction improvement above conventional methods.

Keywords: Steam explosion; Melon seed, Fatty Acids

Effect of High Hydrostatic Pressure With Pre-Treatment Extraction Kinetics Vanillin (*Vanilla planifolia*)

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Vanilla is an orchid genus *Vanilla planifolia*, native to Mexico and Central America considered the main source of obtaining the flavor of greater importance in the world. The extract is obtained from cured vanilla pods by a process of solid-liquid extraction with ethyl alcohol by conventional methods, which require prolonged periods. Several factors are involved in the extraction such as the particle size, temperature, time, solvent and solid-liquid ratio, becoming essential to evaluate their interaction, as well as to explore new technologies that help improve the process, so that the high pressure hydrostatic is considered as an alternative extraction of bioactive compounds from plants, which operates at high pressures ranging from 100 to 1000 MPa, so the objective of this investigation is to evaluate the effect of APH as pre-treatment on vanillin extraction kinetics. Cured vanilla pods were used and were pressurized at 400 MPa for 1 and 10 min, solvent ethanol 60% and a solid-liquid ratio of 1:5, Treated samples (CN-PH) without pretreatment (CN) were taken and then samples were submitted with and without pre-treatment in a temperature bath at 60 ° C for 24 h and 1: 5. The statistic was conducted by a multifactorial ANOVA with statistical software Statgraphics Centurion 15.1® all the tests were performed in triplicate, vanillin and sugars were determined by UV-VIS spectrophotometry. The results revealed that the best operating time was 1 min APH for extracting vanillin (0.228 ± 0.011 g vanillin / 100g pod) and sugars (0.503 ± 0.127 g of sugar / 100 g pod), reaching a equilibration time of 12 h in conventional extraction kinetics with a final yield of vanilla (1.365 ± 0.004 g vanillin / 100g pod) and sugars (7.260 ± 0.044 g of sugar / 100g pod) regarding the kinetic control, vanillin (0.515 ± 0.004 g vanillin/100g pod) and sugars (2.936 ± 0.411 g sugars/100 g de pod. The process of high hydrostatic pressure as pretreatment favored vanillin extraction, promoting improved conventional extraction, increasing the mass transfer and reducing processing times, so it is concluded that APH proved an effective technology.

Keywords: High Hydrostatic Pressures, Vanillin, Sugars

Synthesis and Evaluation of Wound Healing of *Aloe Vera* Mucilage and Polyvinyl Alcohol Electrospun Nanofibers

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Nanofibrous films were fabricated from blend emulsion of PVA, *Aloe vera* mucilage and α -tocopherol by electrospinning technique. Emulsions of α -tocopherol 5% with PVA solutions at 20% and *Aloe vera* mucilage at 20% w/v can be successfully electrospun. The electrospinning process was carried out using the equipment at room temperature. The tip of the needle is where the positive voltage of 15 KV was applied, roll collector is where the negative voltage of 15 KV was applied. Distance between the tip of the needle and the roll collector was 12 cm, with a flow 0.1 ml h⁻¹. The electrospun nanofibers were collected on an aluminum foil which was used for covering the roll collector. Electrospinning equipment used in this project is the horizontal configuration. Scanning electron microscopic images showed that the continuity of the blend fibers was improved with an increase in the *Aloe vera* mucilage ratio and indicated the obtained fibers had a diameter smaller to 10 microns. In order to evaluate its function on wound healing *in vivo*, full thickness wounds were created on the dorsal surface of mice. Application of nanofibrous films accelerated the wound closure compared to the non-treated control group. The comparative study showed that the wounds treated with PVA *Aloe vera* mucilage fibres healed on the 8th day, while those treated with cotton gauze healed on the 18 days. Histological analysis showed that new granulation tissue and epithelialization progressed better in wound treated with the obtained fibers. The result indicate the PVA and *Aloe vera* mucilage fibers can be considered as non-irritating to the skin. This study demonstrated a potential to use nanofibrous films of PVA and *Aloe vera* mucilage to accelerate the wound healing process.

Keywords: mucilage, Electrospinning, Nanofibers, Wound Healing.

Effect of Nanocapsules of β -carotene in the Quality Parameters of Beverage With Strawberry Juice Pasteurized and Stored at 4 ° C.

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The aim of this study was to evaluate the effect of β -carotene nanocapsules on the quality changes of a beverage with 30% of strawberry juice, pasteurized and stored at 4 °C. 30 kg of strawberry were purchased, washed and disinfected, and extracted juicing for preparing of the beverages. The nanocapsules used were prepared by the method of emulsification-diffusion, using 1 g / L of β -carotene and 250 mg of poly- ϵ -caprolactone in the organic phase and 0.8 g / L Pluronic ®F-127 as surfactant in the aqueous phase. The beverage was prepared using a 30% of strawberry juice, 100 mg / mL of β -carotene nanoencapsulated, 3.5% sugar, 0.015% citric acid, 5% gum arabic and / or 0.05% of xanthan gum, controls without nanocapsules without gums were considered. The beverages prepared were packaged and pasteurized at 80 °C / 5 min with cooling to 4 °C / 4 min and subsequently stored at 4 °C / 4 weeks. Changes in pH, acidity, turbidity, color and total anthocyanins were determined. Acidity not vary significantly in the samples with nanocapsules of β -carotene, however, in the control samples without any treatment they showed an increase from 0.24 to 0.30%, which was also reflected in the change of pH, samples with nanocapsules of β -carotene and a mixture arabic gum-xanthan gum showed minor changes in turbidity which it is lower to 200 NTU compared with control samples had a decrease of turbidity from 300 to 150 NTU due to sedimentation of solids strawberry juice, by contrasting this with the behavior that luminosity which increased in control samples, while samples with nanocapsules remained constant for 4 weeks storage. The content of anthocyanins showed minor variations in anthocyanins when nanocapsules and a mix arabic and xanthan gums were used. Concluded that the use of β -carotene nanocapsules and the mixture of xanthan gum and arabic gum help to maintain the quality of beverages for at least 4 weeks refrigerated at 4 °C.

Keywords: Beverage, nanotechnology, β -carotene, strawberries juice

Incorporation of β – carotene of submicron size in pasteurized orange juice.

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Orange juice samples were pasteurized in a scraped surface heat exchanger and storage at 25 °C for 4 weeks. The systems of β -carotene of submicronic size were solution, nanoemulsion and nanocapsules in a concentration of 100 $\mu\text{g/mL}$ and a control for contrast of results. The samples was evaluated by its pH, °Bx, particle size (PS), polydispersion index (PDI) and zeta potential (ζ), turbidimetry (τ) and colorimetry (ΔE). Results were analyzed using the statistical analysis software Minitab[®] Release 16 to determine the effect of submicronic size systems on the variables analyzed. Differences among treatments were a function of variation with respect to the mean performing an ANOVA and Tukey test ($\alpha = 0.05$). Nanocapsules had an average PS of 244 nm with a PDI of 0.09 and nanoemulsion PS of 195 nm with PDI of 0.119 indicating a submicronic size with narrow particle distribution. The ζ was of -42.19 mV for nanocapsules and -45.13 mV for nanoemulsion suggesting a physical stable dispersion with low probability of aggregation. A substantial changes in PS was evaluated in all the treated juices, less than 1000 nm in all samples. ζ was e significant effect given by submicronic size system and time of storage ($p \geq 0.05$) with values around on – 40 mV to -15 mV. On the other hand, pasteurized juice has lower and a* (redness) and b* (yellowness) and higher L* colors than untreated juice showing ΔE around than 11 at end of storage associated with the loss of total β -carotene content. τ no show significant changes with values around of 3000 NTU. The use of nanotechnology could be an alternative to thermal treatments and could contribute to better maintain valuable attributes of orange juice.

Keywords: Nanotechnology, β – Carotene, Orange Juice

Increasing of Penetration Rate of Citric Acid in Carrots by Application of Ultrasound: Modeling of the Process

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The penetration rates of citric acid in carrots were evaluated by immersion in water and compared with immersion in ultrasonic bath. In the food industry, citric acid is applied in fresh carrots in order to extend their shelf-life (as antioxidant and antimicrobial). Citric acid solutions were prepared at 150, 400 and 900 ppm. Carrot cylinders (2.8 cm diameter, 10 cm length) were immersed in every solution (1:5, carrot:solution) during 120 min in static bath, samples were taken at 0, 15, 30, 45, 60, 90 and 120 min. The same procedure was carried out in samples immersed in an ultrasonic bath at 40 kHz and 110 W of output power. For modeling, the diffusion model from Fick's second law was applied. Moisture content in carrots increased with immersion time for both static and ultrasonic baths. Citric acid content increased in carrots with increased immersion time, with higher rate in ultrasonic treatment ($p < 0.05$). For static bath, calculated diffusion coefficient values were higher ($p < 0.05$) for solutions at 900 ppm than solutions at 400 and 150 ppm. Diffusion model did not apply satisfactorily for treatments with ultrasound, new models should be applied taking account the ultrasonic energy effect. Application of ultrasound has high potential to be employed for impregnation of carrots with citric acid, diminishing the immersion time and getting good penetration of the acid in the sample.

Keywords: carrots, citric acid, ultrasonic treatment, diffusion

Active biofilm formulation from Mexican hawthorn (*Crataegus mexicana*) fruit pectin

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Food packages currently used in food industry are constituted of polymeric materials from nonrenewable sources due to the diverse advantages that they offer among the first its industrial scale availability, as well as their low production cost, versatility and relatively good barrier properties. Nevertheless, this materials represent a source of environmental pollution, generating a great amount of residues, hence its production as well as its disposal represents an environmental risk that must be reduced. With this expands an investigation of new technologies developed trying out renewable and biodegradable raw materials. Therefore there is a recent interest in biopolymers, which are seen as an alternative of a synthetic polymer with different applications, obtained from a natural source such as living organisms, from proteins, polysaccharides, or others. Conversely, consumer interest for the high quality foods with extended shelf life and a reduced environmental impact has encouraged the development of films and coverings from biopolymers. In present study different biopolymers formulations were develop to create plastic films capable of protecting food from deteriorative microorganisms with the purpose of extend its shelf life. Biofilms were prepared using pectin extracted from Mexican hawthorn as polymeric matrix, glycerol as plasticizer agent (at different concentrations; 5, 10 and 15 %) and capsaicin as antimicrobial agent, being habanero hot pepper the capsaicin source as active component. Once biofilm forming solutions were prepared, they were placed in Petri dishes afterwards they were allocated over a flat surface allowing them to dry at room temperature. Biofilms obtained were further characterized to study its main mechanical and barrier properties. Additionally it was determined its disintegration in *compost* with the purpose of evaluating the biofilm sustainability. It was possible to observe in this study that both plasticizer and antimicrobial agent used in biofilms show great compatibility with polymeric matrix due to stability and flexibility they confer, improving considerably its mechanical properties such as elongation percent at rupture point with a significance level ($P < 0.05$) mainly PG10C biofilm. Furthermore they are highly biodegradable representing a sustainable study.

Keywords: Biofilms, pectin, packages.

Ethanol Production by Solid State Fermentation of Sweet Sorghum: submerged culture comparison.

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Sweet sorghum is a crop with several advantages in the production of ethanol as high fermentable sugars concentration, tolerance to adverse conditions, little water and nutrient requirements and many crops in a year. Production of ethanol from sweet sorghum is conventionally done in submerged culture, in recent years there has been renewed interest in solid state fermentation (SSF), a process that can be used for the improvement of agro-industrial waste, especially in eastern countries, where they have developed complete and efficient SSF processes, decreasing the costs associated with energy consumption in milling and evaporation operations of conventional fermentations. The aim of this work was to make a comparison of submerged and solid state fermentation processes using two yeast (*S. cerevisiae* ITV-01 and *P. kudriavzevii* ITV-S42), therefore, kinetic were performed for each type of yeast and fermentation (submerged culture 500mL flask, SSF destructive sample 250ml static flask) as well was evaluated the effect of the sterilization step of the solid prior to fermentation. °Brix, pH, and cell count at Thoma chamber were measured and HPLC was performed for sugar and ethanol quantification. All experiments were performed in duplicate. Statistical analyzes were performed using one-way analysis of variance (ANOVA). The mean values were differences between using Tukey's multiple compared range test with a significance level $P \leq 0.05$ defined as using Minitab 17.0 (Minitab Inc., State College, Pennsylvania). It was observed that the yeast used in this study grew adequately in solid culture showing viability values above 90%. With respect to *S. cerevisiae*, the submerged cultures reached higher yields of ethanol, up to 25%, however, the SSF allowed to reach higher productivities, up to 42%, reducing the fermentation time required to half. On the other hand, *P. kudriavzevii* consumption of fermentable sugars favored biomass instead of ethanol. According to the results SSF do not need a sterilization step of solid material prior to fermentation, which decreases energy expenditure and reduces processing time by dispensing a unit operation. This results are promising due to the low cost, high productivity and flexibility of SSF.

Keywords: Solid State Fermentation, *S. cerevisiae*, *P. kudriavzevii*, Sweet Sorghum, Ethanol.

Two Probiotic Bacteria Isolated from “Tejuino” Have Antimicrobial and Adhesion Activity

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“Tejuino” is a traditional fermented drink made with nixtamalized corn mass that is characteristic in western Mexico. In our laboratory (CIATEJ *ex vivo* digestion lab) we isolated and characterized 2 bacteria from “tejuino” with probiotic potential. The objective of this study was to evaluate both the pathogen inhibition and adhesion capability on colon epithelial cells from the two isolated bacteria (*Leuconostoc citreum* and *Weisella cibara*). The extracellular metabolites for to evaluate antimicrobial activity were obtained from cell-free supernatant probiotic 16h cultures. It was evaluated through well diffusion assay. Briefly: Seven 8 mm wells were made in tryptic soy broth plates, inoculated with 3 pathogens (*Salmonella typhimurium* ATCC 14028, *Listeria monocytogenes* ATCC 19114 and *S. aureus* ATCC 25923). In each well 130 μ l of cell-free supernatant from probiotic culture were added. The presence of inhibition zone was assessed visually following 24 h of aerobic incubation at 37°C. Probiotic adhesion capability was evaluated by co-culturing monolayers of adherent epithelial colon cell line (HT-29) with *L. citreum* or *W. cibara* during two hours, cells were washed three times and cell-adhering bacteria was determined by plate count after 24 hour of incubation at 37°C. *L. citreum* metabolites inhibited (in mm): *S. typhimuruim* (10 \pm 0), *S. aureus* (11 \pm 0.57), *L. monocytogenes* (9 \pm 0). While *W. cibara* metabolites inhibited only *S. aureus* (10 mm \pm 0). Both *L. citreum* and *W. cibara* were capable to adhere to colon cells *in vitro*. However, *L. citreum* showed 84-fold high adhesion capability compared with *W. cibara*. This results indicates that both *L. citreum* and *W. cibara* have a high probiotic potential. Perspectives: currently we are identifying the molecules associated to this inhibitory effect using HPLC techniques.

Keywords: Probiotic, antimicrobial activity, adhesion.

An Ultrasound-Enhanced System for *Saccharomyces cerevisiae* Inactivation Using Supercritical CO₂ Treatment in a Continuous Regimen

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Supercritical carbon dioxide (SC-CO₂) inactivation technology represents a promising non-thermal processing method, as it promotes minimum impact on nutritional food properties. However, in some cases, high pressures or temperatures and too long treatment times are required to guarantee the food's safety. In order to obtain the required lethality at shorter processing times, the aim of this work was to study the effect of pressure, temperature, and product residence time on yeast inactivation using the continuous flow SC-CO₂-HPU system constructed for this application and to model and optimize the process operation. A pilot plant equipment for supercritical CO₂ with high power ultrasound (SC-CO₂-HPU) treatment which operate in a continuous regimen was designed and built. The core of the equipment is a 500 mL sonication vessel followed by a 52 mL holding tube. Apple juice, previously inoculated with 1-10x10⁷ CFU/ml of *S. cerevisiae*, was treated in the equipment at different juice residence times (3.06-9.2 min), temperatures (31-41°C) and pressures (100-300 bars). Inactivation ratios were fitted to a hybrid (Boolean-real) model in order to perform a statistical evaluation of the effect of the process variables. The ultrasound assisted continuous system has shown a great potential for microbial inactivation using SC-CO₂ under mild process conditions. The results demonstrated that the maximum inactivation achieved by the system was 7.8 log-cycles. The hybrid model demonstrated that HPU has a significant and decisive effect on inactivation after shorter residence times. A multi-objective optimization performed with the hybrid model showed that 6.8 log cycles of inactivation could be obtained after a minimum residence time (3.1 min) with HPU application, whereas under the same conditions but without HPU, the inactivation would be 4.3 log-cycles.

Keywords: Non thermal process, Supercritical CO₂, Ultrasound Continuous regime, *S. cerevisiae* inactivation

Design of a biosensor in *E. coli* to detect a *Listeria monocytogenes*

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Listeriosis is a serious bacterial infectious disease for human beings produced by *Listeria monocytogenes*. This bacterium is a facultative intracellular pathogen widely distributed in nature and is adapted to live in both ground and in the cytosol of a eukaryotic cell. The *Listeria* genus include Gram-positive bacilli that can be grouped in short chains, and not produce spores or capsules. This organism grows at temperatures between less than 0° and 45°C, it is able to tolerate different pH ranges (4.5-9.2), and survive at high concentrations of NaCl. *L. monocytogenes* is mainly transmitted through food, sometimes causing very serious clinical conditions in humans, such as septicemia, gastroenteritis, meningitis and encephalitis. One of the regulatory mechanisms of *L. monocytogenes* is Agr (accessory gene regulator) system, responds to the extracellular presence of a secreted peptide signal (also called an autoinducing peptide or AIP), which belongs to a self-induction system organized in the operon agrBDCA. Because of the importance of *L. monocytogenes* as bacteria in food, in this work we will show preliminary studies about the development of a biosensor using *Escherichia coli* as a chassis to allow the detection of this bacteria using foundations of synthetic biology. A bioinformatic analysis of the genome of *Listeria monocytogenes* was performed to localize the sequence coding for the agr operon, based on this, three sets of oligonucleotides which were used to amplify agrB-agrD, agrC-agrA and the promoter 2 were designed; also oligonucleotides were designed to amplify the GFP reporter gene, once amplified these genes the following constructs were obtained E.Coli/Pet28a-agrB-agrD y e.coli/pet28a-agrC-agrA-p2-GFP; the first construction will be purified by affinity chromatography and quantified, after this, a trials be conducted to determine the concentration of self-inductor that is required to activate the biosensor construct containing GFP, once tested the biosensor assays will be carried out in the which listeria monocytogenes will be confronted.

Keywords: Biosensor, agr, *Listeria monocytogenes*, *E. coli*.

Valorisation of Mexican avocado residues using Microwave-Assisted Extraction

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Avocado is a fruit native to Mexico and Central America and is one of the main crop produced in Mexico with 30% of worldwide production. The avocado processing industry generates large amounts of wastes, since the pulp is the main part used, and from the obtained residues, seeds and peels, it is possible to recover high quantities of high value added compounds with antioxidant capacities that in the actuality are unexplored. The objective of this work was the evaluation of different chemical and thermochemical extraction procedures to recover bioactive compounds from avocado residues in order to evaluate a global profile avocado valorisation to make favourable in industry. Microwave-assisted extraction (MAE) was evaluated under two profiles, low temperatures (30 - 60 °C) for phenolic compounds recovery, using acetone, and high temperatures (120 - 180 °C) using water for polysaccharides extractions. In both profiles, the extraction times were 10 - 30 min and power of 600 and 1200 W. Also, MAE extractions were evaluated at 60 °C with 60 min testing acetone, ethanol, methanol and water. Extractions by Soxhlet and agitation by 8 h at room temperature was tested. The results showed that avocado residues have high content of polyphenols and high antioxidants activities compared with other natural sources. Acetone was the best extraction solvent in almost all the methods with a total phenol content of 60-174 mg GAE/g.sample, and antioxidant activities of 99-217 and 130-370 mg TEAC/g of sample, in DPPH and ABTS methods, respectively. Soxhlet extracts showed lowest quantities of phenols and antioxidant capacities, in contrast with agitation method. For high temperatures extractions, seeds showed more elevated quantities of sugar (52%) and starch recovery (40%) compared with peel results. The phenolic extracts were evaluated by *Artemia salina* tests where peels extracts showed no toxicity at concentration between 0.05-1 mg/mL, instead the seeds extracts showed high toxicity with LC50 values of 18.13, 29.17 and 74.68 µg/mL for MAE acetone, ethanol and methanol extracts. Avocado residues showed to be a relevant source for high value bioactive compounds as polyphenols and starch, in order to apply as functional food ingredient and antioxidant additive.

Keywords: microwave, avocado, starch, antioxidants capacities

Biosynthesis of silver nanoparticles using plant extracts and microwave

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Nanoparticles are compounds with sizes ranging from 1–200 nm, are widely used as therapeutic compounds, transfection vectors, anti-microbial and anticancer agents, in DNA modification and drug delivery systems. The synthesis of metal nanoparticles was carried out by chemical, electrochemical, radiation and biological methods, being the latter the most desirable route for synthesis. Biological methods are part of green biotechnology where plants and microorganisms are used to synthesize nanoparticles. Within the metals converted into nanoparticles are silver, gold, copper and palladium. Silver nanoparticles (AgN) are reported as potent antimicrobial agents that can be applied in various areas. The aims of this work were to synthesize AgN using plant extracts and measure their antibacterial activity. For nanoparticle synthesis were used leaf extracts of *Ficus benjamina*, *Euphorbia mili*, *Pelargonium hortorum*, *Ficus carica*, and *Rosmarinus officinalis*, and cinnamon and clove extracts; since they contain phytochemicals as terpenes and phenols with antimicrobial, antioxidant and chelating activities. The synthesis was carried out adding the plant extract to a 2 mM of AgNO₃ solution and were immediately heated in a domestic microwave oven at full power for 3, 6, 9, 12 and 15 seconds. The synthesized AgN were characterized by UV-vis spectroscopy, particle size and SEM. The antibacterial activity of was screened against the pathogens *Staphylococcus aureus* and *Escherichia coli* by the well diffusion method. All the plant extract showed color change after the addition of AgNO₃ solution, indicating the biosynthesis of AgN, the absorption spectra was obtained with a maximum absorbance at wavelengths near to 425 nm, confirming the presence of AgN. As microwave heating increased the particle size was reduced, the smaller nanoparticles were obtained at 9 s, after this time there were no significant differences. The particle sizes obtained were from 23 to 143 nm, the lowest was obtained with clove extract. All extracts had antibacterial activities, *P. hortorum* and *F. carica* have a greater effect against *E. coli* (16 mm inhibition), and there was no significant difference of all extracts with *S. aureus* (12 mm inhibition). The biosynthesis of silver nanoparticles was successfully carried out by the utilization of environmentally friendly green extracts.

Keywords: silver nanoparticles, plant extracts, microwave, antibacterial activities

Phenolic Compounds from Candelilla Stalks: Conventional and Pressurized Extraction

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Candelilla (*Euphorbia antisiphilitica* Zucc) is an endemic specie of the semi-desert region of the states of Chihuahua, Coahuila, Durango, Hidalgo, Nuevo León, Oaxaca, Puebla, Querétaro, San Luis Potosí, Tamaulipas y Zacatecas. Is a non-timber product that comes from the commercial collection and is used to recover their wax. However, the waste (stalks) is used as fuel for the extraction process. Only a few authors have mentioned that it is used as a potential source of natural antioxidants. In this work, the possibility of recovering purification (through of Amberlite XAD-16) and characterizing such compounds is presented. Previously, the wax of candelilla plant was retired, the residue (stalks) was dehydrated 48 h at 60 °C and milled to reduce the particle size. Conventional method was made at 60 °C for 30 min and the pressure method at 121 °C/15 PSI for 25 min. The solid liquid ratio was 1:20. Additionally, the flow process was designed using the Microsoft Visio 2010 and the general balance of matter was made. To prove the stability of the polyphenols recovered, an antioxidant capacity was evaluated by DPPH, ABTS assay. The amount of polyphenols needed to inhibit 50% the reaction (IC₅₀) was determined using a cubic equation using a curve from 0 to 600 ppm. The process has an efficiency ranging from 83.12 to 97.7%. The flowchart can clearly identify the process steps graphically. The antioxidant capacity ranges from 303.17 to 401.80 ppm (IC₅₀), but the conventional method is the best ($p < 0.05$). The traditional method is a viable, simple and effective method for the recovery of phenolic compounds that can be used from the pharmaceutical industry up to the food industry because only used as solvents water and ethanol.

Keywords: candelilla, pressurized, phenolic compounds, antioxidant activity

Ultrasound-Assisted Extraction of Phenolic Compounds from Mango Peels and their antioxidant activity

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The use of synthetic antioxidant compounds in the food industry (BHA, BTH, TBQ, etc.) has generated controversy due to its carcinogenicity. Therefore, the recovery and use of natural antioxidants is an opportunity area to substitute synthetic compounds. Mango peels is a potential source of antioxidants, however, is necessary search alternatives to improve extraction yields. Also, it is necessary to determine the antioxidant capacity of compounds to prove their functionality. The extraction of total polyphenols of mango peels (TPMP) was carried out using a Box-Behnken design 3^3 (15 treatments). The factors were time (15, 30 and 45 min), citric acid concentration (0.5, 1 y 2 %) and solid liquid rate (1:15, 1:30 and 1:45). The extract was centrifuged at 10,000 rpm/10 min. Column chromatography of TPMP was performed using an Amberlite XAD-16. First, water was used as the eluent to discard undesirable compounds, and then, ethanol was employed as the eluent to obtain a TPMP fraction. Solvent was evaporated from the fractionated extract and TPMP was recovered as a fine powder. The response variables were: yield of pectin (mg pectin/g mango peels d.b.), yield of TPMP (mg TPMP/g mango peels d.b.), gallic acid equivalents (mg (GAE/g TPMP). To select the best treatment, the selection index was used. The characterization of TPMP selected consist in evaluate: yield, hydrolysable tannins, antiradical activity (DPPH[•], ABTS^{•+}, FRAP) and antioxidant activity (Lipid oxidation inhibition assay - LOI). We used a completely randomized design with three replications and a comparison of means by Tukey ($p \leq 0.05$). Finally, the chromatographic profile of phenolic compounds was made with an UPLC-MS. The yield of pectin varies from 40.2 to 65.3 mg of pectin/g mango peels d.b. The yield of TPMP varies to 15.7 to 47.9 mg of TPMP/g mango peels d.b. The best treatment selected was the 9 (30 min, 0.5 % citric acid and 1:15 solid liquid rate). To inhibit in 50% (IC₅₀) the free radicals is needed up to 208.08 ppm of TPMP ($R^2 = 0.9866$). Finally, is feasible the recovering of total polyphenols of mango peels using emerging technologies (ultrasound).

Keywords: DPPH[•], ABTS^{•+}, Lipid oxidation inhibition, Mango peels, Ultrasound.

Optimization extraction conditions for improving phenolic compounds and antioxidant properties in nut shell using an ultrasound

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Every day, the food industry produces a significant volume of waste. In recent years, several studies have been conducted, aimed at developing new alternatives for the use of these byproducts, which have high chemical and nutritional potential. The north of the country, is a major producer of nut, which represents an area of opportunity for the use of waste generated. Several methodologies have been employed for decades. By this reason, application of ultrasound offers many advantages like less amount of solvent, lower temperatures and short extraction time. The extraction of total polyphenols (TP) was made using a Box-Behnken design 3^3 (15 treatments). The factors were: time (30, 40 and 50 min), concentration of ethanol (0, 35 and 70 %) and solid liquid rate (0.05, 0.1 and 0.75 w/v in g/mL). The extract was centrifuged at 10,000 rpm/10 min. Column chromatography of TPMP was performed using an Amberlite XAD-16. First, water was used as the eluent to discard undesirable compounds, and then, ethanol was employed as the eluent to obtain a TPMP fraction. Solvent was evaporated from the fractionated extract and TPMP was recovered as a fine powder. The response variable to optimize was: yield of TP (mg TPMP/g nut shell d.b.). The characterization of TP selected consist in evaluate: yield, hydrolysable tannins, antiradical activity (DPPH^{*}, ABTS⁺⁺, FRAP). The results were statistically analyzed by the software STATISTICA 7.0 ($p \leq 0.05$). Finally, the chromatographic profile of phenolic compounds was made with an HPLC-MS. The yield was 26.26 mg TP/g dry shell under the best conditions (0.05873 w/v, 39.68815 % of ethanol and 51.43702 min). Antioxidant activity (IC₅₀ – Polyphenols amount necessary to inhibit the oxidation reaction) was 281.18 ± 9.23 ppm (DPPH^{*}), 256.06 ± 16.70 ppm (ABTS⁺⁺) and up to 6.36 ± 0.18 at 320 ppm (FRAP). The total phenolic content is 44.25 %. Some of the compounds identified by HPLC-MS are ellagic acid, quercetin and catechin. Nut shell is a potential source of compounds with high antioxidant capacity and major phenolic compounds that can be used in various industries and the use of ultrasound allows fast and efficient recovery.

Keywords: optimization, ultrasound, antioxidant activity, nut shell.

Combination of emerging technologies to improve the extraction of bioactive compounds from white tea (*Camellia sinensis*)

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Tea (*Camellia sinensis*) is one of the most consumed beverages in the world. Phenolic compounds, present in this tea, show antioxidant properties. However, it is necessary to design a methodology to recover bioactive compounds so as to maintain their functionality. For this reason, the use of emerging technologies is an alternative to improve extraction processes, as well as the combination thereof to accelerate the process and maintain the functionality of bioactive compounds. For this research microwave, ultrasound and a combination of both technologies was used. The extraction of total polyphenols of tea (TPT) was carried out as follows: Microwave (10 s), ultrasound (30 min/60 °C) and combined. The solid liquid ratio was 1:20 of ethanol water 1:1 for all of samples. The extract was centrifuged at 10,000 rpm/10 min. Column chromatography of TPMP was performed using an Amberlite XAD-16. First, water was used as the eluent to discard undesirable compounds, and then, ethanol was employed as the eluent to obtain a TPMP fraction. Solvent was evaporated from the fractionated extract and TPMP was recovered as a fine powder. Additionally, the flow process was designed using the Microsoft Visio 2010 and the general balance of matter was made. To prove the stability of the polyphenols recovered, an antioxidant capacity was evaluated by DPPH and FRAP assay. The amount of polyphenols needed to inhibit 50% the reaction (IC_{50}) was determined using a cubic equation using a curve from 0 to 500 ppm. We used a completely randomized design with three replications and a comparison of means by Tukey ($p \leq 0.05$). The yield of gallic acids equivalents (GAE) in a sample of 100 ppm was 10.5 (ultrasound), 40.55 (microwave) and 28.31 (combined). However, the combination of these methodologies is more efficient because more antioxidant activity is obtained 33.66 at 100 ppm (FRAP), 282-62 ppm – IC_{50} (DPPH); 22.08 at 100 ppm (FRAP), 380.62 ppm – IC_{50} (DPPH) and 17.25 at 100 ppm (FRAP), 377.66 ppm – IC_{50} (DPPH) to combined, microwave and ultrasound, respectively. The combination of ultrasound and microwave improves antioxidant activity, however, it is necessary to identify compounds which are extracted.

Keywords: microwave, ultrasound, combined methodologies, antioxidant activity

Preliminary Study of the Separation of Proteins in a commercial WPC by Ultrafiltration Using a Bench-Scale Hollow Fibre Membrane

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This work presents preliminary results concerning the separation of proteins such as α -lactalbumin and β -lactoglobulin by tangential membrane-based ultrafiltration as a simple, robust and scalable process to convert whey into a high added value by-product in the cheese manufacturing industry. Whey protein concentrate (WPC, Lacprodan 80) was kindly donated by Arla Foods Industries (USA). WPC dispersions were tested at low concentrations (0.05-0.15%) and at varying transmembrane pressures (TMP < 1 bar) and different feed flow rates (20-76 L/h), to screen the effects on permeate flux. α -Lactalbumin and β -lactoglobulin were separated from WPC dispersions by ultrafiltration using a Quixstand unit (General Electric, USA) coupled to a peristaltic pump Watson-Marlow 313S; the membrane module, an UFP-10-C-3MA (Xampler, GE, USA), has a surface area of 140 cm². Permeate flux of the hollow fibre membrane was measured for distilled water and for each tested whey dispersion at different feed velocities and at one output pressure. The protein concentration in the feed, permeate and retentate were analysed by HPLC (Agilent Technologies, Germany). The results showed that increasing the feed flow rate leads to an increase in distilled water permeate flux, from 84 to 215 L/m².h.bar; on the contrary, when increasing the TMP at a fixed feed flow rate (47 L/h), a maximum permeate flux of around 220 L/m².h.bar was obtained at very low transmembrane pressures (around 0.4 bar), indicating that TMP may have a more important effect in permeate flux and could be limiting in the permeation process. When WPC dispersions were filtered at varying TMP and a fixed feed flow rate, an important permeate flux decline was observed (up to 50%). The membrane module could filtrate the WPC dispersions operating continuously up to 70 minutes before important surface fouling was observed. HPLC analysis indicated that protein concentration in the permeate flow is very low or null, confirming that protein is effectively separated from WPC.

Effect of Microwave Treatment on the Plantain (*Musa paradisiaca* AAB) Pulp Preservation

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The aim of this work was to evaluate the effect of the application of microwave as a method of preservation to the plantain (*Musa paradisiaca* AAB var. curaré enane) pulp during storage. The plantain was harvested in Tuxtepec, Oaxaca and used with a maturity state of 7 stage (yellow with small brown spots). Slices of 3.5 cm in diameter and 1.0 cm thick were obtained in order to generate three different microwave treatments with a frequency of 2450 Mhz: a) samples previously submerged in solution of ascorbic acid at 1 %, b) samples previously submerged in solution of whey protein at 1 % c) samples previously submerged in water. All samples were exposed to microwave irradiation and as a witness was used slices without microwave treatment. Exposure times for the irradiation were 30, 45 and 60 s. The samples were subjected to a storage period of 0, 15 and 30 days at 4 °C. The plantain slices were packaged in special bags for vacuum sealing. The proximate chemical composition (PCC), reducing sugars, acidity, and color by the method CIELAB, texture, peroxidase and microbiological analysis were determined for each treatment. The results obtained showed that there was a decrease in the moisture content of the plantain slices probably by the water loss during 30 s of the microwave irradiation. There was no significant effect of the ash content and fats. The application of microwave and ascorbic acid and whey protein at 1 % had effect in the reduction in size of the slices, as well as a time of 45 s of microwave irradiation affected the strength, hardness and fracturability during storage. Regardless of the microwave time applied, the safety of the plantain pulp samples was favored. The use of microwave as a preservation method was shown to be effective in the reduction of the peroxidase, moreover that it did not change the chemical composition in a negative way of the plantain pulp slices and preserved the color and texture during the storage time evaluated.

Keywords: Plantain, Microwave, Preservation.

Shelf life evaluation of Strawberry (*Fragaria ananassa*) festival variety treated with ultraviolet shortwave radiation (UV-C)

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Each year one-third of the world production of food is wasted; being fruit and vegetables the foods with highest rate of wastage. Shelf life of these products plays an important role for marketing certain fruit products, as well as for the consumer and for the industry, therefore it's important to extend the shelf life of such products. One of the main factors in detriment of fruits and vegetables quality is deteriorative micro-organisms, being the most important fungi and yeasts. UV-C light is an emerging technology that replaces microbiological inactivation processes such as thermal treatment or use of chemical disinfectants. In this research Strawberry (*Fragaria ananassa*) Florida variety was exposed to a treatment with UV-C light at a wavelength of 254 nm. Radiation dose used in the experimentation was 0.6315 KJ/m² (during 10 min) as the sole method of inhibition yeasts and fungi to prolong shelf life. Kinetics of microbial inactivation was performed using different irradiation times in order to determine time and light dose irradiated onto the food surface. Physicochemical parameters were determined aw, pH, Humidity and texture depending on irradiation time. Finally a shelf life study and microbiological quality of Strawberry (*Fragaria ananassa*) was performed. UV-C light application is feasible for this type of food since it was obtained an increase in strawberry shelf life maintaining the same physicochemical parameters as well as ensuring an innocuous food and consumer health.

Keywords: fruit and vegetables, strawberries, deteriorative microorganisms, UV-C light, shelf life.

Application of Polymeric Coatings from PVA in Fruits

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Edible films have been developed in order to extend shelf life of food products. Its formulation is based on the presence of polysaccharides, proteins, and lipids. These films must be completely neutral with respect to color, texture, and odor of food. Its application on fruit and vegetables can modify breathing. They can also be used as carriers of antimicrobial agents, antioxidants or nutrients such as vitamins and minerals. Polyvinyl alcohol has excellent film properties, as emulsifier, and as adhesive. It is also resistant to oil, lipids and solvents. Vegetal origin foods were used in this work, Mexican hawthorn and apple, to which PVA was applied by dip-coating method and varnishing at different concentrations (3.8%, 7.5% y 15%). Shelf life of coated products was monitored within a 20 day period for physicochemical and sensory changes. Analysis of permeability to water vapor and oxygen, colorimetric analysis and mechanical stress were performed. Films of PVA concentration of 7.5% and 15% had a greater efficiency in the fruit conservation in comparison to 3.8%. Increasing Shelf life of this products up to 90 days storage temperature at 25° C. Developed coatings represent a useful alternative to extend shelf life of Mexican hawthorn and apple, improving also its physical characteristics, concluding that best coating was formulation 3 (PVA 15%), applied by immersion and cold force air drying. These coatings help to reduce packaging costs and solid waste generation, increasing product shelf life.

Keywords: Polyvinyl alcohol, coatings, polymers.

Comparative Study of Two Extraction Methods of Phenolic Compounds from Pomegranate Waste (*Punica granatum* L.) under Optimized Conditions

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Pomegranate peel (PP) is a by-product of pomegranate juice processing that can be used to bioactive compounds recovery with a high antioxidant activity. The aim of this study was compare under optimized conditions, the conventional (CE) and ultrasound assisted-extraction (UAE) of phenolic compounds. Pomegranate peel (dehydrated, pulverized and sieved) was used to evaluate the effect on the release of total phenolics compounds (TPC) expressed as mg of gallic acid equivalents per gram of dry peel (mgGAE/gdp) under a 2k factorial design. For UAE were evaluated the following factors: solvent concentration (ethanol/water), ratio m/v, particle size, temperature (°C), time (min), wave amplitude and cycle. For CE particle size, temperature (°C), time (min), solvent concentration (ethanol/water), ratio m/v and stirred (rpm) were evaluated. All factors evaluate showed two levels (-1 and 1). Once selected the factors with most significance on TPC recovery, a central composite design (CCD) was used to maximize the TPC recovery. From the data analysis, a second order model was obtained to estimate the maximum extraction of TPC for both extraction methods. The best conditions of UAE were: water 100 %, ratio m/v 1:75, particle size 0.15-0.42 mm, temperature 60 °C for 10 min, wave amplitude 40 % in continuous cycle, which allowed an extraction of 467.20 mgGAE/gdp. In case of CE the best conditions were: Water 100 %, particle size of 0.85-1 mm, 60 °Cm 38 min, ratio m/v 1:130 and 250 rpm, reaching a maximal extraction of 305.28 mgGAE/gdp. The obtained conditions by the models were used in an experimental test to validate the models, achieving yields of 469.06±1.18 and 309.67±0.47 mgGAE/gdp for UAE and CE, respectively. These results indicate that the optimized conditions for the models closely explain the recovery process of TPC from pomegranate peels. Compared to CE, the use of UAE allows to increase the extraction yields up to 153 % with a reduction in the extraction time of 26 %.

Keywords: Total phenolics, Ultrasound assisted-extraction, pomegranate peel, central composite design

Obtention of Anthocyanins from Red Creole Corn Cob Using Emerging Technologies.

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Mexico poses a wide genetic diversity of corn. Research has found its focus in anthocyanin extraction from colored maize, principally from crop, in the recent years. Nevertheless, the content of anthocyanins in other parts, as the cob, has been ignored. Corn cob is generally considered as waste. The aim of the present work was to obtain an extract of anthocyanins from the cob of red creole maize. Red corn cobs were used as raw material for the extraction processes. Anthocyanins extracts were obtained by a traditional technique (maceration) and two emerging techniques (ultrasound and microwaves) using ethanol at 55% v/v and following factorial designs (2x3 and 3x2 respectively) having as independent variables exposition time, solid/liquid rate, and temperature. The obtained extracts were tested for antioxidant capacity by DPPH and ABTS techniques. Total Phenolic Content was assayed too. Results were analyzed by ANOVA. The criterion of selection was antioxidant capacity. Of all resultant extracts, the one obtained by microwave process, with a solid:liquid rate of 1:100 at 100 °C for 5 minutes shows the highest antioxidant activity (74.2 ± 7.4 mg/ml Trolox Equivalents for DPPH and 89.6 ± 0.87 mg/ml Trolox Equivalents for ABTS) with a Total Phenolic Content of 64.5 ± 6.4 mg/ml of Gallic Acid Equivalents. Extraction using microwaves results into be faster than conventional maceration and ultrasound process. Zhou y Liu (2006) reported that microwave-assisted extraction is more efficient due it presents more efficient energy transference between vegetal material and solvent based on the interaction of the molecular electromagnetic camp. The Microwave-assisted process results in the most suitable technique for obtention of anthocyanins from red corn cobs.

Keywords: Red creole corn cob; anthocyanins, microwave

Modeling and Optimization of Ultrasonic-Assisted Extraction of Phenolic Compounds From Mexican Avocado (*Persea Americana* var. *Drymifolia*) Peels by Stepwise Regression

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The present study was designed to model and optimize the ultrasonic-assisted extraction process for obtain the maximum yield of total phenolic compounds (TPC) and their antioxidant activity (AA) from avocado (*Persea Americana* var. *Drymifolia*) peels, which is a traditional Mexican fruit. For that purpose, the extractions of phenolic compounds were carried out using an ethanol-water solution (80 % v/v) at 25 °C and powder of avocado peels. Extractions were carried out with ultrasound (USE) at two different electric powers (60% and 100 %) and with agitation as the conventional extraction (CE) (1000 rpm) at different extraction times (3, 5, 10, 15, 25, 30, 40, 50 and 60 min). After, TPC and the AA were determined for each extract by Folin-Ciocalteu and TEAC methods, respectively. Ultrasonic-assisted extraction was modeled and optimized by using stepwise regression (SR), using the extraction times and electric powers as factors and the TFC and AA as responses. The highest values of TFC (10009 mg GAE / 100 g d.m.) were reached at 0% of electric power and 60 min; however, the optimal conditions obtained for the AA were at 79% of electric power and 36 min (22294 mg TROLOX / 100 g d.m.) of extraction. In spite of that the USE appears to increase the yield, this one only able at certain conditions of electric power and time, when this is compared with the CE. This fact could be related with the behavior of the ultrasonic assisted-extraction kinetics of TFC and their AA after 30 min, where the curves showed a decrease in comparison with the CE, it could be due to the chemical reactions induced by the cavitation phenomenon which degrades the phenolic compounds. Models obtained by SR were able to represent more than 78% of the variation of all experimental data with estimates deviated on average 4.7% from the real values. Compared to CE, the USE under certain conditions, can be considered a more efficient procedure, because it shortened the treatment time what could be considered an interesting alternative to improve the extraction process of phenolic compounds from Mexican avocado.

Keywords: avocado, ultrasound, phenolic compounds, antioxidant

Influence of High-Intensity Ultrasound Application On Functional Properties of Pork Meat (*Longissimus dorsi*)

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The aim of this work was to evaluate the effect of high-intensity ultrasound on the functional properties. To this end, two batches were obtained, with (WUS) and without (WOUS) ultrasound treatment, thus, samples of meat blocks (10 x 10 x 10 mm) were sonicated into an ultrasonic bath (37 kHz; 820 W) at different temperatures (20, 30 and 40°C) and treatment times (6, 30 and 60 min). The WOUS batch was obtained by stirring. Later, the Exudate Yield (%EY), Cooking loss (%CL) and pH of the samples were determined. In order to identify the effect of both factors on the responses a stepwise regression (SR) was applied. The results indicate that there exists an increase of pH at lower temperatures and longest treatment times in WUS samples, which could be related with the ageing period, accelerated by the effect of ultrasound; however there are no changes in pH at high temperatures and long treatment times. On the other hand, the %EY showed in both batches that the higher the temperature and time, the higher the %EY, however, the lower values obtained correspond to WUS samples; this could be inferred that ultrasound could be causing a mechanical stress so that the water is retained in the porcine tissue. Finally, the results abovementioned could be related with the %CL results, where the higher values were obtained for the samples treated with US, which mean that the water remained in the matrix-meat was released in the cooking process, but until certain temperature, when it was greater than 30°C, showing a decrease of %CL as a consequence of the protein gelification, which keeps the water into the matrix-meat. Therefore, the ultrasonic treatment could be caused changes into the porcine tissue, which considerably influenced on the functional properties.

Keywords: ultrasound, pH, exudate yield, cooking loss, pork-meat

Microbiologic and physicochemical changes during the shelf life of pasteurized mango nectar using ohmic heating

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Over the years the technology has advanced so as to allow for items with longer shelf life, safe for the consumer as well as being foods minimally processed so that no significant changes in their organoleptic characteristics, such technologies are known as technologies emerging, one is ohmic heating. Ohmic heating has been used for pasteurizing beverages, increasing its life and ensuring safety. Moreover, it is known that the mango (*Mangifera indica* L.) is one of the most climacteric fruit production in Mexico, therefore, the products derived from it, as is the nectar, are abundant in the country. Therefore, the objective of this study was to evaluate the microbiological and physicochemical changes mango nectar pasteurized using ohmic heating (OH) during shelf life. Mango nectar was pasteurized using OH applying a voltage of 150 V and 250 V to a temperature of 85 °C, keeping it for 5 min. Nectar cooled quickly and stored under controlled temperatures of 8, 25 and 35 °C. Microbiological and physicochemical changes nectar stored every 15 days, for a period of three months were analyzed. The results showed that the storage temperature had a significant effect on the physical and chemical changes mango nectar: viscosity, brix and color. The viscosity was significantly affected by the applied voltage. While the microbiological quality of nectar remained without growth of microorganisms. It can be concluded that the OH ensures the safety of mango nectar during their shelf life.

Keywords: ohmic heating, shelf life, mango.

Effect of High Pressure-Homogenization Processing on Physical Stability of Green Coconut Water.

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Industrially, thermal treatments are widely used to inactivate microbial population and increase the shelf-life in foods. Although, the shelf life of thermally treated beverages is long, this process tends to decrease the nutrient content and completely destroys its natural flavor. Nowadays, the food industry is demanding for new pasteurization methods with reduced impact on the overall food quality is increasing. Coconut water is a liquid obtained from coconuts (*Cocos nucifera L.*) that contains functional health properties and nutritional benefits. The high pressure homogenization is being studied as an alternative to thermal pasteurization of liquid food products. In the present research work, the effect of high pressure homogenization (HPH) on the quality characteristics of green coconut water was studied. The coconut water was submitted to different HPH treatments: 100 MPa, 200 MPa (3 and 5 passes), at 10 °C of inlet temperature. The HPH-treated coconut water was compared with the untreated sample and pasteurized beverage. The HPH treatment in coconut water allowed the preservation of their physical properties (pH, total soluble solids, color, turbidity, and density). When a coconut water was HPH-treated at 200 MPa and 5 passes, a stable translucent color ($L^* = 59.83$, $a^* = -0.50$, $b^* = 1.54$) was observed in comparison to a pink color ($L^* = 57.18$, $a^* = 2.86$, $b^* = 2.00$) observed by the pasteurization treatment. Overall, the results suggested that quality of coconut waters in terms of physical properties was influenced by homogenizing pressure. The study has shown that coconut water can be stable after high pressure homogenization processing and the results can influence the development of techno-functional beverages used for the welfare of the consumers, especially vegan and/or vegetarians.

Keywords: coconut water, high pressure homogenization, physical stability

Chitosan/silica-based nanoparticles films with controlled rosemary essential oil release for antifungal activity in bread slices

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Fungal growth is the most frequent cause of spoilage in many products such as fruit juices, purees, and bakery products. In bakery industry, it is estimated that approximately 1-5% of the bread production goes to waste caused by fungal growth. Referring to bread, mold contamination determines not only changes in color, taste, but also loss of food quality. Propagation of mold spores and contamination of bread can take place indirectly by air in the storage room or by direct contact with boxes, equipment, etc. Essential oils (EOs) are aromatic oily liquids obtained from plant material (flowers, buds, seeds, leaves, twigs, bark, herbs, wood, fruits and roots). The volatile nature of EOs present an important challenge in their protection from degradation or losses by evaporation and to achieve a controlled release. Silica (SiO₂)-based nanoparticles (SBNs) applications has been increased, mainly by their excellent properties as drug delivery vectors, biocompatibility, low toxicity, high stability at different environments and also their inexpensive production. In this research work, SBNs were employed as nano-carriers for rosemary essential oil (1:2) and later added to the chitosan solution (1%). The final solution was poured in a glass petri dish and dried at 40 °C for 24 hours to obtain a film with antifungal activity. For the bread storage assay, preservative-free sliced wheat bread was aseptically placed into sterile petri dishes. A suspension of 10⁶ conidia per mL of *Penicillium digitatum* (model fungi) was inoculated on the bread slices. Afterwards, films were attached to the petri dish lid, simulating commercial packaging conditions. Plates were sealed and incubating for 7 days at 25 °C. All tests were performed in triplicate and the fungal growth was monitored and recorded. Results indicated significant fungal growth ($p \leq 0.05$) was observed for the *Penicillium*-inoculated preservative-free bread, while the chitosan/SBNs/rosemary essential oil films a weak fungal growth was observed at day 3 thorough storage. This experiment demonstrates the effectivity of chitosan/SBNs/rosemary essential oil films to prevent fungal contamination and extend the shelf lives of perishable foods, such as bread.

Keywords: silica-based, chitosan, antifungal activity

Instant Controlled Pressure Drop (DIC): A Novel Technology for the Treatment of Non-Nutritional Factors Over *Vicia sativa*

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Vetch or common vetch (*Vicia sativa*) is a native crop in Europe, North Africa and West Asia and occasionally grown in the highlands of Mexico. The main objective of this crop is to benefit the soil for other crops. These crops generally called overburden, are legumes, cereals or a mixture of both, so it covers the ground with a high percentage of foliage and protects the soil from various factors such as the drops of rain and wind. It has also been shown to provide soil organic matter and improves its structure due to water infiltration. The use of common vetch in Mexico is limited only as forage, because mainly in the country other legumes such as beans and soybeans are consumed together with grains such as corn and wheat. It is well known that some legumes have anti-nutritional factors that also limit their use for human consumption. A sample of common vetch was ground prior analytical procedures. A proximate chemical analysis of common vetch was performed according to standard methods of AOAC, which includes moisture (12.5%), ash (1.8%), total nitrogen (15.3%), crude fat (2.8%) and crude fiber (8.7%). Traditionally, for the removal of non-nutritional factors, a process of soaking and cooking is done. However, we decided to test the instant controlled pressure drop drying technology (DIC) with a pressure of 2.25 MPa and a time of 3 minutes in order to reduce the amount of non-nutritional factors such oligosaccharides (verbascose 2.54 mg/100g; raffinose 16.33 mg/100g), total phenols (114 mg/100g) and flavonoids (145.55 mg/100g) prior to our DIC process. After the DIC process we estimated a reduction around 30% of non-nutritional factors: oligosaccharides (verbascose 1.78 mg/100g; raffinose 11.43 mg/100g), total phenols (79.8 mg/100g) and flavonoids (101.89 mg/100g). With the obtained results, it is possible to know if the instant controlled pressure drop drying technology is ideal for the removal of non-nutritional factors, to make wider use of common vetch as a novel and non-commercial source for human consumption or a novel source of some biological activity of interest in further investigations.

Keywords: DIC, Non-nutritional factors, *Vicia sativa*, instant controlled pressure drop

Stability of Bioactive Compounds In Broccoli As Affected By Ultrasound Treatment And Storage Time

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Broccoli contains high levels of bioactive compounds (i.e. vitamin C, phenolic compounds, and glucosinolates). Abiotic stresses such as ultrasound (US) can increase the extractability and induce the biosynthesis of secondary metabolites in horticultural crops during postharvest. Herein we investigated the effects of US treatment and storage time on the extractability and stability of vitamin C, phenolic compounds and glucosinolates in broccoli florets. Broccoli florets were submerged in water, treated with US (frequency 24kHz, amplitude 100 μ m) for 0, 5, 10, 15, 20, 25 or 30 min and stored at 20 °C for 24 h. Phytochemical analyses were performed immediately after US treatment and after storage. Glucosinolate and phenolic compounds were analyzed by HPLC-DAD, whereas vitamin C was determined by spectrophotometry. Analyses of variance were conducted to determine main effects and interactions, and mean separations of treatments were performed using the LSD test ($p < 0.05$; $n=3$). As an immediate response to US treatment, vitamin C content was not affected in broccoli. However, after 24 h of storage, vitamin C was degraded by 60% in the control, while US treated samples showed no degradation. Regarding the phenolic profile, US treatment increased the extractability of 5-O-caffeoylquinic acid, 1-sinapoyl-2-feruloylgentiobiose, 1,2,2-trisinapoylgentiobiose, and 1,2-diferuloylgentiobiose by 45.0%, 77.5%, 49.2%, and 24%, respectively. On the other hand, after 24 h of storage, samples treated for 15 min of US showed 99.5% higher levels of 1,2-disinapoylgentiobiose. Regarding glucosinolates, US did not affect their concentration as an immediate response, however after 24 h of storage, the control showed degradation of glucoraphanin, glucobrassicin and 4-hydroxy-glucobrassicin, showing 87.7, 651.5, and 18.2% higher levels, respectively, as compared to the control. Results demonstrated that US treatment could increase the extractability (5-O-caffeoylquinic acid, 1-sinapoyl-2-feruloylgentiobiose, 1,2,2-trisinapoylgentiobiose, and 1,2-diferuloylgentiobiose), induce the biosynthesis (1,2-disinapoylgentiobiose) or prevent the degradation (glucoraphanin, glucobrassicin and 4-hydroxy-glucobrassicin) of certain bioactive compounds. Further experiments will include the measurements of sulforaphane content in US treated broccoli samples.

Key words: Postharvest ultrasound, Vitamin C, Phenolic Compounds, Glucosinolates

Industrial Implementation of Gaseous Ozone to Produce and Market Safe Shell Eggs

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Most of the whole shell eggs now available and purchased for home consumption in the USA and in Mexico are raw, with significant food safety risk. Most hospitals and nursing homes do not allow fresh shell eggs due to unacceptable risk. The United States Egg Safety Action Plan, a presidential order initiated seventeen years ago, requires improved consumer safety from raw eggs. An emerging technology may finally enable its implementation. A \$3 million USD award from the Ohio Third Frontier program enables construction of commercial scale machinery for egg processing with gaseous ozone. Egg processors in this state may have major impact on the US and global industry with an invention patented by OSU Professor AE Yousef that makes every fresh egg safe. Partnership with three major Ohio egg producers researched, patented and now implement an ozone technology that kills pathogens such as Salmonella that are naturally present, both on the surface and inside of fresh eggs. A private sector engineering company designed and built the first commercial machine. The team successfully developed an egg coating that solves an egg shattering problem and greatly improved consumer acceptance. Both the coating and the ozone process gained regulatory clearance from the US Food and Drug Administration. A commercial foodservice market is likely and sales of safe eggs in markets where they are not now allowed is a primary outcome. Whole fresh shell eggs can be pasteurized with minimal heat and made safe, much preferred to the traditional shelled egg liquid or powdered egg processes. Producers with this technology gain a competitive advantage, are able to comply with federal safety requirements, and have two new markets for new emerging technology process machinery and for safe eggs that boost consumer food safety. This is one of the first commercial applications of ozone that makes a food commonly handled raw much safer. Much like the pasteurization of raw milk, consumers will benefit from a system that ensures all fresh shell eggs are pasteurized for safety. Marketing of safe fresh eggs is likely within the year.

Keywords: Egg safety, ozone, pasteurization

UV-Induced Production of Glucosinolates in Broccoli (*Brassica Oleracea italica*) Sprouts

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Plants have the unique characteristic that, when exposed to abiotic stresses such as ultraviolet radiation (UVR), they respond by activating endogenous mechanisms that trigger the biosynthesis of defense-metabolites with potential industrial applications. Particularly, broccoli (*Brassica oleracea* var. *italica*) sprouts have attracted attention in recent years for their high content of chemo-preventive and therapeutic molecules such as glucosinolates and phenolic compounds, the first being the most studied. Although broccoli sprouts are naturally a rich source of these compounds, they are still underutilized and, most importantly, they have the potential to be enhanced by applying abiotic stresses. The present project's objective was *to study the overproduction of glucosinolates in broccoli sprouts exposed to UVR*. Seven-day-old sprouts were subjected for two hours to four independent UVR regimens: low (20 W) and high (40 W) intensity UV-A, and low (20 W) and high (40 W) intensity UV-B radiation. Sprouts were harvested either 2 or 24 h after the UV treatment and later lyophilized. Extraction using 70% (v/v) methanol or 70% (v/v) ethanol and further high-performance liquid chromatography with diode-array detection (HPLC-DAD) analyses of glucosinolates were performed. Analysis of variance (ANOVA) was conducted to determine main effects and interactions, whereas mean separations of treatments were performed using the LSD test ($p < 0.05$; $n=3$). Among all treatments, harvest of broccoli sprouts after 24 h of the application of high intensity UV-B light showed the highest improvement, significantly increasing the concentration of total glucosinolates by ~175%, compared to 7-day-old, non-treated sprouts with methanol as extraction solvent. Similarly, the concentration of the individual glucosinolates 4-methoxyglucobrassicin, glucobrassicin, glucoraphanin and glucoerucin increased by ~303%, ~211%, ~171% and ~168%, respectively. These findings suggest that UVR stress increases the content of nutraceutical metabolites in broccoli, thus UV-irradiated broccoli sprouts could be exploited as a functional food for fresh consumption or as a source of bioactive compounds with potential application in the nutraceutical foods, dietary supplements, pharmaceutical and cosmetics markets.

Keywords: broccoli sprouts, ultraviolet radiation, glucosinolates, abiotic stress.

Storage Analysis of Low-Fat Panela Cheese Using Thermosonicated Milk Added with Whey Protein Concentrate

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Health-conscious consumers are turning to low-fat cheeses (LFCs) as suitable alternatives to their full-fat counterparts. However, texture defects in these products remain an issue. Thus, the dairy industry is interested in exploring novel ingredients and state-of-the-art technologies that help improving both textural and rheological properties of such products. In this work, thermosonication (TS, power ultrasound coupled with LTLT pasteurization) was evaluated as a tool for modifying whey proteins incorporated in panela cheesemilk to function as fat replacers. An ultrasonic processor (Hielscher UP400S, 400 W, 24 kHz, 120 μm) was used to sonicate reduced-fat milk and whey protein concentrate (WPC, 80% protein) mixtures. Three 2-L cheesemilk systems were prepared and TS-treated (US+LTLT) considering the following ultrasonic conditions and mix formulations: 120 s, 50°C (1%-fat milk + 1.33% WPC); 144 s, 50°C (1%-fat milk + 1.33% WPC); 120 s, 60°C (1.5%-fat milk + 1% WPC). LTLT-pasteurized 3% fat milk was used as control. A conventional panela cheese-making procedure was followed. All treatments were run in duplicate according to a complete randomized design and analyzed by 1-way ANOVA. Use of TS in milk-WPC mixtures increased yield (0.5-7% increase) and moisture content (9-11%) of LFCs and showed reduced hardness compared to control while luminosity (L^*), pH, titrable acidity and a_w showed no significant differences between treatments at day 1 and remained unchanged during 14-d refrigerated storage. TS might be used as a valuable pretreatment of WPC-containing cheesemilk for low-fat panela cheese manufacture.

Keywords: Thermosonication, Low-fat cheese, WPC

Effects of Storage Relative Humidity on the Properties of Corn Starch Edible Films Obtained by a Combination of Extrusion Technology and Casting Technique

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Nowadays there are numerous reports about the development and use of Edible Films (EFs) in order to maintain quality and extend food preservation. Starch is one of the most used polysaccharides in the formulation of EFs. The use of starch EFs is limited due to their poor mechanical and barrier properties. The objective of this work was to develop starch EFs using extrusion technology as a pretreatment to casting technique to improve interactions between starch-plasticizers and evaluate the effect of storage Relative Humidity (RH) to determine their possible application as food coating. To this, corn starch and a mixture of plasticizers (sorbitol and glycerol) were processed in a twin screw extruder with the following conditions: Extrusion Temperature = 89°C, Screw Speed = 66 rpm and Plasticizers Ratio (Sorbitol:Glycerol) = 79.7:20.3; then casting technique was used for EFs formation. Subsequently, the EFs were conditioned at different storage relative humidities (53, 75 and 100%) for 10 weeks to evaluate its effect on their physicochemical properties. The studied variables were: Rupture Resistance (RR), Deformation (D), Water Vapor Permeability (WVP) and Solubility (S). Data were subjected to analysis of variance (ANOVA) and mean comparisons were performed using the least significant difference (LSD) of Fisher with a confidence level of 95%. From the physicochemical characterization of EFs at ambient RH (65%), were obtained $RR = 10.39 \pm 2.73$ N, $D = 12.41 \pm 1.34$ mm, $WVP = 3.05 \times 10^{-11} \pm 3.5 \times 10^{-12}$ g m Pa⁻¹s⁻¹m⁻² and $S = 65.98 \pm 4.15\%$. The results of the storage indicated that EFs at 53% RH were those that showed better RR and WVP. For S and D no significant differences ($p > 0.05$) were shown between treatments, just 100% RH treatment shows difference ($p < 0.05$) with respect to the other two treatments in deformation response. According to the results it can be concluded that the combination of extrusion technology with casting technique can generate EFs with good mechanical and barrier properties; likewise, these could be used as a coating of intermediate moisture food, as it was in that range where the best physicochemical properties were obtained.

Keywords: corn starch, edible films, extrusion technology-casting technique, storage relative humidity, physicochemical properties

Volatile Profile of Milk: Effect of Ultra-High Pressure Homogenization at Moderate Inlet Temperatures

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Based on promising physicochemical and microbial results obtained in a previous study evaluating the use of Ultra High Pressure Homogenization (UHPH) in milk, the aim of this work was to evaluate the volatile profile of whole milk treated by UHPH 300 MPa with inlet temperature (T_i) = 65, 75 and 85°C, comparing the results to heat-treated milks (pasteurized and UHT). The results obtained showed that ketones and aldehydes were the most abundant compounds detected in all samples. In UHT milk, ketones and dimethyl sulfide concentration was higher than in any other sample. On the contrary, the concentration of aldehydes in UHPH-treated milk samples, especially in $T_i = 85^\circ\text{C}$ sample, was higher than the concentration detected in heat-treated samples, probably because of secondary stages of oxidation. PCA resulted useful to explain the variations in the observed responses, presenting well-defined groups, with similarities in the volatile profiles between pasteurized and UHPH-treated milk at 300 MPa with $T_i = 65$ and 75°C . According to this, UHPH represents a suitable alternative to reduce the cooked-related compounds presented in heat-treated milk.

Key words: Ultra-High Pressure Homogenization, milk, volatile profile, heat-treated milks

Evaluation of Polylactic Acid (PLA) Foils Modified With Oxygen Absorbers and Antioxidants for Application in Active Packaging

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In this work were developed foils of polylactic acid (PLA) with different additives whose purpose was to allow the diffusion of active antioxidant compounds and increase the barrier properties to oxygen and water vapor, in order to study the feasibility to be used as material for food packaging. Additives used were: an oxygen scavenger (SCA), an UV stabilizer and two antioxidants; α -tocopherol (ATOC) and butyl hydroxy toluene (BHT). Foils were developed by co-extrusion process. Properties characterized were: a) physical-mechanical (tension and elongation, scraping and puncture) and b) thermal (thermogravimetric analysis (TGA), differential scanning calorimetry (DSC)). The results showed that the addition of antioxidants BHT and ATOC changed physico-mechanical properties but not the thermal of PLA. Additionally, the release of the antioxidant was evaluated from PLA foils in three food simulators (methanol, water and oil) at two temperatures (8 and 25 ° C) for 60 days. The results showed that the release in methanol for both antioxidants was gradual however, the ATOC release was 40% greater than BHT at both temperatures. At 60 days a release of 83.33% and 68.6% respectively of ATOC and BHT was recorded. In Oil or water no migration was detected for both antioxidants. As regards the study of the barrier properties, the low functionality of the additive SCA was confirmed, by increasing transmission rates of oxygen (OTR) and water vapor (WVTR) due to low compatibility and increase in free volume polymer matrix, confirmed by micrographs obtained by electron microscope (SEM). Finally, due to the physical-mechanical behavior of the materials obtained, the processing method of these polymeric matrices for the manufacture of containers remains restricted to thermoform.

Keywords: migration, active packaging, polylactic acid, antioxidants.

A New Optical Biosensor For Biogenic Amines Detection In Food

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Biogenic amines (BA) are toxic compounds produced in food by bacteria that possess amino acid decarboxylase activity. Because some of them are toxic to humans when ingested, it is important to develop fast detection/quantification methods that guarantee safe levels of BAs. The objective was to develop an optical biosensor for BA detection in food. The biosensor was constructed using 1 cm² fragments of Type-P doped SiO₂ wafers cleaned and surface-hydroxylated by piranha solution. The substrates were functionalized with 3-aminopropyltrimethoxysilane (3APTES) in order to expose amino-groups on the surface through a self-assembled-monolayer; the functionalized SiO₂ substrates were then submerged in a 10% solution of glutaraldehyde (GA) in ethanol (v/v) for 2 hours at RT and washed with ethanol to remove the GA excess. Finally, a plant-source Diamine Oxidase (PSDAO) was covalently immobilized onto the SiO₂-3APTES-GA substrates. To do this, 1U of PSDAO in 0.1M PBS was deposited over the substrates at RT for 2 hours. The enzyme excess was washed with 0.1M PBS. Every step in the biosensor's fabrication was checked using FT-IR, AFM and SEM. To test the sensor's activity, 20 μ L of a 100mM solution in 50mM Tris of either putrescine or histamine was deposited into de liquid stopper of an ATR (diamond crystal) accessory and measured in the mid-Infrared region for 50 minutes generating one spectrum per minute using a Bruker Vertex-70 FT-IR Spectrometer. By FT-IR it was determined that a wide band at 1200-1100cm⁻¹ corresponded to the NH₄ synthesized by the enzyme when oxidizing the BA. This was demonstrated getting the spectrum of a NH₄OH standard. This band tends to increase its absorbance as the reaction takes place due to the accumulation of NH₄ and it was absent when running a kinetic exposing the biosensor with only Tris Buffer. Moreover, absorbance of this band was stabilized faster on putrescine than on histamine, this was expected because the K_M of PSDAO is lower for the former than for the latter. At 20 minutes the band's absorbance showed a complete stabilization aside the tested BA, so we propose it would be a suitable contact time for a biosensor-food assay.

Keywords: Biosensor, biogenic amines, functionalization, FT-IR.

Water Quality Assessment for *Chirostoma estor* Intensive Culture Based on a Reasoning Model

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Whitefish (*Chirostoma estor*) is an endangered species that grows in the lake of Pátzcuaro, located in Michoacán, México. It represents one of the most important economic effect in the gastronomy of this highly touristic zone. Actually, efforts for conserving this specie has focused on culturing white fish in intensive cultured systems, that can be built by particular producers in order to commercialize it and avoiding over-exploitation. In this work, a computational system for assessment water quality in white fish cultured systems is presented as a way for preserving and reproduce this important food species. A new artificial intelligence based model has been developed in order to interpret good or bad environmental conditions that can affect the water quality of the production system. Critical environmental parameters (dissolved oxygen, temperature, pH and non-ionized ammonia) are classified according to their negative impact in the habitat, based on toxicological pollutant concentrations and the combinations that can be harmful for the organism. Then, a reasoning process evaluates different water conditions, determining a situation that is expressed as a Water Quality Index in four different statuses; excellent, good, regular and poor. Comparison with similar models used in literature and by international organizations show a good performance of the proposed index with accurate assessments on real environments. Generally, daily variations on temperature and dissolved oxygen were found. In this case, both parameters present values inside and outside optimal levels, which directly influenced the good condition of water quality. The computational system emerges as a suitable and alternative tool to be used in the water management in white fish aquaculture, where unfavorable situations, the doubtfulness and imprecision in criteria employed in the decision making process will be reduced. Avoiding negative situations intensive production systems will decrease stress and mortality in the organism, generating a better final product.

Keywords: white fish, *Chirostoma estor*, artificial intelligence, computational model



II. FOOD BIOTECHNOLOGY

Evaluation of Fermented Pomegranate (*Punica granatum* L.) Juice: Physicochemical Properties and Antioxidant Profile

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The aim of this study was to evaluate the physicochemical (pH, titratable acidity, total soluble solids, and color parameters) and antioxidant (antioxidant activity, total phenols and anthocyanins) properties of fresh and fermented pomegranate juices. Antioxidant activity, total phenols and anthocyanins were evaluated according to the DPPH, phenol Folin-Ciocalteu, and differential pH methods, respectively. Three fermentation conditions were tested based on the total soluble solids (°Brix) of pomegranate juice (°Bx in natural juice and adjusted to 17.5 and 25 °Brix). Differences within means were considered significant for $p < 0.05$ using ANOVA and Tukey's tests. In fresh juice, the total soluble solids content was 13.9 ± 0.03 °Brix; pH and titratable acidity (citric acid) were in the range 3.3 to 3.7 and 0.30 to 0.51 %, respectively. The L^* , a^* , b^* , H (hue), and C (purity) color parameters were 25.67 ± 0.02 , 24.12 ± 0.05 , 9.84 ± 0.04 , 22.20, and 26.05, respectively. For fresh and fermented pomegranate juices, the antioxidant activity was in the range 192.60 ± 0.02 and 40.50 ± 0.03 mg Trolox/100 mL of juice; total phenolics content varied from 229.39 ± 0.01 to 29.7 ± 0.02 mg Gallic acid/100 mL of juice and the anthocyanins content was observed between 3.92 ± 0.03 and 1.30 ± 0.04 mg cyaniding-3-glucoside/100 mL of juice. Significant differences ($p < 0.05$) were observed within averages for the physicochemical and antioxidant properties of fresh and fermented juices. These results provide valuable information on the changes in physicochemical and antioxidant properties of pomegranate juice during fermenting, which could be useful for determining the quality of fermented beverages.

Keywords: pomegranate, fermented, antioxidants

Kinetic of the PUFA Esterification by Different Lipase Sources

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Enzymatic hydrolysis has been widely studied for the production of polyunsaturated fatty acid (PUFA) concentrates. However, there is a lack of information about the kinetic parameters for the esterification of PUFA. The activity and specificity that commercial enzymes display for the hydrolysis are different for the esterification reaction. In this work the activity and specificity of commercial lipases for the esterification of PUFA from sardine oil in a free solvent media were evaluated. The PUFA concentrate was obtained by chemical hydrolysis of sardine oil followed by urea-complexation. A lipase from *Candida antarctica* immobilized on microporous acrylic resin; and three soluble enzymes from *Pseudomonas* sp., *Aspergillus niger*, and *Rhizopus oryzae* were screened for the esterification of PUFA to glycerol. Results show that all enzymes were able to esterify the PUFA to glycerol in different extents. The lipase from *Pseudomonas* exhibited the lowest degree of esterification (20%) after 12 h, whereas lipases from *Aspergillus niger*, and *Rhizopus oryzae* produced 45-55% and *Candida antarctica* lipase reached 90.82% of esterification in a 4 h reaction period. The kinetic parameters for the esterification were obtained and global esterification showed a $E_a=25.91$ kJ/mol. The results and parameters obtained in this work can be useful for the design of an industrial process for the production of glycerides with a high concentration of PUFA.

Key words: lipase, esterification, PUFA, sardine oil.

Characterization of Bacteriocins Produced by LAB Isolated From Artisanal Cheese Produced in Brazil

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Bacteriocins are antimicrobial proteins, produced by different lactic acid bacteria (LAB), isolated from various ecological niches, including different dairy products. Application of bacteriocins in control of food borne pathogenic bacteria is a possible answer in reduction of chemical preservatives and production of healthier food products. Bacteriocin producing LAB was isolated from artisanal cheeses produced in Minas Gerais state, Brazil. Total LAB microbial count determined on MRS (Man, Rogosa and Sharpe) plates was estimated to be around 8.3×10^6 CFU/ml. 149 colonies with potential for bacteriocin production based on the applied 3 levels approach for isolation of LAB with antimicrobial potential were selected and from them 18 were confirmed to be bacteriocin producers against *Listeria monocytogenes*. Based on RAPD-PCR analysis, 8 isolates were selected for future study. Selected strains were identified based on the biochemical, physiological and biomolecular characteristics, including API50CHL and 16s rRNA sequencing, as *Enterococcus* spp. 54, *Lactobacillus plantarum* 56, *Pediococcus pentosaceus* 63, *Lactobacillus rhamnosus* 70, *Enterococcus* spp. 87, *Enterococcus* spp. 91, *Lactobacillus plantarum* 127, *Pediococcus pentosaceus* 146. Antimicrobial substances produced by selected LAB were characterized as bacteriocin/s based on sensitivity to proteolytic enzymes, such as proteinase K, papain, pepsin. However, antimicrobial substances were not affected after treatment with lipase, catalase and α -amylase. Selected chemicals, such as triton-X100, laurilsulfate, tween 80, NaCl and milk not affected stability of expressed bacteriocins. In addition stability of produced bacteriocins was studied at temperatures (from 25 to 121oC) and pH (from 2.0 to 10.0). Studied bacteriocins were able to inhibit large number of *Listeria monocytogenes*. Maximal bacteriocin production was recorded at 37oC during the end of the exponential growth phase (800 AU/ml for *Enterococcus* spp. 54 to 25600 AU/ml for *Pediococcus pentosaceus* 146); and stays stable during the 24h of incubation. Very low levels of expressed bacteriocins have been detected to be adsorbed to cell surface of the producer strains.

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Keywords: bacteriocin, lactic acid bacteria, *Lactobacillus*, *Pediococcus*, *Enterococcus*

Anthocyanins Extraction and Evaluation of *Hibiscus sabdariffa*

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Anthocyanins are plant pigments with great potential for competitive replacement of synthetic dyes, in addition to its chemical and bioactive properties, that are present in different organs of plants, such as fruits, flowers, stems, leaves and roots. The aim of this study was to evaluate the extraction and identification of anthocyanin compounds in Jamaica (*Hibiscus sabdariffa*) flowers. Extraction was performed at a temperature of 30 ° C with a solvent at pH = 2.3 and constant stirring at 350 rpm for 120 min. Solvent ratio 1:20 (m / v) with two different particle sizes (1.25 mm and 0.595 mm) was used. Differential pH method was used to quantify the concentration obtained and UV-visible spectrometry for identification, reporting the values of the total monomer anthocyanins as anthocyanidin-3-soforoside-5-glucoside. Most extraction efficiency (48.96%), with mean values of 329.39 concentration mg / L, was for the particle size 1.25 mm with 46.78% yield. The results were affected by parallel chemical reactions such as oxidation and co - pigmentation; the latter refers to a phenomenon that typically occurs in an aqueous medium, that it is affecting the anthocyanin's monomers in flavylium cation form, while another phenolic compounds, usually unpigmented, causing bathochromic effect, namely a shift to more bluish red color shades. The loss of anthocyanin in the presence of oxygen depends on the pH and color retention improves with oxygen removal by heating or by vacuum. The anthocyanin's extraction conditions open a new perspective for obtaining colored products, functional foods and / or dietary supplements with added value for human consumption. However, more studies are needed to establish the real implications of anthocyanins in the health - promoting properties conferred upon them.

Keywords: Anthocyanins, Extraction, Co-pigmentation, Oxidation

Assessment of Non-extractable Polyphenol Compounds of *Amaranthus hypochondriacus L.*

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Amaranth is well known because of its high protein quality. However, it has been used as anti-diarrheic, diuretic, anti-hypertensive and antioxidant. These effects are caused by secondary metabolites and protein content. Secondary metabolites as extractable and non-extractable polyphenols has an important role in the biological activities. Moreover its content of non-extractable polyphenols (NEPP) is still unknown. Similarly to extractable polyphenols (EPP), NEPP has displayed beneficial biological effects to human health because of their antioxidant activity. Since NEPP assessment has been underestimated, the aim of this research was to quantify the non-extractable polyphenolics content of amaranth plant. To this purpose, stem, leaf and stubble were separately oven dried and milled to obtain a flour. Afterwards, the EPP fraction of each flour, using a methanol/acetone (80:20) mixture, was obtained and assessed by Folin-Ciocalteu method. Gallic acid (GA) was used as antioxidant standard. Once the EPP was obtained, the remaining residue was used to evaluate the NEPP measured as hydrolysable tannins, using an acid hydrolysis (10% H₂SO₄/methanol; 10:90) and the condensed tannins as proanthocyanidins (PA), which were quantified by the colorimetric test called Porter assay using a butanol/HCl/FeCl₃ mixture. The hydrolysis of PA to anthocyanidins in butanol-HCl (95:5) is an auto-oxidation, which was recorded at 555 nm. Anthocyanidins concentrate (carob pod) was used as standard. Amaranth stubble afforded the highest EPP content as well as hydrolysable tannins (95.61 ± 1.19 mg GAE/100 g dw and 56.10 ± 1.26 mg GAE/100 g dw, respectively). As for the leaves, they had the highest amount of NEPP (46.74 ± 3.70 mg CE/100 g of dw). The EPP occurrence in several natural sources is ranged from 13-160 mg GAE/100 g dw), thus NEPP can increase the amount of EPP in order not only to contribute to use the whole amaranth plant, but also to increase the antioxidants and to take advantage of their antioxidant benefits to human health.

Keywords: Amaranth, non extractable polyphenols, antioxidant.

Molecular Characterization and Identification of *Pyrenophora teres* Causal Agent of Net Blotch of Barley in Mexico

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Barley is an important crop, followed by wheat, corn and rice. Both the seed and the plant are used in livestock, food and brewing industries. In Mexico barley it is sown in an area of 283, 386 ha; where 90% of this area is located between the states of Guanajuato, Hidalgo, Mexico, Puebla and Tlaxcala. Nevertheless, barley production is affected by fungal diseases such as cereal rusts (*Puccinia* spp.), net blotch (*Pyrenophora/Drechslera teres*), leaf spot or spots in leaves (*Cochliobolus sativus/Bipolaris sorokiniana*), root rots and head blight (*Fusarium* spp.) among other. Of these diseases the ones that cause more damage to barley plantations are the yellow rust and net blotch. In Mexico, there is not enough information about molecular identification of fungi barley diseases. Therefore, the aim of this research was to identify morphologically and molecularly strains of pathogenic fungi from barley grains with net blotch symptoms. The methodology involved the morphological and molecular characterization of the JCP2, JCP7, JCP10, JCP16, JCP19, JCP50, JCP51 and JCP57 strains. Morphological characterization of each isolate was performed using an optical microscope. Molecular characterization from total genomic DNA was extracted for each strain and was amplified the conserved region ITS I/5.8s/ITS II of the rDNA, using the primers ITS1-ITS4. Results confirmed identification of *Pyrenophora teres* and later was confirmed molecularly using the BLAST and MEGA version 6.0 programs. Results showed similarity between 98 to 99% for the GenBank sequences of *P. teres* (KP097728, JX187587, EF452452, JN943645, EF452469) with the Mexican barley strains isolated in this research. Morphological and ITS sequence based identification showed that the Mexican barley strains isolates from seeds with net blotch symptoms were consistent with *Pyrenophora teres*. With the results obtained can be identified in general, the major species of pathogenic fungi found in the cultivation of barley. Furthermore, it may establish a proposal for controlling *Pyrenophora* strains characterized in this work.

Key words: Barley, Molecular characterization, *Pyrenophora teres*

Inhibition of Growth of a *Kluyveromyces marxianus* Strain by a Higher Aromatic Alcohol: 2-Phenylethanol

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2-Phenylethanol (2-PE) is a higher aromatic alcohol with a rose-like odor that is considered a valuable flavor and fragrance, especially when it is obtained through natural ways. 2-PE is used in composition for food, mainly in soft drinks, candies and bakery, but also is important as a bacterial inhibitor. Natural 2-PE can be obtained by biotechnological pathways, however these processes are affected by product inhibition, for this reason it is important to know the tolerance of the microorganism to ensure a successful process. The aim of this work was to evaluate the growth inhibition of *K. marxianus* at the presence of different concentrations of exogenous 2-PE. Experiments were carried out in cell culture polycarbonate baffled flasks (125 mL), equipped with vent cover. A native strain *K. marxianus* ITD0090, isolated from *Agave duranguensis* must was proved as a promising producer of 2-PE and high tolerant to the effect of this alcohol. Inhibition kinetics were performed using mineral medium with 9 g/L of L-Phe at pH 5 and adding exogenous 2-PE at different concentrations (0.5, 1, 1.5 and 2 g/L), with a control fermentation. Each flask was inoculated (1×10^7 cel/mL) and incubated at 30 °C and 150 rpm. Cell viability was determined by spot assay for yeast, counting significant colonies in each quadrant by triplicate. Results showed that control fermentation presented a higher growth rate than fermentations with exogenous 2-PE, reaching $2.36 \times 10^9 \pm 2.36 \times 10^7$ UFC/mL after 48 hours, at this time the sugar consumption was completed. By adding exogenous 2-PE it is evident that the growth rate decreases, the biomass for 0.5, 1 and 1.5 g/L reached $1.57 \times 10^9 \pm 1.41 \times 10^8$, $1.78 \times 10^9 \pm 1.72 \times 10^9$ and $6.67 \times 10^7 \pm 0.0$, respectively. At 2 g/L concentration the growth was completely inhibited after 48 hours of culture, the impact of 2-PE in the metabolism of the yeast can affect the transport systems of sugars and amino acids, also the permeability of the membrane increases and the passive diffusion of ions and small metabolites accelerates. However, these results showed that the yeast can tolerate a considerable concentration of 2-PE and is a promising strain to be used in the production of this interest compound.

Keywords: 2-phenylethanol, inhibition, *Kluyveromyces marxianus*.

Effect of Light And Temperature on Pigment Production from Microorganisms Isolated From the Air of Santiago Papasquiario, Durango, México.

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Color is the most pleasing attribute of any product. In foods, the color is associated with quality, certain food groups are acceptable only if they fall within certain range of color gamma and their acceptability is reinforced by their economic worth judged purely on the color value. Various synthetic coloring agents have potential carcinogenicity. Natural colors, extracted from fruits, vegetables, seed roots and microorganisms and often called “biocolors” due to their biological origin and have proved to be safe and edible coloring agents. In this work, we obtained three microorganisms from air sampling from different areas of the gardens of the Instituto Tecnológico Superior de Santiago Papasquiario. Sampling technique was sedimentation using open Petri-dishes containing different media. Culture media were exposed at air for 2 hours, then the Petri-dishes closed were taken into the laboratory of Microbiology and were incubated at 28°C for 48 hours. Microorganisms that showed pigmentation from microbial growth in petri dishes, we selected those. The selected microorganisms were exposed to temperatures of 4, 17 and 28°C with and without UV radiation (290 to 310 nm). For the pigment extraction and biomass quantification, cells were harvested, and the pellet was suspended in methanol (5 ml). Then it was incubated in a water bath at 60°C for 15 min until all visible pigments were extracted, then the liquid was filtered (Whatman 40 paper). The colored extracts were analyzed by scanning the absorbance in the wavelength region of 400-600 nm using the spectrophotometer, according to the color of the pigment produced. Apparently, microorganisms found are a red fungus, a pink yeast and a yellow bacterium. The results showed that temperatures and radiation conditions affect pigment production; the best temperature for pigment production is 17°C for all cases. There is no significant difference between the different operating conditions for producing red pigments produced by fungi. Pink pigments have higher concentrations under conditions of 17°C and UV light. Yellow bacteria reach their highest concentration at temperatures of 17°C without illumination.

Keywords: Pigments, microorganisms, UV light.

Cellulase production in SSF over guishe (*Agave salmiana*) byproduct with applications in the food industry.

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Agave lechuguilla Torrey (lechuguilla), has been of great importance to communities that develop in arid and semi -arid northern Mexico. It has been reported that the *Agave lechuguilla* Torrey contains only 15% by weight fiber, while the remaining 85 % corresponds to a pulp called “Guishe“. Currently, this pulp has no commercial value because it is considered a residue, which so far not has reported some use. The objective of this study was to evaluate the cellulose production in FMS (solid state fermentation) using fungi microorganisms isolated from semi-arid desert of Coahuila. Were isolated 4 fungi strains (M1, M2, M3 and M4) and identified by biochemical and molecular techniques. An L9 taguichi were followed using 4 factors in 3 levels (air 0.4, 0.8 and 1.2 L/min; C:N 8, 16 and 24 g/L; particle size 10, 5 and 1 cm) using guishe as substrate in SSF. The enzymatic production was carried out testing each 24 h to 196 h using Ghose method (endo and exo-glucanase) and reduced sugar by Miller technique. The strain M4 has the highest growing and was identified as *Aspergillus* sp. The optimal production of cellulase using guishe as substrate were 0.4 L/min, 16 g/L and 5 cm. Guishe as byproduct is an alternative to produce cellulases with application in the food industry.

Keywords: cellulase, solid state fermentation, guishe, *Agave salmiana*

Antimicrobial Activity of Recombinant Bovine Lactoferrin Expressed in *Pichia pastoris*

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Lactoferrin (Lf) is an iron-binding glycoprotein belonging to the transferrin family. It is found in high concentrations in colostrum and milk, and in lower amounts in mucosal secretions such as tears, saliva, semen, nasal and bronchial secretions, bile, and gastrointestinal fluids. Because of its multiple properties, such as its antimicrobial, antioxidant and immunomodulator effect, Lf has been named nutraceutical protein. In the present work, bovine lactoferrin (bLf) was expressed in *Pichia pastoris* KM71-H under AOX1 promoter control, using pJ902 as the recombinant plasmid. Dot blotting analysis revealed the expression of recombinant bovine lactoferrin (rbLf) in *Pichia pastoris*. After Bach fermentation and purification by molecular exclusion, we obtained an expression yield of 3.5 g/L of rbLf. The functionality of rbLf was tested by its potential antimicrobial activity; rbLf and predominantly pepsin-digested rbLf (rbLfcin) demonstrated antibacterial activity against *Escherichia coli* (*E. coli*) BL21DE3, *Staphylococcus aureus* (*S. aureus*) FRI137, and, in a smaller percentage, *Pseudomonas aeruginosa* (*Ps. Aeruginosa*) ATCC 27833. The successful expression and characterization of functional rbLf expressed in *Pichia pastoris* suggest that, in the future, rbLf could be used safely in neonates and will have a positive impact on their development and health.

Keywords: Lactoferrin, nutraceuticals, recombinant proteins, antimicrobial activity

Quantification of Carbohydrates during the Fermentation of *Opuntia ficus-indica*

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Opuntia ficus-indica has been recently included as cattle feed. *Opuntia* has a high content of fiber and therefore represent difficulties for its consumption. However, this problem can be solved by a fermentation process. It has been demonstrated that the use of yeasts during fermentation promotes the increase in protein content, but it is unknown which is the behavior over the substrate used by yeasts in the process and the impact of using a yeast over the microbial population of *Opuntia*. Based on the above mentioned, the aim of this study was to evaluate the carbohydrate content of *Opuntia* during the fermentation process with *K. marxianus*. Three treatments were designed to evaluate the fermentation by *K. marxianus*, as follows: T1 (*Opuntia*), T2 (*Opuntia* inoculated with *K. marxianus*) and T3 (*Opuntia* sanitized with K₂S₂O₅ and inoculated with *K. marxianus*). The kinetic behavior was analyzed in the three fermentative processes, *Opuntia* were inoculated with 1X10⁸ cells/gr of yeast and incubated at 28°C until 120h. The treatments were dried, milled and hydrolyzed adding 100mL of H₂SO₄ 1.5N to 0.1g of each sample. After 30min total sugars were determined by the phenol-sulfur method. Consumption of total sugars at 120h was 51.9% for T2. Results show the influence of *K. marxianus* when it is incorporated in the process, reducing the time to which carbohydrates reach maximum consumption; this is observed for treatment T1 reached a maximum consumption of 41.2% at 120h, while for treatment T2, this reached a maximum consumption of 51.9% at 72 hours. And for the case treatment T3 was of 44.5% at 96h, so that the addition of yeast, and the sanitization process, increases the consumption of total sugars (p <0.05). These results suggest that the addition of yeast promotes the consumption of carbohydrates by microbial population.

Keywords: *Opuntia ficus-indica*, fermentation, sugars, yeast

Probiotic Potential of a Yeast Isolated From Tibicos (An Ethnic Starter for Tepache)

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In Mexico there are a variety of artisanal fermented beverages, such as tepache, in which microorganisms involved in the fermentation process may be associated with beneficial health effects. Probiotic *Saccharomyces cerevisiae* var. *Boulardii* is the only yeast that belongs to this group. In this work, the probiotic potential of a yeast isolated from tibicos used to prepare tepache was evaluated, production of extracellular enzymes and a preliminary identification using API 20C AUX were also conducted. This gallery indicated a 94.75% of identity with *Saccharomyces cerevisiae*. The first feature that a probiotic yeast should possess is survival under gastrointestinal transit conditions. Antioxidant activity and auto-aggregation after 2 and 24 h were another evaluated properties. In the first case, corresponding to 0.066 mM Trolox Eq. for antioxidant activity, and 52.5 and 96.95% for 2 and 24 h, respectively for auto-aggregation. Resistance to 3 different antimycotics (Nystatin, Ketoconazole and Fluconazole) was also proved. The yeast isolated from tibicos present larger inhibition halos with nystatin. All experimental assays were compared with a commercial probiotic (*Saccharomyces cerevisiae* var. *Boulardii*), showing similar behavior and sometimes a better one because yeast isolated from tibicos showed higher survival to gastrointestinal conditions (83.33% compared with 72.73% viability of the commercial probiotic) and higher antioxidant activity (where commercial probiotic obtained 0.035 mM Eq.). This yeast showed interesting properties, indicating as a possible potential probiotic that could confer a functional value to fermented beverages with tibicos.

Keywords: yeast, probiotic potential, tibicos

Effect of Osmotic Stress and The Red Light on the Induction of Somatic Embryos in Maradol Papaya

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The somatic embryogenesis represents an alternative for the generation of plants, which they influence diverse factors during the *in vitro* culture; between these, the conditions of illumination and stress of culture media during the training of somatic embryos are determining. The objective of this work was to evaluate the effect of the red light and osmotic stress in the production of somatic embryos of Maradol papaya. Immature fruits of Maradol papaya were used (60 days after the anthesis), was extracted the seeds to them in aseptic conditions. The seeds were washed and disinfected using a chlorine solution (6%), approximately seven embryos were placed in petri dishes that contained embryogenic culture media (MEmb) added with 3, 6 and 9% of saccharose (first level of the design). The petri dishes were stored in conditions of darkness providing to them certain doses of red light (0, 1 and 2 h) (secondly level), obtaining a total of nine treatments. In each treatment it was evaluated: the time of appearance of the somatic embryos, the quality of these, and the biomass with respect to the time. The results demonstrate a positive effect of the red light on the speed of the formation of somatic embryos, reducing of 3 months in conditions of total darkness, to 1,5 months when it is applied 2 hours to him of red light and 6% of saccharose; the results also show that the treatment with 3 and 9% of saccharose did not reach the speed of somatic embryogenesis as were obtained in the treatment with 6%, the petri dishes with 3% of Saccharose and exposed to 2 h of red light, induces the somatic embryogenesis similar to the control (6% Saccharose without exposition to red light) ($p < 0.05$). The obtained advances in this moment, indicate a positive interaction between the stress produced by the saccharose in the culture media and the exposition to the red light, which induces to an efficient process somatic embryogenesis.

Keywords: somatic embryogenesis, Maradol papaya, red lighth, osmotic stress.

Purification and Partial Biochemical Characterization of an Endoglucanase form *Penicillium commune* ITV01

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A *Penicillium commune* strain with high endoglucanase activity was isolated from soil samples of tomato crops in the Cotaxtla Experimental Station, Veracruz, México. In order to purify the enzyme, cells were grown in cellulose and activity was induced (112,182 mU/mL). A 10-500 kDa concentrated fraction was obtained by ultrafiltration from the fermented broth and was fractionated by isoelectric focusing (IEF), since it showed significant endoglucanase activity (895,757 mU/mL). Twenty fractions were obtained, seven of which showed endoglucanase activity (F2-F8). The fractions with the highest endoglucanase activity were purified to homogeneity by gel filtration chromatography (Sephadex G-100). The chromatographic separation showed one peak with high endoglucanase activity. According to SDS-PAGE, the endoglucanase purified is a monomeric enzyme with a molecular mass of 88.3 kDa (EG88). Based on IEF, EG88 has an estimated pI of 4.01. The optimum conditions for EG88 activity were at pH 4.0 and 38 °C. The enzyme showed high specificity toward CMC, was inhibited completely by Hg²⁺ and its activity was increased by Co²⁺ ions. EDTA had not effect on activity and suggests that EG88 does not require divalent cations for its catalytic function. In conclusion, an extracellular endoglucanase purified showed characteristics for biotechnological applications.

Keywords: *Penicillium commune*, endoglucanases, characterization, purification, cellulose.

Ethanol and osmotic tolerance of lactic acid bacteria involved in agave juice fermentation

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Lactic acid bacteria (LAB) are involved in agave juice fermentation, actually, there are not reports about their functions in this fermentation process and how they survive in this harsh environment, where high level of ethanol and osmotic pressure inhibit the growth of many microorganisms. The aim of this study was to find which ethanol and sugar concentrations allowed the growth of *Lactobacillus plantarum*, *Leuconostoc sp*, *Weissella cibaria*, *Lactobacillus fermentum* and *Oenococcus sp* in MRS modified medium, which simulates the agave must concentrations. The experimental strategy for ethanol tolerance testing was to growth the LAB in traditional MRS medium with different ethanol concentrations (6%, 12% and 18% v/v). The effect of osmotic stress was determined in MRS medium containing 100, 150 and 200g/l of sucrose, these two conditions were incubated at 30°C for 48 hours and taking samples every 4 h determining O.D. at 600 nm. As a result of this study only 3 LAB grew at the same osmotic and ethanol concentrations of agave must, and some of them grew more than the traditional MRS medium (control test). Due to this characteristics these LAB are capable to survive during the alcoholic fermentation process, where the initial sugar concentration in agave juice is 100 g/L and 6% (v/v) ethanol concentration at the end of alcoholic fermentation, in fact not only is necessary to know the osmotic and ethanol tolerance, but is important to know how they interact with yeast, due to the interactions between LAB and yeast can improve or deplete the quality on the final product.

Keywords: LAB, Ethanol tolerance, Agave juice.

Supercritical Fluid Extraction of Fatty Acids from *Heterotheca inuloides* and *Arthrospira platensis*

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According to the European Food Information Council, fatty acids are essential components of cell membranes because they promote the proper development and functioning of the brain and nervous system. Furthermore, they are precursors to many substances in the body such as hormones involving in the blood pressure, blood viscosity, and vasoconstriction, immune and inflammatory responses mainly. Supercritical fluid extraction (SFE), a green extraction process, has gained wide acceptance due to SFE has several unique properties as a promising alternative to conventional solvent extraction for separation of organic compounds in herbs, plants, fruits, mushrooms, and microalgae/cyanobacteria. The biomass analyzed were from *Heterotheca inuloides* (arnica) and *Arthrospira platensis* (cyanobacteria). The objective was the extraction of fatty acids with the potential to be high-value compounds. The methodology involves pretreatment of the biomass, SFE process, transesterification and gas chromatography analysis (GC-FID). The experimental design (DOE) Taguchi was used for *H. inuloides* and a 2k DOE for *A. platensis* for evaluate the effect of the pressure [bar], temperature [°C] and the co-solvent (ethanol, EtOH) [g/min] in the lipid extraction. The range of values used in the experimental design was 100-400 bar and 450-150 bar for pressure; 40-60 °C for temperature; 0-8, 4-10 g/min of co-solvent, to *H. inuloides* and *A. platensis*, respectively. The statistical analysis in Taguchi showed that any parameter plays were significant in the extraction of fatty acids in *H. inuloides* ($p > 0.05$). In the other hand, in the design 2k for *A. platensis* the pressure was a significant parameter ($p < 0.05$). Furthermore, the highest content of fatty acids obtained was 2.1 % w/w for *H. inuloides* at (300 bar, 40°C and 8 g/min of EtOH) and 3.48 ± 0.08 % w/w for *A. platensis* at (450 bar, 60°C and 10 g/min of EtOH). The extraction processes were performed during 60 min and 50 min for *H. inuloides* and *A. platensis*, respectively. Between 4 and 17 fatty acids were found in the profile depending on the sample. For these reasons, we consider the importance to study fatty acids is relevant to food, therapeutic and nutritional applications. This work represents huge opportunity to produce information on these areas using SFE technology.

Keywords:

Supercritical Fluid Extraction, Fatty Acids, Green Extraction, *Heterotheca inuloides*, *Arthrospira platensis*

Gene silencing effect on the kinetics *Tomlox B* lipoxygenase in tomato (*Solanum lycopersicum*)

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Shelf life extension of fruits has been the subject of numerous investigations based on the expression and activity measurement of ACC synthase and oxidase, which are related to ethylene production. It also includes other enzymes related to tissue softening as polygalacturonase and pectin-methyl esterase. Furthermore, lipoxygenase is an enzyme involved in the maturation processes, which catalyzes the addition of molecular oxygen to unsaturated fatty acids, that contain a *cis, cis*- 1,4-pentadiene. This enzyme is involved in the production of jasmonic acid, generation of volatile compounds and in the response to injury. However, the relationship between gene expression (*TomloxB*), the production of hydroperoxides, and their participation in fruit ripening has not been thoroughly studied. We pursued to analyze the enzymatic activity of lipoxygenase with *TomloxB* gene antisense silencing in tomato fruits. The methodology was as follows: tomato fruits were harvested in selected stages of maturation (break, turning and pink). Lipoxygenase enzyme activity was measured in wild and genetically modified fruits using linoleic acid as substrate, by measuring the absorbance at 234 nm λ . Kinetic parameters such as V_m and K_m were calculated. Reduced activity was observed in the modified fruits, mainly in the broken and pink stages; obtaining a V_{max} of 14.92 AU and 67.56 AU on two lines, while the wild fruits had a V_{max} of 84033 AU. The results so far indicate that reduced *TomloxB* activity decreased was attributed to the transformation event where the gene was silenced.

Keywords: Lipoxygenase, Kinetics, Silencing.

***TomLox B* silenced mutants of tomato (*Solanum lycopersicum*) var. TA234 has an increased postharvest life**

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Postharvest life is an important area in fruit and vegetable crops because this period determines its economic value and opportunities of trade. This study is based on gene expression related to softening and textural changes aimed to help understanding the complex mechanism of ripening and thus the opportunity to increase the postharvest life of tomatoes. *Tomlox B* plays an important role in ripening, mainly in loss of cellular integrity due to the action on fatty acids released from the lipid matrix of membranes which initiate oxidative deterioration, which is carried into senescence. In order to increase postharvest life, we produced transgenic tomato plants via *Rhizobium radiobacter* with *Tomlox B* antisense constructs under control of the cauliflower mosaic virus 35S promoter. Lipoxygenase activity and firmness were measured in tomato fruit and lipid profile was determined. Transgenic fruits were maintained for 40 days in optimal conditions, whereas wild type fruits remained in similar conditions for only 6 days. Firmness in pink and red stages was significantly lower in wild type fruits than in two transgenic lines. Linolenic acid was the most important fatty acid substrate consumed by Lipoxygenase in both turning and pink stages of ripening. Lipoxygenase activity was diminished in comparison with the wild type. These results suggest that silencing *Tomlox B* gen promote significant changes in postharvest life being one the most important the increase in postharvest life.

Keywords: Lipoxygenase, tomato transgenic, postharvest life.

Off-line Monitoring of Fructanase Enzymatic Activity Produced by *Kluyveromyces marxianus* by Sequential Injection Analysis

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The aim of this work was to develop a method to monitor off-line the production of a fructanase produced by a strain of *Kluyveromyces marxianus* isolated from the mezcal process. The methodology was carried out in a sequential injection analyzer (SIA) designed in our laboratory. Off-line samples of culture broth were taken from a bioreactor and fructanase was determined with the SIA system. The established technique was validated against the standard method by means of quantifying the fructanase activity in our laboratory, via 3,5-dinitrosalicylic acid and sucrose as substrate (statistical analysis for comparison was done in the program STATGRAPHICS Centurion XVI at the 95% confidence level). The method consisted into pump cell free samples from the fermenter to the SIA. If necessary automated dilutions were performed in function of the culture elapsed time and then substrate was added to the sample and incubated, to then be mixed with DNS reagent, and heated/cooled to finally be read by a spectrophotometer at 540 nm. The sequential injection analysis allows us to measure the activity of an undiluted sample in a linear range of 0.01-1.4 U/ml, with the capability to perform up to 100,000 fold dilutions. The methodology could perform from 4 to 5 runs per hour, depending on the required dilution. The current methodology could be adapted to measure on-line the concentration of substrate (residual reducing sugars) during fermentation; gathering more information using the same method. Sampling will be performed by a ceramic filter sampling probe attached to a 3L fermenter. An on-line monitoring system could provide information in real time of the state of the culture, enabling the design of optimization and process control strategies for the production of enzymes capable to hydrolyze long oligosaccharide chains to monosaccharides; thus, setting the basis for the production of added value products such as high fructose syrup or prebiotics.

Keywords: *Kluyveromyces marxianus*, fructanase, off-line, monitoring, SIA.

Kinetic of the Hydrolysis of Sardine Oil by Different Lipase Sources

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In this work the activity and specificity of commercial lipases for the hydrolysis of sardine oil were evaluated. Lipase from *Burkholderia cepacia* immobilized on celite; and soluble lipases from *Aspergillus niger*, *Rhizopus oryzae*, *Pseudomonas fluorescens*, and *Burkholderia cepacia* were screened for the hydrolysis of sardine oil emulsified in phosphate buffer (0.1 M, pH 7.0, with TRITON 0.7%). Results showed that all enzymes were able to hydrolyze the sardine oil in different extents. The soluble lipases exhibited the lowest degree of hydrolysis (25%) after 8 h, whereas immobilized lipase reached 50% of hydrolysis in a 6 h reaction period. The kinetic parameters (V_{max} , K_M , k_1 , k_{cat}) for the lipases were estimated by regression analysis with the integrated model of the Michaelis-Menten equation. Good predictability of the reaction under experimental conditions was achieved validated by the coefficient of determination (R-squared).

Keywords: kinetic parameters, lipase, hydrolysis, PUFA, sardine oil.

Effect of the Nixtamalization and Fermentation on the Nutritional and Functional Quality of Pozol of Native Pigmented maize

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Nixtamalization affects the functional quality of maize, but the fermentation can improve this attribute. The aim was to evaluate the nutritional and functional quality of pigmented native maize subjected to nixtamalization and fermentation. 5 landraces of pigmented maize were analyzed, determining moisture (%), ash (%), fat (%), protein (%), anthocyanins (mg * 100 g⁻¹), total polyphenol (mg GAE * 100 g⁻¹) and antioxidant activity (% DPPH inhibition). The variety with more anthocyanins and total polyphenols was subjected to two types of nixtamalization (N): N-traditional (Ca (OH)₂) and N-ecological (CaCO₃); it was then leavened for 40 hours using *Lactobacillus rhamnosus* GG and *Streptococcus thermophilus*. The variables described above were evaluated anew and, besides lactic acid (%), free amino groups (mg Eq Glycine * mL⁻¹) and GG *L.rhamnosus* viability (CFU * mL⁻¹) was evaluated. The found values for each of the variables evaluated varied among 5.42-6.18, 1.30-1.40, 10.3-12.43, 3.44-4.47, 1.15-27.3, 73.53-122.18, and 68.79-91.85 respectively. Significant differences were found in all variables except ashes ($p \leq 0.05$). The variety X'ejúu nuk nal exhibited higher concentrations of anthocyanins and polyphenols. Both methods, N-traditional (Ca (OH)₂) and N-ecological (CaCO₃) of nixtamalization led to an increase in humidity (more than 10 times) and a decrease of the other variables in a range from 3.09 to 90.26% in N-traditional and 9.98 to 85.68% for N-ecological respectively (compared to the initial value). Fermentation reduced ash, protein and fat in a range from 15.4 to 44.38% and caused the increase of anthocyanins, polyphenols and antioxidant activity in a range from 1.17 to 3.7 times as compared to the value after nixtamalization. The value of lactic acid and free amino groups increases from .026 to .15 and from .04 to .32 after fermentation, in both methods, N-traditional (Ca (OH)₂) and N-ecological (CaCO₃) of nixtamalization. The viability of *L.rhamnosus* GG was 2.23×10^8 and 3.01×10^7 for N-traditional and N-ecological. Nixtamalization and fermentation had significant effects on all the evaluated variables ($p \leq 0.05$). The use of nixtamalization and subsequent fermentation, allows us to obtain a probiotic and antioxidant drink.

Keywords: pigmented maize, Fermentation, nixtamalization, functional and nutritional value

Production of a Fructanase by *Kluyveromyces marxianus* with Possible Application in the Manufacture of High Fructose Syrup.

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The objective of this work was to compare the production of a fructanase in batch cultures, evaluating five different carbon sources, using the *Kluyveromyces marxianus* SLP1 strain isolated from the elaboration process of mezcal in San Luis Potosí, México. Batch fermentations were carried out in 3L fermenters with a working volume of 1.5L under the following parameters: from 20 to 40x10⁶ inoculated cells, 1vvm of aeration, 500rpm, controlled pH at 4.5 and a constant temperature of 30°C. The carbon sources (at 25g/L) were glucose, fructose, sucrose, inulin or agave fructans in chemically defined medium. Sampling was executed every 1-2h until the stationary phase was reached following the growth kinetics by means of an in-line permittivity probe. Enzyme activity was performed via the 3,5-Dinitrosalicylic acid technique using sucrose as substrate. The resulting enzyme activity increased, depending on the carbon source, as follows: glucose (215U/g), fructose (968U/g), sucrose (1267U/g), agave fructans (5838U/g) and inulin (6681U/g). The ANOVA showed that there was no significantly statistical difference between the agave fructans and inulin batch cultures, but they were significantly different from the glucose, fructose and sucrose cultures. Moreover, glucose culture was no different from the fructose culture, and the latter, had no significantly difference from the sucrose batch culture (all the analysis were performed in STATGRAPHICS Centurion XVI at the 95% significant level using Tukey HSD test). All the results indicate a partially constitutive enzyme that could be produced in order to hydrolyze long chain oligosaccharides for the production of high fructose syrup from agave fructans, in a one enzyme - one step process, pointing towards the organic market which is growing every year.

Keywords: *Kluyveromyces marxianus*, fructanase, cultures.

Effect of Storage in Formation Biogenic Amines in Rabbit Meat with Different Packaging

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The aim of the study was to identify the production of biogenic amines (AB) and microbial load in rabbit meat (*Longissimus thoracis et lumborum*) using 3 different packaging: Plastic Bag, control group (C), in tray polyethylene film semipermeable plastic (ES) and vacuum packaging (EV), measured putrescine (PU), cadaverine (CA) and histamine (HI). In the package C, the pH value showed significant differences ($p < 0.05$) when compared on day 0 vs. 7, 14 and 21 days. Color brightness (L) was statistically different ($p < 0.05$) between the days of refrigeration, the highest value was taken on day 0 and then decreased 3.67 units at the end of the experimental period. The a^* and b^* semipermeable control and packaging had the lowest value on day 0 and increased with cooling of samples in 3.3 and 4.0 units ($p < 0.05$), respectively. PU concentration increased 17.3 and 41 units from 14 and 21 respectively. The highest concentration of PU was in the ES, the CA in the EV and HI in the C all at the end of the experimental period. The count of enterobacteriaceae to 14d in the ES group (6.05) was lower than in the EV group (1.98). The coliform bacterial count was no statistical difference ($p > 0.05$) on days 0, 7 and 21d between the three types of packaging. However, 14d, the comparison between groups C and EV decreased 2.7 units. In conclusion, the AB content increased with the storage time, increasing production from AB 7d. The amount of enterobacteriaceae not altered by the shelf, but this did not happen with the count of aerobic mesophilic bacteria, which increased at the end of the evaluation period.

Keywords: Amines, meat, bacteria, packaging.

Study of the Interaction between Protein Ricin and Proanthocyanidins Extracted From Grape Pulp by Ultrasound

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Ricinus communis L. castor belongs to the subfamily Acalyphoideae. The solid residue remaining after castor oil extraction process, has a total protein content of 34-36%, was reported be present to the extent of 1.5% in the residue. Currently different methods have been used for partial or total removal of this toxic protein, to obtain a product with high content of beneficial proteins, but residues are not suitable because of the total elimination of proteins, leaving a residue which only serve as fiber. Therefore, for removal of solid waste it has been thought in the selective precipitation of ricin using proanthocyanidins derived from grape pulp using ultrasonic, due to the possible interaction between proteins and polyphenols. In the present study, the possible interactions that allow precipitation of proteins such as ricin with proanthocyanidins extracted from grape pomace by ultrasound were analyzed. The solid residue was extracted with a 0.14M ricin pH4 solution and was analyzed by electrophoresis performed a TRICINE-SDS-PAGE and quantification by the method of Lowry. Proanthocyanidins were extracted from grape pulp with a mixture of solvents acetone, water, methanol, and quantification by the Folin-Ciocalteu method; size was measurement by floroglucinolisis. The proanthocyanidins were placed in contact with the solid residue from *Ricinus communis* at different concentrations and the precipitate was analyzed. The results showed that the extract recovered in electrophoresis has the characteristic band of molecular weight of ricin (64KDa). Through Protein identification by LC-MS analysis confirm the presence of ricin and some amino acids contained in the extracts. In trials precipitation with proanthocyanidins ricin, it was found that the concentration where exist more precipitation was 50/50 (v / v). These results were confirmed by HPLC which representative peaks are observed. This study confirms of the interaction between proanthocyanidins and protein ricin contained in the solid residue seed, providing an understanding of the interaction between proteins and specific groups of polyphenols.

Keywords: ricin, proanthocyanidins, interaction

Effects of Lamb Meat Quality Using Biogenic Amines Evolution along Storage Time with Packing Impregnated with Rosemary Herb Microcapsules

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The aim of the current study was to evaluate the effects of Rosemary herb (Ros) microcapsules on the stability of lamb meat with and without bruising during 1 and 21 days of stored. Ros was encapsulated with a emulsion using paste-like microcapsules which were prepared as water-in-oil, contained distilled water, 20% w/v in 3% w/v sodium lactate and in 20 mM sodium bicarbonate, which these were emulsified with an oil mixture of 22% butter fat plus 78% corn oil and 0.1% polyglycerol polyricinoleate. Treatments were divided in: 1) Control: Vaccum-no bruising (VNB) and vaccum-bruising (VB), 2) VNB and VB impregnated with Ros, 3) VNB and VB impregnated with Ros microcapsules. Formation and accumulation of biogenic amines in meat is the result of the enzymatic amino acids decarboxylation; therefore, the determination was made by high performance liquid chromatography. Results: VNB and VB from 1st until 21st day of stored presented the highest content of putrescine (VNB: 26.3 and VB: 60.1mg/kg), cadaverine (VNB: 13.7 and VB: 45.0mg/kg) and histamine (VNB: 4.4 and VB: 11.3mg/kg) than other treatments ($P < 0.01$). The histamine, cadaverine and putrescine levels were no significant differences during 1st day of stored in Ros-treatments ($P > 0.05$). Histamine was higher in 21 days of stored to VB-Ros than VNB-Ros (6.1 vs 3.0mg/kg), but these levels was lower than no-Ros. Ros microcapsules was a lightly effect only in VNB, in this case VNB- impregnate with Ros microcapsules had lower level of histamine (2.4mg/kg) and cadaverine (6.1mg/kg) than VB impregnated with Ros microcapsules (histamine 5.2mg/kg, cadaverine 20.4mg/kg and putrescine 39.2mg/kg, $P < 0.05$) during 21 days of stored. As conclusion, meat impregnation with Ros decreased levels of amines. Ros microcapsules decreased amines levels in samples meat-no bruising than meat-bruising group, improved the shelf life of meat.

Keywords: Amines, Meat, Microcapsules, Rosemary herb.

Isolation and Classification of a Protease Extracted from *Solanum elaeagnifolium* Cavanilles Berries

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In some places of Chihuahua México, the fruits of the plant *Solanum elaeagnifolium* have been used ancestrally as milk coagulant in the manufacture of cheeses. This plant is native to America, and it is considered a problem for some crops. The protease from *S. elaeagnifolium* has been scarcely studied. Neither the molecular mass of the protease molecular nor its catalytic type has been established yet. For this reason, the aim of this work was to classify and purify the protease partially from *S. elaeagnifolium*. For this, yellow berries were collected and analyzed for its proximal composition. Then, the berries were blended with a buffer solution to obtain crude extracts (CE). From the CE, two purifications processes were tested. In the first protocol, a liquid-liquid extraction using ethanol was used to fractionate the proteins of the CE. The second protocol of purification an ammonium sulfate fractionation was used. The results showed that the ethanol extraction was a good purification method since the supernatant got high proteases concentration. The analysis of the supernatant by SDS-PAGE showed three marked bands (58, 15 and 14 kDa). The 58 kDa band was proposed as the possible molecular mass of the protease. Ammonium sulfate fractionation did not show good protein separation in the SDS-PAGE, probably due to the high content of sugars in the extracts. When assessing the protease proteolytic action on milk proteins, it was evidenced a nonspecific hydrolysis over caseins. The electrophoresis gels showed the protease degraded α_{S2} -, β -, α_{S1} -and κ -caseins. On the other hand, the protease did not hydrolyze whey proteins. Furthermore, it was noticed that the protease hydrolysis requires less energy and occurs ten times faster than chymosin hydrolysis since its activation energy resulted ten times lower than chymosin. Besides, the serine protease inhibitor, PMSF, showed the highest inhibition. These results indicate that the *S. elaeagnifolium* berries contain a serine protease with an approximate molecular mass of 58 kDa. This protease can hydrolyze milk caseins nonspecifically, but can't hydrolyze whey proteins. Consequently, this enzyme could be used for modifying soft cheeses or could be used for bioactive peptides production.

Keywords: *Solanum elaeagnifolium*, purification, caseins, whey proteins, serine protease

Enzymatic Conversion of Sucrose to Isomaltulose by Sucrose Isomerase Expression via an Expression Vector in *Pichia pastoris*.

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There are incorrect eating habits, highlighting excessive consumption of refined carbohydrates, which has led to problems such as increased chronic diseases such as type 2 diabetes, obesity, dyslipidemia and metabolic syndrome. Sucrose is the sweetener used at present, this contributes to the occurrence of metabolic disorders. Isomaltulose is a natural sweetener that has half the value in calories than sucrose, however, its physiological effects vary to sucrose, it is low glycemic and insulinemic index, provides a power supply more constant and balanced lasting as glucose. Due to the benefits of isomaltulose, it seeks expression gene encoding sucrose isomerase to convert *in vitro* way to sucrose in isomaltulose with the purpose of application in food industry. There has been some research works with expression vectors to determine the production of sucrose isomerase and thus the isomerization of sucrose into isomaltulose. Thin layer chromatography was made to prove the presence of isomaltulose due to isomerization of sucrose. Due to the background mentioned, in this work it pretends the expression of sucrose isomerase enzyme through a pD902 expression vector using a eukaryote expression system like *Pichia pastoris*. The enzyme sucrose isomerase was expressed in *Escherichia coli* (as a comparison) using the inductor IPTG and *Pichia pastoris* taking advantage of the methylotrophic promoter AOX1. The size of the enzyme (66-68kDa) was verified by SDS-PAGE and the presence of isomaltulose with a thin layer chromatography. We are now preparing a batch induction and cell immobilization assays.

Keywords: Isomaltulose, Sucrose Isomerase, *Pichia pastoris*

Enzymatic Synthesis of Fructooligosaccharides (FOS) Using Aguamiel as Substrate

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Fructooligosaccharides (FOS) are prebiotic compounds non-digestible with many beneficial properties, which include a good absorption of mineral in the body, regulate blood glucose and cholesterol levels and contributing to the prevention of colonic cancer for their high prebiotic potential. FOS are formed by enzymatic synthesis from sucrose through fructosyltransferases enzymes (FTases) (EC 2.4.1.9). The reaction mechanism occurs when high concentrations of sucrose are used. Aguamiel is a by-product rich in fermentable sugars such glucose, fructose and sucrose obtained of some agave species which proves to be an excellent alternative to study the enzymatic synthesis of FOS. The objective of this work was evaluated the enzymatic synthesis of FOS using aguamiel as substrate. FOS synthesis was carried out using FTases enzymes from *Aspergillus oryzae* DIA-MF previously produced by solid-state fermentation with aguamiel as culture media. First, 100 μ L of enzymatic concentrated extract were mixed with 900 μ L of aguamiel (sucrose content 37 g/L) and incubated in a water bath for 1 h. Finally, the reaction was stopped by ebullition during 3 min. The effects of incubation temperature (30, 40 and 50 °C) and initial pH (5.0, 5.5 and 6.0) were evaluated in the reaction. Determination of the FOS produced was measured by HPLC analysis. The results showed that the synthesis of FOS in aguamiel was possible achieved yields of 9 g/L at 1 h of reaction. In addition, the incubation temperatures and pH tested had no significant effect in the synthesis of FOS. Also, a kinetic study for the enzymatic production of FOS was performed with an incubation temperature of 30 °C, and initial pH of 5.0. This study revealed that the maximum production of FOS was in a period of 60 to 120 min with a yield between 8-11 g/L of kestose with a sucrose reduction of 43% and a FOS production of 30%. In conclusion, the enzymatic synthesis of FOS from aguamiel was possible and therefore this by-product represents a viable and economical alternative for the food industry in the formulation of functional beverages.

Keywords: Aguamiel, fructooligosaccharides (FOS), fructosyltransferases.

Isolation and Characterization of Bacteriophages Infectives of Pathogenic Bacteria of Foods

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Bacteriophages or phages are viruses that infect bacteria and the most abundant biosphere entities are considered. In rural areas of southern Sonora, México there have been outbreaks of enteric diseases caused by consuming contaminated food and water. There is enough scientific evidence on the effectiveness of phages as biocontrol agents against bacteria such as *E. coli* and *Salmonella*. These agents have been approved as GRAS (generally recognized as safe). The objective of this research is the isolation and characterization genomic of lytic bacteriophages own in southern Sonora, having infectivity against *Escherichia coli* O157 and *Salmonella* EC-48 *choleraeius* (10708) and can be proposed as a biocontrol in foods. For the isolation of these organisms environmental samples from rural communities in southern Sonora were taken and the phages were replicated in double agar. Purification was performed with buffer solution and washed using ultracentrifugations. Phage DNA was extracted and purified from phage lysates using QIAGEN lambda Mini Kit. Phage samples were digested with restriction endo nucleases (*Hind* III, *Eco* RV, *Bam* HI, *Eco* RI), and DNA fragments were separated by electrophoresis and banding patterns were visualized with uv transilluminator. The results showed three lithic phages, forming between 150-400 PFU (Plaque Forming Units) were selected for the genomic study and designates by their source (DAF1, DAF2, residual water and lithic to *E. coli*) (DJNoF, surface water and lithic to *Salmonella*), phage showed DAF1 wider polymorphism when digested by *Hind* III, *Eco* RV and *Eco* RI enzymes, phage DAF2 was that showed greater polymorphism to be digested by the four enzymes. In contrast, the phage DJNoF showed less polymorphism, however, the enzyme *Bam* HI restricted showed a pattern of bands. This result confirmed the genetic differences of the isolated phages and suggest could be studied how biocontrol in foods.

Keywords: Bacteriophages, *E. coli*, *Salmonella*, Biocontrol.

Transgenic Tobacco Plants Transformed With the Gene that Encodes Bovine Lactoferrin: a Nutraceutical Protein.

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Currently, the use of genetically modified plants as bioreactors for the production of recombinant proteins is taking great importance in the food and pharmaceutical industry. Tobacco plants are recognized as one of the best platforms production of heterologous proteins because they are easy to handle and also we achieved to obtain their high levels of expression. In the present work, we transformed tobacco plants via biolistic with the plasmids pIGF1 and pIGF2 that contain a gene that encodes for recombinant bovine lactoferrin via nucleus and chloroplast, respectively. The purified of recombinant bovine lactoferrin will allow us to study the capability of the protein to enhance the immune response and later, the use as possible nutritional supplement. Lactoferrin is a nutraceutical protein that have an antimicrobial and immunomodulatory effect, among others. After plant regeneration we obtained two lines of transgenic tobacco plants (Nt-pIGF1 and Nt- pIGF2). Putative transgenic plants were selected first by dot blotting analysis to confirm the presence of recombinant bovine lactoferrin. Positive clones were propagated and molecular analyses were done. Chloroplastidic lines were hybridized with Digoxigenin probe targeted to lactoferrin and or aadA that confers spectinomycin resistance to tobacco transformants. Also, nuclear targeted genes were hybridized against lactoferrin and to detect nptII gene (kanamicin resistant gene). We will move forward to express nutraceutical proteins in lettuce.

Keywords: Bovine lactoferrin, tobacco plants, nutraceutical protein

Evaluation of Pectinesterase Activity and Changes on Sensory Attributes of Granny Smith Apple Juice.

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In recent years it has been observed that consumers tend to give greater importance to the quality of the food they consume, interested not only by the nutritional value of the same but by the degree of satisfaction and pleasure that they give you. It is so in the present, the choice of food is done on the basis of their quality or "degree of excellence", which includes concepts such as nutritional value, appearance, texture, flavor and aroma. That is why the consumer prefers that some juices such as apple and pear, have a crystalline aspect, to achieve this are added pectinases (pectinesterasa) juice to decrease the viscosity. The objective of the present work was to inactivate the pectinesterasa (PE) through heat treatments and evaluate sensory changes after each of them. The results were analyzed using a completely randomized design and Tukey test ($P \geq 0.05$) for the significant differences. To achieve the objective apple juice of the Granny Smith apples was obtained and was physicochemical characterized (TSS, TA, color, pH,). The juice was submitted to different heat treatments (50-90°C) to inactivate the PE during 0, 5, 10, 15, 20, 25 and 30 minutes. It was followed by the assessment of the activity pectinesterase, taking as a reference the enzyme activity of the control sample (fresh juice without heat treatment). A sensorial evaluation was conducted with 21 trained judges to evaluate the changes in the sensory properties of the juice treated at different temperatures and times. The sensory test applied was a hedonic using a scale of nine points. The inactivation of the PE was achieved at 70°C for 25 minutes, the rate constants of inactivation were 0.0066, 0.0568 and 0.1181min⁻¹ for temperatures of 50, 60 and 70 °C, respectively. The Z value was 16.02°C and the activation energy (Ea) was 31.7681 Kcal/g-mol. The results of the sensory evaluation show that heat treatments applied to samples of juice evaluated affected the attributes evaluated. There were significant differences ($P < 0.05$) between samples regarding the attributes of color, appearance and global acceptance. However, there were no significant differences ($P < 0.05$) for attributes of odor and flavor.

Keywords: pectinesterase activity, apple juice, sensory evaluation, enzymatic inactivation, physicochemical properties.

Purification, Characterization and Antifungal Activity of β -1,3-Glucanases From *Penicillium commune* ITV01 Against Phytopathogenic Fungi

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The damaging effect caused by chemical pesticides to the environment, have resulted in the implementation of other alternatives such as biological control. In this regard, many microorganisms like *Trichoderma* have demonstrated its usefulness in controlling pathogens. However, other microorganisms have been targeted as potential antagonists of phytopathogenic fungi diseases of fruits and vegetables. *Penicillium* strains or their enzymes could be used as biological control agents of phytopathogenic fungi. The objective of this study was to purify and characterize the β -1,3 glucanolytic system of the strain *Penicillium commune* ITV01 which has high glucanase activity. β -1,3-glucanases were induced in minimum medium and laminarin as sole carbon source. Proteins were precipitated with ammonium sulphate and β -1,3-glucanases were purified by Sephadex G75 gel filtration and DEAE-sepharose ion exchange chromatography. The fungus produced at least four β -1,3-glucanases. Their molecular masses were estimated by SDS-PAGE: 98, 87, 58 and 32 kDa and designated as F98, F87, F58 and F32. F98 and F87 had its maximum activity at pH 5.0 and temperature of 50°C. F58 and F38 reach maximum activity at pH 6 and 5, respectively. F87 was specific for β -1,3 and β -1,4 linkages. F98 and F87 were stimulated by Co^{2+} , F58 by Mg^{2+} and F32 by Mn^{2+} . Incubations of *Pestalotia pezizoides* and *Helminthosporium solani* cells walls with F58 enzyme resulted in the highest production of reducing sugars (67 and 69 $\mu\text{g mL}^{-1}$). The effect of purified enzymes on fungi growth on PDA medium showed that produced inhibition on *S. rolfsii* (13%) and *F. solani* (36%). The results show that β -1,3 glucanolytic system has low capability as a biological control agent of phytopathogenic fungi, however, its properties could conduce to a research from biotechnological applications.

Keywords: β -1,3-glucanase, characterization, phytopathogenic, *Penicillium commune*, purification.

The Weevil *Rhyzopertha dominica* Modulates the Kinetic and Biochemical Properties of Progenies' Isoamylases to Feed on Stored Wheat Kernels in Response to Amylase inhibitors

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The coleopteran *Rhyzopertha dominica* is a pest that feeds on wheat kernels under storage causing significant economic losses. Wheat cultivars differ in resistance to stored-product insects and α -amylase inhibitors are considered in plant breeding programs to reduce insect infestation. However, resistant wheat varieties do not completely prevent infestation by *R. dominica* and damage always occurs. To gain insight into this problem, the present study was carried out to study some biochemical and kinetic properties of amylase inhibitors from infested wheats and the amylase activity of *R. dominica* progenies. Samples of eight wheat varieties varying amply in α -amylase inhibitory activity were infested with the weevil and emerging progenies were used as source of amylases. The albumin fractions of the most (Villa Juarez) and least (Bourlag) infested wheat samples were selected to study and contrast their inhibitory activity against the amylase activity of the progenies reared on them. The amylase activity of weevil progenies was resolved into three isoamylases by hydrophobic interaction chromatography. The albumins of the wheats were separated by gel filtration chromatography and tested against the isoamylases of each progeny. Kinetic parameters, K_m and V_{max} of the isoamylases were determined by the double reciprocal plot of Lineweaver-Burk. Determination of the half maximal inhibitory concentration (IC_{50}) was carried out by using different concentrations of purified albumin inhibitors. The results demonstrated a negative linear relationship ($r = -0.84$) between progenies number and amylase inhibitory activity. The gel filtration profiles of the albumin fractions of the two wheats showed that the least infested wheat contained very active inhibitors. The kinetic parameters K_m and V_{max} of the progeny isoamylases reared on that wheat were lower than those of the most infested wheat (Bourlag), however their hydrolytic efficiency rates (V_{max}/K_m ratio) showed lower values indicating that starch hydrolysis was not efficient affecting negatively the development and reproduction of the weevils. The amylase inhibitors isolated from Villa Juarez showed lower IC_{50} values (3.6-8.3 μg) than those of Bourlag (39.5-103.0 μg). The results of the present study demonstrated that the amylase inhibitors in wheats induced catalytic changes in *R. dominica* amylase activity during infestation.

Keywords: Amylase activity; Amylase inhibitors; Wheat resistance; Characterization

A Novel Metabolomics Approach to Predict the Sensory Profile of Coffee Beverage

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The chemical composition of food and beverages has a direct relation with sensory traits and product quality. Therefore, the raw material used in food productions has a crucial influence on the final customer satisfaction. For this reason we develop new breeding strategies to enable the selection of plant varieties with desirable agronomic and sensory traits. Coffee is one of the most important products in food and beverages industries because of its global trade volume. Conventional breeding of coffee plants takes several generations and long time. We propose a non-targeted metabolomics approach to identify highly heritable metabolites linked to coffee beverage sensorial traits in early stages of development. Our experimental design consisted in a maternal half sibs approach to estimate the metabolites heritability through forty mother and eighty half sibs of *C. canephora* plants. Leaves at early plant development stages and mature fruits were collected from an experimental farm in Chiapas, México. Fruits were post-harvest treated, to obtain green coffee and subsequently subjected to roasting. The extracts of leaves, green and roasted coffee were analyzed by UPLC-MSn (Ultra Performance Liquid Chromatography-Mass Spectrometry). MS data analysis was conducted in MZmine. Identity of metabolites was determined using high resolution accurate mass and MSn data. The heritability of metabolites was calculated by linear regression progeny-progenitor. Coffee beverages were subjected to sensorial evaluation employing a trained cuppers's panel. Preference, flavor, aromatic intensity, aromatic quality, body, acidity, sourness, bitterness, astringency and aftertaste were assessed using a 0 to 5 scale. Correlations 'metabolite-sensory trait' were determined by Spearman correlation analyses. Statistical analyses were conducted in Rstudio. We identified 150 highly heritable metabolites (heritability ≥ 0.4) linked to coffee beverage sensory traits (Spearman CC ≥ 0.7 ; p value ≤ 0.01). Particularly we detected a group of lipids associated to multiple attributes: DGTS 36:9, DAG (16:0/18:2), DGTS 38:9, PC (16:0-18:1) and PC (16:0/16:0). Lipid levels were able to predict flavor, bitterness, acidity, sourness and preference of coffee beverage with high accuracy. Our novel metabolite markers-assisted strategy accelerates the selection of *C. canephora* plants with desired sensory characteristics and therefore the genetic improvement of coffee plants.

Keywords: Metabolite Markers, Coffee Sensory Traits

Assessment of Quality of *Psidium guajava* producing area Zacatecas Cannons, Through the Physical Characterization.

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Characterization and evaluation of the quality of germplasm 503b Campeche, Campeche germplasm 511C and crosses selection selection 10 x 51, determining the nutritional value suitable for consumption. Physicochemical analysis parameters fresh pulp samples are directly proportional to the physiological maturation stage, including degradation of starch and enzyme activity pectinmetilestereasa and polygalacturonase, climacteric fruit. Fruit ripening is manifested in changes of attributes that affect fruit quality: color, firmness, % acidity, pH, °Brix, and the content of ascorbic acid (vitamin C). Test results Tukey HSD ($P > 0.005$), applied to variables physicochemical analysis, indicate that the germplasm Campeche 503b and 511C, in size are in a range of [3.5 ± 0.42^b , 4.4 ± 0.73^a cm] weight [42.31 ± 5.25^c , 98.46 ± 21.48^b g.], firmness [0.0620 ± 0.0098^a , 0.0288 ± 0.0061^b N], color: Chroma [24.49 ± 0.54^b , 16.96 ± 0.28^c], °H [181.94 ± 2.21^b , 166.25 ± 1.54^c] green color - yellow, soluble solids [14.0 ± 1.4^a , 10.1 ± 0.8^c ° Brix] pH [4.17 ± 0.1^b , 4.54 ± 0.1^a], % acidity [1.3 ± 0.05^c , 1.2 ± 0.03^b ml NaOH] and ascorbic acid [91.83 ± 11.25^b , 108.3 ± 4.75^b mg / 100 g], compared with crosses selection selection 10 x 51 cm size 3.2 ± 0.29^c cm , weight 62.53 ± 9.36^a g , firmness [$0.0255 \pm 3.33 \times 10^{-6}^c$ N], color: Chroma [26.22 ± 0.67^a], °H [91.55 ± 2.25^a], yellow tone, soluble solids [11.9 ± 1.0^b ° Brix] , pH [3.80 ± 0.1^c], % acidity [0.9 ± 0.01^c ml NaOH], ascorbic acid [211.21 ± 23.90^a mg / 100g]. The crossing selection selection 10 x 51, shows a significant change in concentration of endogenous ascorbic acid with antioxidant properties antiscorbutic, in cancer treatment and for diabetes mellitus.

Keywords: guava, Ascorbic acid, hybrid, antioxidant.

Evaluation of Alternative Protein Sources for The Production of Lactic Acid with *L. casei* and Cheese Whey Permeate

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The evaluation in the production of lactic acid with *L. casei* and cheese-whey, which is an agro-industry waste product, was performed in this study. A factorial 2^k experimental design was used in order to evaluate the rates of lactic acid production with conventional protein sources such as yeast extract and soy peptone as well as with alternative sources like dried blood meal, whey hydrolysate (WH), and corn steep liquor (CSL). Also the effect of CaCO_3 addition was evaluated. It was observed that the highest conversion rate of lactose to lactic acid was 77% obtained with yeast extract and the addition of CaCO_3 compared to 64% obtained with soy peptone and 52% with WH. The experiments performed with dried blood meal were not successful as no lactic acid was produced. It was observed that the addition of CaCO_3 had a significant effect ($P < 0.05$) on lactic acid due to the prevention of high pH drops (below 5) during fermentation. Nevertheless, yeast extract and soy peptone are expensive protein sources that are not suitable during the scale up of this process. CSL that is cheaper protein source due to the fact that it is a waste product from bioethanol production from corn had conversion rates above 90%. Thus, this alternative protein source will be further studied in order to optimize fermenting media and achieve higher lactic acid rates so that subsequently the scale up through the use of process simulation software like Aspen Plus can be obtained and the cost feasibility of lactic acid from cheese whey can be estimated.

Keywords: cheese whey, lactic acid, microbial fermentation

Microbiological, Nutritional Study and Identification of Lactic Acid Bacteria from Corn Silage

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The aim of this research was to evaluate the safety of corn silage and its nutritional value. The silage was sectioned into longitudinal sections called first, second and third sections, subsequently and were also divided into strata as high, medium, low, to give 9 treatments or areas of analysis. For each treatment the presence of *S. aureus*, *E. coli*, yeast, mold, anaerobic bacteria was determined, as well as protein content and pH. Identification of lactic acid bacteria was done through carbohydrate fermentation test (API 50CHL); all samples were analyzed in triplicate. The data were analyzed by completely randomized design with a 3 x 3 factorial arrangement of treatments by using the mixed procedure of SAS. Significant differences ($p \leq 0.05$) were found in the quantity of coliform between the longitudinal sections, being higher for the sample from the third section of the silo. A significant increase ($p \leq 0.05$) in the amount of yeast and mold was observed from low stratum and low stratum of the third section respectively. There are not observed growth of *S. aureus* and *E. coli*. There are not differences in the protein concentration. pH value in the treatments remained below 4, except the third section of the high stratum. Lactic acid bacteria isolated appertain to the genus *Lactobacillus plantarum* (12.5%), *Lactobacillus brevis* (12.5%) y *Lactobacillus fermentum* (8.3%). Treatment 5, corresponding to the second section and middle stratum, showed more stability in their components.

Keywords: corn, silage, lactic acid bacteria.

Screening of *Kluyveromyces marxianus* strains for ethanol production

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Kluyveromyces marxianus is known as an microorganism applied for the production of different compounds. It is a food-grade yeast that is characterized by thermotolerance and rapid growth that makes it attractive for bioethanol production on simultaneous saccharification and fermentation process (SSF). The SSF process is an alternative system to simplify obtaining and decrease bioethanol price, requires of yeast strains which are able to produce ethanol at the temperature close to optimum cellulase activity temperature (around of 50°C). The goal of the present study was to compare the seven *Kluyveromyces marxianus* strains as ethanol producers: one from ATCC 8554 (selected due to its wide using in studies related with fermentation processes) and six from ITD's (175,089,040,211,157) and UAdeC's (DIA L9) collections of microorganisms isolated from Mexican semi-desert conditions. Fermentation was performed at 42°C and 50°C using YPD broth. Ethanol production and glucose consumption was measured on UPLC (Waters). Biomass growth was monitored by CO₂ estimation in NaOH trap. None of the strains was able to be active at 50°C. Strains (adapted from desert habitat) from our collections were able to produce higher levels of bioethanol than ATCC strain under the same condition. The same result was observed by monitoring of glucose consumption. The strain ITD 157 that was selected from this screening, belongs to ITD's collection and was isolated from maguey residue. The native Mexican *Kluyveromyces marxianus* strains are a good candidates for its application in SSF due to their ability to produce higher ethanol levels at 42°C in comparison with previously reported strain.

Keywords: screening, thermotolerant yeast, ethanol production, *Kluyveromyces marxianus*.

Evaluation of the Effect of Different Fermentation Conditions on the Production of The Biopolymer Poly 3-hydroxybutyric acid

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Poly (3-hydroxybutyric acid) (PHB), a biodegradable thermoplastic produced by many bacteria, is the most common member of the polyhydroxyalkanoate (PHA) family. This biopolymer is synthesized as an intracellular carbon and energy storage granules under conditions of restricted growth. Cheese whey is the principal by-product of the cheese manufacturing industry, occupying approximately 90% of the milk volume. This by-product is considered an ideal substrate due to its nutritional value; its major nutrients are lactose (4.5–5 % w/v), soluble proteins (0.6–0.8 % w/v), lipids (0.4–0.5 % w/v), mineral salts (8–10 % of dried extract), lactic (0.05 % w/v) and citric acids. The aim of this work was to optimize the PHB fermentation by *Bacillus* 2355, a Gram-positive bacteria, using cheese whey as a low-cost carbon source. Assays for PHB production were performed in whey media; firstly the experimental variables were inoculum size (1, 5 and 10% v/v), nitrogen source (yeast extract, soy peptone or ammonium sulphate 5% w/v), carbon/nitrogen (C/N) ratio (10, 25 and 40) and fermentation time (24 and 48 h). In a second stage a central composite design and RSM was conducted in order to evaluate the C/N ratio and pH effect in PHB production at 37 °C with an inoculum size of 5 % v/v. Results indicated that the highest production of PHB was obtained with a C/N molar ratio of 6.8, pH 7.6, inoculum size of 5 % w/v, fermentation time of 24 h and supplementation with (NH₄)₂ SO₄ achieving a PHB value of 0.54 g/L ± 0.2. From this study it is clear that this wastewater could be further exploited as a platform for the creation of a biorefinery.

Keywords: cheese whey, biopolymer, microbial fermentation

Cellulase and Xylanase Production in *Pleurotus djamor* Mycelium by Solid Fermentation in Agroindustrial Pineapple Residues.

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Mexico has the seventh position worldwide in pineapple production with 701,740 ton by year which usable pulp percentage fluctuates between 36.4 and 41.9 %, generating a huge quantity of organic waste. In recent years, agricultural pineapple production has achieved significant relevance due to its economic dynamic both in the production and merchandising of fresh fruit and the industrialization process, giving as a result organic residues with a big potential of usages such as biodiesel and biogas source, in fiber obtainment and as a substratum of lignocellulosic fungus for solid state fermentations (SSF). The *Pleurotus djamor* mycelium was abundantly developed in the experimental substrate, proving that the used substratum has the appropriate nutritional content for the growth of the fungus. Nonetheless, in the metabolic level, statistical differences were observed in the generation of cellulase and xylanase enzymes. These results indicate that the evaluated enzymatic activity in the three substrata resulted higher for the enzymes produced in the shell and the core and lower in the ones produced in the pineapple leaf bracts. In the case of the cellulase, the highest activity was obtained with the pineapple core in function of the fiber percentage and the contained carbohydrates and the stimulus of the added corn straw percentage. In regard to xylanase, the highest evaluated activity was obtained with pineapple shell. These results are also sustained with the cellulose and xylanase content as a cellular wall constituent and the reported carbohydrates content in this substratum.

Keywords: enzyme, xylanase enzymes, cellulase enzymes

Modelling the Lipase Catalyzed Esterification of PUFA to Glycerol: Multi-substrate Multi-product Ping-Pong Mechanism

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In this work a lipase from *Candida antarctica* immobilized on microporous acrylic resin was screened for the esterification of PUFA to glycerol for the production of mono-, di- and triacylglycerols. The PUFA concentrate (81.5%w) was obtained by chemical hydrolysis of sardine oil followed by urea-complexation. The esterification reaction was conducted with a known molar ratio of PUFA/glycerol in capped glass flasks flushed with nitrogen. Products of the reaction were analyzed by HPLC-ELSD during 10.5 h. A kinetic model was developed based on a proposed ping-pong mechanism for the reaction. The kinetic model parameters were estimated using nonlinear curve fitting (MATLAB® v2013) through optimization methodology and the model was verified by using data from different experiments. Good predictability of the reaction under experimental conditions was achieved and validated by the coefficient of determination (R-squared).

Keywords: ping-pong mechanism, kinetic parameters, PUFA esterification.

Biochemical and Microbiological Study Associated to Sucrose Biogenesis, for Action of Kombucha Consortium in a Dairy System

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Many dairy products are obtained by fermentation processes. Dairy products line is the main sector within the functional food global market. Within functional foods, there are functional beverages, such as Kombucha, which has been attributed with some biological activities. Kombucha is the fermented product of sweetened black tea with a consortium of bacteria from the genus *Gluconacetobacter*, *Lactobacillus* and *Gluconobacter*, and yeast of genus *Saccharomyces*, *Schizosaccharomyces* and *Saccharomyces*. Some of these genres have been categorized as sucrose producers under certain conditions as regards composition of the culture medium. The objective of this research is the biochemical study of the consortium Kombucha fermentation substrate having a dairy system as well as the identification of the microbiome associated with it. Kombucha biomass formed in black tea was used as inoculum. Fermentation was tested using two types of milk (whole and lactose-free milks), and two temperatures (25 and 28°C). Fermentation was monitored by recording pH, titratable acidity, osmolality, and the carbohydrate profile of samples during the process analyzed by Ultra-performance liquid chromatography tandem mass-spectrometry (UPLC-ESI-MS-MS). During fermentation period, counting of acetic acid bacteria, lactobacilli and yeasts was performed in selective media to study population dynamics of microorganisms. Consortium adaptation was observed to the dairy system. It was detected a pH decrease of two levels after 72h of fermentation as well as an increase in osmolality of the system. In the fermentation of lactose-free milk it was not observed consumption of glucose-galactose (1g/L); however, an increase in concentration of sucrose in the system was observed (20g/L). According to plate count on selective media, changes were observed in the relationship of the acetic acid bacteria, yeast and lactobacilli during fermentation, as well morphologically different colonies were isolated, 25 from acetic acid bacteria, 24 yeast and 16 lactobacilli. The use of lactose free milk substrate, permits the development of microorganisms during fermentation Kombucha and suitable conditions for the production of sucrose by the microbial consortium.

Keywords: Kombucha, Milk, Sucrose, Fermentation

Production of a commercial interest glycosidase by *Aspergillus niger*

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Aspergillus niger is a filamentous fungi capable to secrete a great variety of extracellular enzymes. This capability has been exploited at industrial scale to produce economically important enzymes such as glucoamylase, glycosidase, etc. Some glycosidases have antimicrobial activity against microorganisms such as *Micrococcus luteus*, *Lactobacillus*, *Clostridium tyrobutyricum*. Hence are of particular interest for the food industry. The aim of this project was to test different carbon sources and pH's for the production of a glycosidase with a transoformed strain of *Aspergillus niger*. For the production of glycosidase, *A. n.* was grown at flask level with starch, maltose and maltodextrin at 10 g/L; the growth conditions were 30°C, 100 rpm during 120 h. Several samples were taken to analyze pH, dry weight and enzyme activity with the bioassay using as indicator the microorganism *Micrococcus luteus*, for these factors was employed a statistical analysis ANOVA. Our results shown that *A. n.* produced more glycosidase when grown in starch reached 76 U/mL of activity compared with maltose y maltodextrine, 12 U/mL y 10 U/mL respectively. Furthermore, this strain produced higher quantity of glicosidase at pH 4 at 36 hours after this time *A. n.* secret greater proteases which readily degrade amount glycosidase thus decrease activity values. When the carbon source is starch and the pH was 4.0 a higher enzymatic activity is obtained, while the glycosidase activity decreased if the pH value is greater than 4.5.

Keywords: *Aspergillus niger*, glycosidase, pH.

α -, β - And γ -Cyclodextrins As Obtained of Quinoa (*Chenopodium Quinoa Willd*) Starch

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Quinoa is a cereal crop grown in South America. Its starch has only 11% amylose. Therefore, the high amylopectin occurrence of this crop makes it a good alternative to waxy corn starch, which is used to synthesize cyclodextrins (CD) in the industry. CDs are produced from starch by the cyclization reaction of cyclodextrin glucosyl transferase (CGTase). The most common available CDs are composed of 6, 7, and 8 glucose units named α -, β - and γ -cyclodextrins, respectively. They are used in food, pharmaceutical, drug delivery, and chemical industries, as well as in agriculture and environmental engineering. Therefore, the objective of this work was to use quinoa starch to synthesize CDs, using CGTase previously produced by *Bacillus megaterium*. Quinoa starch was obtained by agitation of seed flour using 0.1 M acetate buffer (pH 6.5, 0.01 M). The resultant slurry was sieved through a series of sieves, until a 400 mesh flour was obtained. Starch and CGTase were added with continuous stirring to sodium phosphate buffer (20 mM; pH 6.0) and incubated at 70°C. After a 24 h reaction, the sample was centrifuged at 4,300 g by Centrikon H-401B. Afterwards, the supernatant was analyzed by HPLC using a column Bio-Rad AminexR Carbohydrate HPX-42A. This column was eluted with distilled water at 85°C. The flow rate was 0.6 ml min. Cyclodextrins were recorded by a refractive index detector. The optimum reaction temperature was 70°C and the amount of enzyme used was 22 U/g starch. Under these conditions with 10 % of starch, β -CD (6.72 \pm 0.12 mg/mL) was preferably produced. The content of CDs, yielded in the final product after centrifugation, was 22.8 %, 53%, and 24.2% of α , β and γ , respectively. Residual starch was 38.4%. Under similar conditions, 54.5% β -CD was obtained using waxy corn starch. Therefore, quinoa starch may be an alternative to produce CDs to use them in the food and pharmaceutical industries.

Keywords: cyclodextrins, quinoa, starch

Biotechnological Production of Xanthan Gum Using Food Waste Materials

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Xanthan gum is an important polysaccharide produced by *Xanthomonas campestris*; widely used in the food industry as thickener, stabilizer and gelling. As a food additive it is commonly used in dressings, sauces, beverages, dairy products, among others. In recent years, the use of waste or by-products generated in food processes for its production has been proposed. In this work, three residues are proposed for its use: (i) dairy whey which is generally discharged to the drain and its high lactose content causes serious environmental problems; (ii) waste water from cooking nopal which contains mucilage that can be exploited in other processes; (iii) tomatoes with quality defects (bumps, bruises, etc.) that are discarded and wasted. The objective was to study xanthan gum production feasibility from the products mentioned. The culture medium consisted in dairy whey from Oaxaca cheese making; tomato broth made from tomatoes that didn't meet quality standards and nopal broth from the waste water from cooking the cactus. First, an exploratory study was made to assess the gum production feasibility in the means proposed. Then, the culture medium that produced the greatest amount of gum was studied using a central composite design where the studied factors were aeration and agitation, and the responses were viscosity and gum production. Finally, the obtained gum was analyzed by FT-IR and HPLC, and it was compared to its commercial counterpart. It was observed that the maximum xanthan gum production was obtained using tomato broth with 1 g/L of $MgSO_4 \cdot 7H_2O$, 20 g/L of K_2HPO_4 , a 200 rpm agitation and a 1.8 L/min aeration, producing 12 g/L of gum. The results also showed that the viscosity didn't seem to be significantly affected by the studied factors; moreover, gum production is only influenced by aeration. IR analysis showed that the chemical structure of the gum obtained didn't significantly differ from the commercial gum.

Keywords: Xanthan gum, *Xanthomonas campestris*, waste food, tomatoes.

Evaluation of the Power Foam and Foam Retention in Amaranth Beer as Quality Parameter

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Inquest done on the quality attributes of the beer, the beer foam has an important place as a benchmark of quality since most consumers expect a formation of consistently small, attractive and abundant bubbles that lasts a long time, decorate and adhere to the vessel walls. The foam traps the volatile compounds and acts as an efficient exchange surface aromas that are detected by smell, looking for that last more, extolling the overall perception of flavor. Foam is composed of a gas phase is dispersed in a liquid phase. This phenomenon is due to beer using high protein ingredients present in the barley, and boosted by the compounds provided by the hops, generating substances which increase the surface tension to stabilize. In this paper, beer was produced using the method of double maceration with different proportions of amaranth and barley, which were 20%, 30%, 40%, 50% and 60% without affecting the concentration of hops, with the main point of identify the affection of the power foaming and foam retention. For the experiment it was compare amaranth beer against beer trademark. Measurements and foam retention were made the same time, analyzes were performed in triplicate and determined mean and standard deviation with a significance level of 0.1 and 0.5 percent. In addition to the following physical and chemical analyzes were performed: Brix, density, viscosity, pH, acidity and alcohol content. It is shown that there is a direct relationship between the increase in the amount of amaranth and low quality of the foam, however an increase regarding to alcohol level. The rest of the analysis has no relation about power foam and foam retention. Commercial beer used on the experiment does no declares ingredients the use of foam stabilizers.

Keywords: beer, amaranth, retention, foam

Biotechnological Production of Xanthan Gum Using Food Waste Materials

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Xanthan gum is an important polysaccharide produced by *Xanthomonas campestris*; widely used in the food industry as thickener, stabilizer and gelling. As a food additive it is commonly used in dressings, sauces, beverages, dairy products, among others. In recent years, the use of waste or by-products generated in food processes for its production has been proposed. In this work, three residues are proposed for its use: (i) dairy whey which is generally discharged to the drain and its high lactose content causes serious environmental problems; (ii) waste water from cooking nopal which contains mucilage that can be exploited in other processes; (iii) tomatoes with quality defects (bumps, bruises, etc.) that are discarded and wasted. The objective was to study xanthan gum production feasibility from the products mentioned. The culture medium consisted in dairy whey from Oaxaca cheese making; tomato broth made from tomatoes that didn't meet quality standards and nopal broth from the waste water from cooking the cactus. First, an exploratory study was made to assess the gum production feasibility in the means proposed. Then, the culture medium that produced the greatest amount of gum was studied using a central composite design where the studied factors were aeration and agitation, and the responses were viscosity and gum production. Finally, the obtained gum was analyzed by FT-IR and HPLC, and it was compared to its commercial counterpart. It was observed that the maximum xanthan gum production was obtained using tomato broth with 1 g/L of $MgSO_4 \cdot 7H_2O$, 20 g/L of K_2HPO_4 , a 200 rpm agitation and a 1.8 L/min aeration, producing 12 g/L of gum. The results also showed that the viscosity didn't seem to be significantly affected by the studied factors; moreover, gum production is only influenced by aeration. IR analysis showed that the chemical structure of the gum obtained didn't significantly differ from the commercial gum.

Keywords: Xanthan gum, *Xanthomonas campestris*, waste food, tomatoes

Antibacterial Activity of Noni Fruit (*Morinda citrifolia*), Teasel (*Parthenium hysterophorus* L.) and Neem Tree (*Azadirachta indica* A. Juss) Extracts against *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Salmonella Typhimurium*.

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Today, traditional medicine has regained great significance; for this reason, the present study focuses on the evaluation of the antibacterial activity by using extracts from medicinal plants found in Veracruz. These medicinal plants are the broom-bush (*Parthenium hysterophorus* L.), the Noni fruit (*Morinda citrifolia*), and the neem tree (*Azadirachta indica a. Juss*). This research has been conducted in order to determine the antibacterial activity of extracts against bacteria that cause foodborne illness such as *Staphylococcus aureus*, *Bacillus cereus*, *Escherichia coli*, and *Salmonella Typhimurium*. Vegetable material samples for testing were previously dried and chopped into fine pieces using soxhlet extraction technique with 1:10 with the following solvents: water, acetone, ethanol, ethyl acetate, methylene chloride, and hexane respectively. After this process, important extracts were obtained and tested against bacteria through diffusion antibiogram (modified) and minimum inhibitory concentration (MIC). Based on the results, ten extracts with a higher level of inhibition were selected. The following four presented a relevant result: essential oil of *Morinda citrifolia* fruit, hexane extract of *Azadirachta indica a. Juss* leaves, essential root oil of *Parthenium hysterophorus* L., and essential oil of *Morinda citrifolia* unripe fruit. The data obtained through MIC test showed an inhibition concentration between 500ppm and 700ppm, which were treated through ANOVA analysis. Essential oils showed a higher level of inhibition compared to the extracts obtained from solvents through soxhlet technique. These data revealed why the broom-bush *Parthenium hysterophorus* L., the Noni fruit (*Morinda citrifolia*), and the neem tree (*Azadirachta indica a. Juss*) are still used in traditional medicine.

Keywords: Extract, antimicrobial activity, *Parthenium hysterophorus* L., *Morinda citrifolia*, *Azadirachta indica a. Juss*

Evolution Sauvignon blanc Wine During Aging in Bottles with Chips vs Oak Barrels

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During the production of wine, both fermentation and aging are the stages of winemaking that influence physicochemical characteristics and quality of wine. These stages provide varietal phenolic compounds and of diffusion from wood to wine, which are influenced by temperature fermentation, variety grape, type of oak used during aging and oxidation-reduction reactions. Therefore, the aim of the present study was elaborated *Sauvignon blanc* white wine using a fermentation temperature of 9–10°C and subsequent aging for six months in bottle with chips as an alternative technology (reducing system) and in barrels of American white oak as traditional method (oxidizing system) in order to assess their parameters related with compounds that are oxidized during these stages such as ethanol, free and total sulfur and total polyphenols; likewise, the activity enzymes (laccase, tyrosinase and polyphenoloxidase) of phenolic compounds was determined. Finally, pH, acidity, color and antioxidant capacity (DPPH assay) were also determined. *Sauvignon Blanc* was obtained with the following physicochemical characteristics: 12.85±0.06%Et, free sulfur 22.61±0.18mg sulfur anhydride/L, total sulfur 49.20±3.69mg SA/L, total polyphenol 0.15±0.01g gallic acid/L, total acidity 5.58±0.02g tartaric acid/L, volatile acidity 0.46±0.01g acetic acid/L and pH 3.74. The enzymatic activity was of 8.00±0.13U/mL, 2.61±0.35U/mL and 190±3.33U/mL for laccase, tyrosinase and polyphenoloxidase, respectively. The activities of laccase and tyrosinase remained constant during the period of aging (six months), however polyphenoloxidase activity increased during aging. The enzymes showed increased activity in the wine most aged in oak barrels. The aging in bottle with chips showed a progressive increase stability in phenolic content unlike barrel, with final concentration of 0.24±0.01 and 0.13±0.01 gGA/L, respectively. Both technologies, exhibited a starting color with green tones, which overtime shifts to yellow tones losing luminosity, being constant in bottle and detecting greater variation in barrel. Additionally, wines showed antioxidant capacity, reaching values of 6.23±0.05 and 6.71geqGA /L for bottles with chips and barrels, respectively. The increase in this activity during the aging time was only constant in bottle with chips. Therefore, the aging in bottle with chips stands a greater diffusion of phenolic compounds, greater stability in the parameters redox indicators and increased polyphenoloxidase activity.

Keywords: bottle with chips, barrels, aging, oxidation-reduction reactions, oxidizing enzymes

Recombinant production of a peptide with therapeutic potential

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Bioactive peptides obtained from food are small peptide chains composed between 2 and 15 amino acid residues. In the last decade it has been shown that these have different biological activities, being attractive for the food industry, since they may be included in several food systems and thus achieve their effect in the body of the consumer. Several studies have demonstrated that bacteria-fermented milk can produce peptide inhibitors for proteolytic enzymes implied in human diseases, in particular for the metalloprotease angiotensin converting enzyme (ACE) involved in cardiovascular disorders. However for these peptides may have a beneficial effect, they should be consumed in concentrations that are not provided by the daily diet, so it is necessary to implement production strategies that meet these needs. In the present study, we propose the recombinant production of the peptide Phe2 in *Escherichia coli*. As a first step the gene encoding the peptide phe2, was designed and obtained in single-stranded DNA. The gene was amplified by polymerase chain reaction (PCR), using specific oligonucleotides then ligated into the plasmid conservation PCR4-TOPO and transformed into *E. coli* TOP 10. After subcloned the pET28a vector and transformed into *E. coli* rosetta gami [DE3] pLysS. The peptide will be expressed and purified by affinity chromatography and finally it will be tested the inhibitory activity of angiotensin-converting enzyme.

Study Antiviral and Antioxidant of Soursop Leaf Extracts as Edible Coating Proposal

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Fresh cut products have increased in the world market, giving rise to conservation technologies as edible coatings incorporated with natural products. Leaves soursop (*Annona muricata*) possess many properties, have been extensively studied in *in vitro* systems, however, has been little studied its action on human cells and antiviral effect, so in the search for natural products that can be use in edible coatings can be an option. The purpose of this study was to evaluate the antioxidant capacity of the extracts of soursop leaves using as cell model human erythrocytes and evaluate their effect on enteric viruses, using as a model the bacteriophage Av-08. Soursop leaves were dried, pulverized and macerated with ethanol-acetic acid solution in relation (10: 1). To the aqueous extract, 10 g of powder was boiled by 5 min in 150 mL of water. its antioxidant capacity was evaluated using human erythrocyte as model cell and antiviral capacity was evaluated using the Av-08 bacteriophage as enteroviral model this was previously characterized by electron microscopy. The extracts were confronted with the virus at different contact times and concentrations. To determine the reduction of virus decimal dilutions they were performed. The results were expressed in log₁₀ PFU (Plaque Forming Units). The protective ability of the extracts to protect human erythrocytes showed values of 33% and 53% for aqueous and ethanolic extracts respectively. Due to the ethanolic extracts showed higher antioxidant capacity, they were selected for the study antiviral. The results showed viral reductions of 4 to 9 log₁₀ PFU in contact times from 15 to 360 min, and showed a dose-dependent manner. The results showed that the ethanol-acidified soursop leaf extract could be an alternative to be evaluated as edible coating due to its protective effect against oxidation of red blood cells and infection of enteric viruses

Keywords: edible coating, antivirals, antioxidants

Preliminary evaluation of antioxidant activity, total phenolic quantification and phytochemical screening from stem of *Persea americana* and *Malva parviflora*

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In Mexico there is a great diversity of plants with high biological potential, among which can be highlighted *Persea americana* (PA) and *Malva parviflora* (MP), as they have different bioactive compounds including phenolic compounds, which give properties such as anti-inflammatory, anti-cancer, anti-microbial, but mainly antioxidant. The aim of this study was to quantify total phenols (PT), to evaluate the antioxidant activity and a qualitative phytochemical screening (TFC) stem PA and MP. Ethanolic extractions was done of stems from PA and MP, these extracts were evaluated by a TFC by qualitative colorimetric tests. The total phenol content was quantitated by the Folin-Ciocalteu for microplate and was evaluated the antioxidant potential with DPPH and ABTS methods. The presence of phenolic compounds, flavonoids, alkaloids, coumarins, lactones and carbohydrates were identified, also possible presence of unsaturations in the identified functional groups. The total polyphenol content was presented in all extracts with values ranging from 50-80 mg EAG / mL. Also by the methods of DPPH and ABTS the antiradical activity of 69-80% between the radical trapping was identified. The extracts from stem of *Malva parviflora* and *Persea americana* can be used as raw material for obtaining polyphenolic compounds of importance in human health, to possess important to combat degenerative diseases like diabetes, cardiovascular, cancer, etc. functions, and as they might be employed in the medium term through its use as food or supplement.

Keywords: phenolics compounds, antioxidant activity, *Persea americana*, *Malva parviflora*

Nutraceutical Beverage Formulation from Corn added with Nejayote of pigmented maize with Anti-inflammatory Activity and Antioxidant Capacity

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The nejayote is the wastewater from the alkaline-cooking of maize and the solids are rich in phenolic compounds. The objective of this study was to evaluate the phenolic compounds, anti-inflammatory activity and antioxidant capacity of corn-based beverages incorporated with nejayote of pigmented maize. For this study, four genotypes of maize (white, yellow, red and high carotenoid) were used to obtain nejayotes solids (NS). NS were incorporated at 3%, the corn beverage to increase the phenolic compounds, anti-inflammatory and antioxidant potential. The quantification of ferulic acid in beverages was performed using HPLC-DAD. The anti-inflammatory activity was determined using the macrophages cell line (RAW 264.7) stimulated with LPS; TNF- α secretion and IL-6 was measured by ELISA kits. The addition of 3% of NS pigmented maize to beverage did not affect the hygroscopicity, water activity and solubility. Beverage with NS red maize had higher antioxidant capacity. Beverage with NS yellow maize containing more free ferulic acid compared to the beverage with NS white maize. The data suggest that ferulic acid has anti-inflammatory activity by inhibiting the secretion of proinflammatory cytokines. Therefore, the NS of pigmented maizes can be used as an industrial product for the production of nutraceutical beverages antiinflammatory and antioxidant capacity.

Keywords: Nejayote, Anti-inflammatory activity, pigmented maize, beverage.

Chemical characterization of silvicultural byproduct guishe for the enzyme production for the food industry

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The main target of present research this is enzymes production for food industry through by a bioprocess solid state fermentation, at the preliminary stage present the chemical characterization of a silvicultural byproduct, known commonly as "Guishe", which is product of lechiguilla incise, on average a leaf may contain 36.87 grams of fiber (ixtle) and 208.96 grams of fresh pulp (Guishe); It is representing a potential accumulation Guishe of 357 tons per hectare. the raw material was obtained en fresh and dry, in the Turtle town, Ramos Arizpe municipality, state Coahuila, Mexico. it was analyzed saponins concentration and chemical characterization was made moisture content, dry matter, ash, ether extract, crude fiber, protein, ADF, NDF, lignin and cellulose, using the methods of the AOAC (Association Agricultural Chemistry 1996 Official), the samples were analyzed in triplicate. The results obtained show that the rate of saponins concentration was of 1.26% Guishe fresh and dry Guishe 0.68%, the results of chemical characterization yielded the following results in percentage: Humidity 68.97 - 10.34; dry matter 88.26 - 89.77; ashes 12.03 - 15.88; ether extract 0.54 - 0.67; protein 62.46 - 86.51; crude fiber 2.98 - 1.08, respectively for fresh and dry Guishe. The saponin concentration is low, however the material could receive a pre-treatment to reduce the concentration thereof, due to the high protein content, the material could be used for the protease enzymes production in solid state fermentation.

Keywords: Guishe, chemical characterization, solid state fermentation

Anti-inflammatory and Antioxidant Activity of Nutraceutical Beverage of Maize Added with Nejayote Solids

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The nejayote is a byproduct of corn Nixtamalization. Previous reports have proven that nejayote is rich in dietary fiber, ferulic acid and calcium. The aim of this study was to evaluate the phenolic compounds, anti-inflammatory activity and antioxidant capacity of ready to reconstitute corn-based beverages added with nejayote. The nejayote was incorporated in 3, 6, and 9%, in the corn beverage to increase the phenolic compounds, antiinflammatory and antioxidant potential. Quantification of ferulic acid in beverages was performed using HPLC-DAD. The anti-inflammatory activity was determined using the macrophages cell line (RAW 264.7) stimulated with LPS; TNF- α secretion and IL-6 was measured by ELISA kits. The addition of 9% of the drink nejayote did not affect the hygroscopicity and water activity of the beverages, but increased the solubility up to 148.2%, and enhanced the antioxidant activities in beverages. Furthermore, beverages showed about 771.6 times more free ferulic acid. Similarly, the data suggest that the ferulic acid present in the nejayote exerted a concentration-dependent anti-inflammatory activity by inhibiting the secretion of proinflammatory cytokines. Therefore, nejayote solids can be used as an industrial product for the production of nutraceutical beverages with antiinflammatory activity and antioxidant capacity

Keywords: Anti-inflammatory activity, ferulic acid, beverage.

Growth Estimation of *Aspergillus japonicus* on Submerged, Superficial and Solid State Cultures.

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Microbial growth is an important variable in the characterization of biological processes. However, biomass measurement in Solid State Culture (SSC) remains a challenge. Several authors have used respirometric analysis for the estimation of microbial growth in SSC. This method assumes that carbon dioxide release or oxygen consumption is completely growth associated. This assumption is not always correct as the amount of biomass produced per unit of gas metabolized can vary with the growth phase. In addition, CO_2 /biomass and biomass/ O_2 yields ($Y_{CO_2/X}$ and Y_{X/O_2}) depends on the microorganism, substrate and culture conditions. In this work, we studied the relationship between fungal growth, CO_2 production and O_2 consumption in submerged (SmC), superficial (SupC) and solid state cultures. *A. japonicus* AN5 was growth in a culture medium used for the production of chlorogenate hydrolase and composed of (g/L) ammonium tartrate (1.842), yeast extract (0.5), KH_2PO_4 (0.2), $CaCl_2 \cdot 2H_2O$ (0.0132), $MgSO_4 \cdot 7H_2O$ (0.5), maltose (2.0) and green coffee extract (15.0). In SC, 1.2% of agar was added as gelling agent, in SSC 7.5 g of perlite were mixed with 12.5 mL of inoculated medium. Cultures were carried out in Erlenmeyer flasks and incubated at 30 °C for 40 h. Biomass was measured by dry weight, CO_2 production and O_2 consumption were continuously measured with a respirometer developed and patented by our group (MX Patent No. 336733). Logistic model adequately described the growth in SmC and SC for 40 h ($R^2 > 0.98$). In SSC, logistic model only described the growth during the first 24 h ($R^2 > 0.98$). The production of CO_2 and the consumption of O_2 were satisfactorily modelled with the Luedeking-Piret and Pirt equations ($R^2 > 0.98$). CO_2 production is mainly growth associated and maintenance coefficients were negligible in the three systems. On the other hand, the growth associated production coefficient (α) and the Y_{X/O_2} strongly depends on the culture system. These results indicate that the growth of *A. japonicus* AN5 can be estimated by respirometric analysis, but it is necessary to estimated first the $Y_{CO_2/X}$ and Y_{X/O_2} for the specific culture conditions.

Keywords: Fungal growth, Respirometry, Solid State Culture

Enhancement of Phenolic Content From of Grapefruit Peel Using Three Fungal Strains

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Citrus fruits are natural source of antioxidants because of high phenolic content, flavonoids and terpenes. Grapefruit (*Citrus paradisi*) is the second most important global citrus and has been exploited in the pharmaceutical and food industries by its antimicrobial, antioxidant and anti-inflammatory properties. The objective of this research was to evaluate the enhancement of phenolic content using three fungal strains (*Aspergillus oryzae*, *Aspergillus niger* and *Penicillium digitatum*) on grapefruit peel. Firstly, a fungal selection was carried out evaluating the radial growth of the microorganism using the wastes of grapefruit as support-substrate. *A. oryzae* and *A. niger* were selected for their growth capacity and releasing of phenolic compounds. After, a solid state fermentation (SSF) system was designed as a method of phenolic content extraction. The conditions of fermentation were 30°C, 70% moisture during 5 days and sampling each 24 h in triplicate. A reactor without inoculum and a maceration system (36° C, 136 rpm) were used as controls under the same conditions. The crude extracts were obtained with ethanol (70% v/v) and the phenolic compounds were determined by the Folin-Ciocalteu (hydrolysable tannins) and butanolysis (condensed tannins) methods. The characterization of the phenolic constituents was made by High Performance Liquid Chromatography coupled to Mass Spectrometry (HPLC-MS). The highest concentrations of phenolic compounds were obtained at 96 h of fermentation with *A. niger*, 434.69±22 mg Gallic Acid Equivalents (GAE)/g dry basis (hydrolysable tannins), and 83.54 mg Equivalent of Procyanidin C1(EPC1)/g dry basis (condensed tannins). On the other hand, *A. oryzae* did not allow the release of phenolic compounds under the studied conditions. The phenolic content of maceration was higher than *A. oryzae* but was lesser that *A. niger*. HPLC-MS analysis showed the presence of naringenin as the main compound, however, other peaks have not yet been identified. The results demonstrate that the use of *A. niger* allows better yields in the release of phenolic compounds against traditional extractions such as maceration using grapefruit peel.

Keywords: *Citrus paradisi*, FES, HPLC-MS, Tannins, naringenin

Effect of the Presence of Serine and sodium selenite on the growth of *Streptococcus thermophilus* in a minimal medium

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Selenium (SE) is an essential trace element in humans. Its deficiency is a public health problem worldwide, with an incidence close to a billion people. It has been shown that SE, in an organic form (eg. selenoproteins) provides higher bioavailability compared to its inorganic form. Several researches conducted have indicated the ability of microorganisms to produce selenocysteine whose synthesis can be performed from media enriched with Na_2SeO_3 . However, there has been no significant recent progress in the study of the generation of this amino acid using *Streptococcus thermophilus* and there are no studies on the metabolic pathway followed by this bacterial genus, although it is known that the serine is involved in the synthesis of selenocysteine. That is why the objective of this research work was to evaluate the effect of the presence of serine and sodium selenite on the growth of *Streptococcus thermophilus* in a minimal medium. *Streptococcus thermophilus* was isolated from a commercial yogurt and then, the bacterium was adapted to MRS broth. The critical inhibitory concentration (CIC) was determined between 20 and 300 mg/L of sodium selenite. Three microbial kinetics were performed in minimal medium. The first one without the addition of serine or Na_2SeO_3 (control), the second supplementing minimal medium with Na_2SeO_3 CCI and the last one, adding Na_2SeO_3 CCI and a known concentration of serine. The ICC was 140 mg/L of Na_2SeO_3 . During the growth of *Streptococcus thermophilus* with the addition of selenium, a lower log phase with respect to control was observed. However, the adaptation phase was greater. In the presence of serine and Na_2SeO_3 , the logarithmic phase was lower than control but higher than with only Na_2SeO_3 although the adaptation phase was the shortest of all experiments. These results indicate that the presence of serine may be activating more efficiently the absorption of inorganic selenium.

Keywords: *Streptococcus thermophilus*, selenocysteine, serine, critical concentration of inhibition.

Standardization of a molecular marker technique, for cultivar identification of the Chihuahua Apple Region

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A study was conducted during summer-fall season, 2015, by identifying nurseries and apple orchards representative of the Chihuahua Apple Region. The objective of this investigation was to standardize the molecular marker technique named Sequences Related Amplified Polymorphism (SRAP), to provide a higher resolution analysis, to be more effective, efficient, inexpensive and easy to apply in an apple breeding program. In order to do this, leaves were randomly collected from five trees per cultivar or pollinator randomly chosen, established in the area provided by the apple producers. The sample were labeled and stored in liquid nitrogen for better preservation before processing. The sample analysis took place at the Biotechnology Laboratory I, School of Chemical Sciences. Leaves were taken from cultivars: Golden Delicious, Golden Spur, Red Delicious, Golden Delicious Tardio, Red Chief, Starkrimson, Gala and pollinators Snow Drift, Manchurian, Rome Beauty and others whose identity is unknown. DNA extraction of the plant material was performed following the protocol of Doyle and Doyle, 1990. DNA concentration of the samples was determined using spectroscopy, a wavelength of 260 nm; moreover, it was use an agarose gel 1% to verify results. The technique was developed using the *Polymerase Chain Reaction* (PCR), a process that amplified DNA specific areas; using two sets of primers following the protocol described by Li and Quiroz, 2001. Each PCR reaction had a final volume of 25 μ L; it was amplified in a thermocycler Palm-Cider; amplicons, on the other hand, were separated on agarose gels 1% and labeled ethidium bromide for later revealed in a gel imaging system. After evaluating different combinations of primers, the set that had the highest number of amplified fragments were selected. It was concluded that the standardized technique, PCR-based molecular markers used in this study, will contribute significantly to the genetic improvement of apple breeding program, as well as yield and quality of crops.

Keywords: PCR, SRAP, genotype, pollinators, breeding program.

Genetics transformation of *Bifidobacterium longum* carrying the sod gene isolated of *Hyptis suaveolens* L.

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Probiotics are microorganisms capable of producing a beneficial effect on health. Currently have developed food products in addition to providing nutrients usual, they have a beneficial health effect, reducing the risk to get sick. These foods are known as "functional foods". Currently chronic degenerative noncommunicable diseases (NCD) affects people of working age, generating high costs for the health sector. Colorectal cancer is within the generative chronic diseases, and is the second leading cause of death in Mexico. There are factors that can trigger this disease, such as excessive consumption of snuff, alcohol, poor nutrition, which favors cellular oxidation. *Helicobacter pylori* infections are also a factor for triggering this cancer and gastric cancer. In order to reduce the risk of developing these diseases they have been proposed various solutions that antioxidants are the key because they are able to inhibit or retard the natural oxidation process of cells. However, these substances must be obtained from food. In this regard, this study aimed to isolate superoxide dismutase gene, which is a potent antioxidant, seed Chan (*Hyptis suaveolens* L.) and genetically transform the probiotic *Bifidobacterium longum* which is one the main bodies of natural microbiota intestine. The Sod gene isolated in this study was 260 bp, same which was successfully cloned into the plasmid pRL using an innovative method of employing nanotubes and microwave technology.

Keywords: Probiotics, antioxidants, genetic transformation.

III. FOOD PROCESSING AND ENGINEERING

Nixtamalization without Insoluble Lime Particles for Preventing the Development of Polluting Characteristics in Cooking Water

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Nejayote from nixtamalization is highly pollutant. High content of remaining lime particles in nejayote cause high levels of pH, alkalinity, hardness and chemical oxygen demand (COD) in nejayote. The objective of the study was to determine the impact of removing insoluble lime particles from the water-lime mixture on the polluting characteristics of nejayote and the impact on nixtamal, masa and tortilla. Limes used for nixtamalization treatments without insoluble lime particles (WOILP) were commercial calcium hydroxide (NIX) and commercial calcium oxide (OXI). Traditional nixtamalization used as reference was prepared with a reagent grade calcium hydroxide (TRA). Nejayote was evaluated for COD, volume and settleable solids and also monitored for pH, alkalinity, total hardness and calcium content across the nixtamalization. Resulting characteristics of nixtamal (pericarp removal, and weight), masa (color) and tortilla (moisture, color and extensibility) were compared among treatments using factorial and CRD designs. Results indicated a clear reduction in pH, alkalinity and total hardness in WOILP treatments after steeping in 3.5 pH units, 1,325 CaCO₃ mg/L, and 170 CaCO₃ mg/L respectively. TRA reduced only 0.7 pH units, increased alkalinity: 423 CaCO₃ mg/L and increased total hardness: 1420 CaCO₃ mg/L. Calcium content, COD and Settable solids in nejayote were lower in WOILP treatments than in TRA (654 vs. 1,482 mg Ca/L; 31,158 vs. 68,365 mg/L; 25.5 vs 68 ml/L respectively). The amount of nejayote was higher in WOILP treatments than in TRA (2.4 vs. 2.1 L). Pericarp removal was faster in TRA than in WOILP treatments (25 vs 45 min respectively). Nixtamal weight was lower in WOILP treatments than in TRA (3.2 vs. 3.7 kg respectively). Masas and tortillas from WOILP treatments were whiter than that from TRA (84.65 vs. 79.6; 77.7 vs 69.6 respectively). Moisture in WOILP tortillas was lower than in TRA (36.7 vs. 42.1%). Tortillas from WOILP were more resistant to tearing than TRA (0.13 vs. 0.07 N/mm²). Overall, OXI and NIX performed similar. The pollution level of nejayote was lowered by removing lime particles. However, it had a negative impact on yield and pericarp removal but positive impact in color and resistance to tearing of tortillas.

Keywords: insoluble lime particles, nixtamalization, nejayote, pollution

Physicochemical and Rheological Characterization of an Acidic Milk Product: Kefir Concentration Effect

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The main objective of this study was the analysis of physicochemical and rheological behavior of a drinkable beverage prepared with different concentrations (5,10 and 20 percent w/w) of Kefir. Several rheological models were also evaluated to determine the model that better fit experimental data. Apparent viscosity was measured with a Brookfield Viscometer within shear rates of 0.26 to 2.09 rad/s; and with an Ar-2000ex TA Instruments Rheometer within shear rates of 0.01 to 1000 rad/s. Physicochemical tests, such as acidity, chloride percent, fat concentration, color, humidity, syneresis, and total solids, were determined using laboratory equipment. The main result observed in all samples tested with Brookfield viscometer was that Kefir drink behaved as a Newtonian Fluid within shorter strain rates (0.26 to 2.09 rad/s). However, when the same samples were tested with Ar-2000ex Rheometer, a different behavior was observed: Over a wider range of shear rates, the fully non-Newtonian behavior of Kefir samples was discovered. Besides, additional variables such as shear and normal stresses, and loss and storage modulus, were analyzed with Ar-2000ex Rheometer. The rheological model that better fitted the experimental data was Cross model, followed by Power Law Model. Statistical analysis of viscosity data acquired with Brookfield Viscometer from all Kefir concentrations was not significant (p values greater than 0.05); which demonstrated that the effect of Kefir concentration over shorter strain rates was not significant, and thus, the samples behave as a Newtonian fluid. On the other hand, p values lower than 0.05 were observed in most of the different Kefir concentration samples tested with Ar-2000ex Rheometer; which indicates that a statistical significant effect was observed and thus a non-Newtonian behavior of Kefir samples. All statistical analysis was performed with SPSS v.16 software, selecting a Duncan Test with a confident interval of 95% to accept or reject the variances compared of the different Kefir concentration samples.

Keywords: Food Rheology, Viscosity, Shear Rate, Kefir Concentration

Monoglyceride Mixtures and their Phase Behavior in Vegetable Oil

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The knowledge on the phase behavior of monoglycerides (MG) in hydrophobic solvents (i.e., vegetable oils) is limited. Commonly it is assumed that their phase behavior in hydrophobic solvents is the same or similar as in water. The phase behavior of MG in vegetable or mineral oils might lead to the formation of organogels with thermo-mechanical properties that could be used in the production of *trans*-free substitutes for butter and lipid spreads or cosmetic products. Nevertheless, the MG-organogels are unstable due to the polymorphic changes of MG. Consequently, the study of the MG behavior in vegetable and mineral oils is essential to support the commercial use of MG-organogels. Within this context, the objective of this study is to investigate the phase behavior of pure MG (C14, C16, C18, and C22) and their blends with C18 in safflower oil and mineral oil. We used MG blends to mimic the composition of commercial monoglycerides. The phase behavior and mechanical properties of the MG-oil solutions and corresponding organogels were studied through differential scanning calorimetry (DSC) and rheological measurements. The pure and mixed MG solutions in the vegetable and mineral oils showed the characteristic crystalline transitions (lamellar, α , and sub- α phases). Nevertheless, this study shows that exist conditions that affect the development of the crystalline phase (i.e., sub- α 2) responsible of the instability of the MG organogels. Apparently, the affinity extent of MG's aliphatic chains for the solvent (i.e., vegetable or mineral oil) might favor or prevent the development of the sub- α 2 phase. Contrary to previous reports, we show that aliphatic chains are directly involved in the initial self-assembly of MG and that the chain length difference in mixtures of MG modifies the crystallization and melting temperatures of the lamellar, α , and sub- α phases. Finally, the mechanical behavior of MG-solutions is closely followed by the delta phase parameter (δ). The use of both the δ profile and cooling thermograms of the MG-solutions are useful to describe the micro-structural organization during the vegetable or mineral oil entrapment through organogelation.

Keywords: Monoglycerides, Phase behavior, Organogels.

Physicochemical and Compositional Characterization of Interesterified Lard-based Cocoa Butter Replacers

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Modification of fats and oils to produce specific triacylglycerols (TAGs) is an alternative for the production of cocoa butter (CBR) and *trans* free fats replacers among others. These structured lipids can also be designed to improve functional and nutritional properties of lipid-based food products. Cocoa butter (CB) is a key ingredient in chocolate, since it is responsible for its particular sensorial properties. However, due to increasing demand and high price, it is necessary to develop CB alternatives. Interesterification is an important technique for the modification of fats and oils. Through interesterification the fatty acids are redistributed within the glycerol molecule modifying the physicochemical properties of the original fat or oil. In this study, we evaluated the effect of interesterified fats on the physicochemical properties of CBR. The interesterified fats were produced from blends of lard and coconut oil. Lard was enzymatically (EI) and chemically (CI) interesterified in a 70:30 blend with coconut oil. For the EI we used a *sn*-1,3 specific lipase from *Candida antarctica B* (Novozyme). The CI was achieved with sodium methoxide (Sigma-Aldrich). The interesterified fats (EI or CI) were blended with CB at ratios of 20:80, 50:50, 70:30, and 80:20. These blends were characterized for triacylglycerides composition by HPLC, crystallization and melting profiles by differential scanning calorimetry (DSC), solid fat content by NMR (SFC), and microstructure through polarized light microscopy. The statistical analysis was done with the Statistica software (V 12.0). Interesterification led to a TAG composition of higher melting temperatures and lower melting enthalpy compared with native lard, with no significant differences in SFC and thermal properties between fats with EI and CI. After using iso-solid diagrams, we concluded that the blend with physicochemical properties appropriate for use as CBR was the one with an 80:20 interesterified fat to CB ratio. This blend presented the thermal profile, SFC and composition similar to CB.

Keywords: interesterification, cocoa butter replacer, lard, physicochemical analysis

Characterization of Oleogels Elaborated With Ethylcellulose And Commercial Monoglyceride

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In recent years, the gelation of vegetable oils has allowed the design of materials that mimic the functionality of saturated and *trans* fats, but with the health benefits derived from the consumption of mono and polyunsaturated fatty acids. The ethylcellulose (EC) is one of the most promising gelator molecules of vegetable oil due to its low cost and food grade status. The gelation process of EC is the result from a balance of molecular interaction between EC-EC and EC-solvent. Reports suggest that the presence of surfactants (i.e., monoglycerides) modify these interactions and subsequently the thermo-mechanical properties of the oleogel. However, no formal studies have addressed this tentative effect of the surfactants. The objective of this investigation was to evaluate the effect of a commercial monoglycerides (MGC) in the development of EC oleogels through differential scanning calorimetry (DSC) and infrared spectroscopy (IR) measurements. The EC oleogels were developed in safflower oil using a complete randomized experiment design with a factorial combination of 7, 8, and 10% EC and 0.0, 0.5, 1, and 2% of MGC. The EC used had a 48-49.5% ethoxyl content and viscosity of 4 cP. The results obtained suggest a synergistic effect between the MGC and EC, resulting in oleogels with different thermal properties than those obtained in oleogels elaborated only with MGC or EC. The melting thermograms of EC-MGC oleogels indicate that only a small fraction of the MGC interact with the EC, apparently through hydrogen bonds between the primary and secondary -OH groups of the monoglycerides and the -OH groups of EC. The major fraction of the MGC crystallized in the EC-MGC oleogels developing the characteristics polymorphic phases associated with monoglycerides, although with a delayed kinetic in comparison with the crystallization observed in MGC oleogels. The MGC effect on the rheology of EC-MGC oleogels still has to be determined. Nevertheless, the presence of small MGC concentrations (i.e., 0.5%) evidently results in improved gelation properties of the EC. Thus, EC-MGC molecular interactions result in the formation of oleogels with novel and useful thermo-mechanical properties with potential application in the food industry.

Keywords: oleogel, ethylcellulose, monoglyceride

Influence of thermal pre-treatments in the diminishing of absorbed oil during the frying of doughnut centers.

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The aim of this work was to evaluate the effect of a thermal pre-treatment during the preparation of doughnut centers by immersion frying at different times and temperatures. Surface oil, absorbed oil (Soxhlet) weight changes, density (by solids substitution with sesame seeds) in fresh dough, after the pre-treatment and after frying were calculated, also Aw (conductivity method) and microstructure (microscope Optisum MIC- 440 T captured by the software ScopePhoto) were evaluated. A mix of wheat flour, sugar, salt, egg, butter, milk and yeast was used to prepare the dough; leaving in rest during 1.5 h, spheres of around 22 mm in diameter with 6 g of weight were formed. Initial moisture (Moisture balance at 105 OC) of the doughnut centers was 28.3%. For the convective drying in a Hamilton Beach electrical oven 65-70OC and 1 or 1.5 h were employed; for the microwave oven GE model JES1160SS, 15 s at 70 or 90% of power were applied. Spheres were fried at 160-170 OC during 3.5 min for dough without drying and for 3 min for dried dough. Trials were performed by triplicate. Mean, standard deviation and variation coefficient were calculated. Oil absorption for doughnuts centers without drying was 27.5%, while convectively dried for 1 h was 14.58%, dried for 1.5 h was 15.71%, Microwave dried at 90% was 24.12%, and at 70% was 20.18%, showing a reduction of absorbed oil of the doughnut with a drying before frying, being better for the reduction the convective drying. Moisture content was almost the same for all the samples (around 12.5 %). Enlargement of samples were greater in doughnuts centers without pre-treatment and microwave drying at 70%. Aw is lower in all cases with reference to the fresh dough. Weight changes were greater with a convective drying during 1.5 h. Density changes were greater in the sample without treatment, because of the greater oil absorption. Also, these samples presented a greater porosity. The drying pretreatments diminishes the oil absorption. It is necessary a further work with the microwave oven to improve drying conditions for the doughnut centers.

Keywords: Frying, drying pretreatments, microwaves, microstructure, doughnuts centers

Coconut Drying (*Cocos nucifera L.*) in a Microwave Oven and in an Infrared Drier for the Manufacture of a Traditional Sweet.

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The aim of this work was to identify the conditions of lower cell damage and the highest yield in microwave drying and infrared heating, during the drying of coconut pulp as a final product for the manufacture of a traditional coconut sweet. Coconuts of the same size and ripeness stage were selected. All the water inside the coconut was extracted and the solids were cut in fine plates of the same width. A General Electric microwave oven was used at 760 watts. Samples of 10 g of coconut each, were dried at different times (1, 2, 3, and 4 minutes) by triplicate, mean values and standard deviation were calculated; a moisture balance Ohaus MB23 was used for the infrared drying by using samples of 3 g of coconut, drying them at 70, 75 and 80 °C during 30 min by triplicate. In both cases, their weight, moisture and solids percentage was monitored. Mean values were calculated. At the end of each trial, the coconut was observed through a digital microscope Optisum MIC- 440 T and captured by the software ScopePhoto, to identify the cell damage and color changes (RGB). Moisture loss percentage $[(\text{final weight}-\text{initial weight})/(\text{initial weight}) \times 100]$ and yield percentage $(\text{final weight}/\text{initial weight} \times 100)$ were calculated. In the microwave oven, due to the higher processing time, there is a greater moisture loss, but a lower yield. The higher yield and also the less damaged structures were obtained at 1 min of processing. At 2 and 3 minutes moisture loss and yield of process are equilibrated. A toasted flavor is obtained. The higher yield with infrared heating is obtained at 70°C. The product is not damaged at any temperature used, the sensorial properties of the product are good, the characteristic coconut flavor is maintained and there are not burned parts observed. According to this work, the microwave heating is not recommended to manufacture a coconut sweet: there is a greater energy expense, the cell structures of coconut are broken and the coconut is burned. Yield increased in 25% in the infrared heating compared with the microwave drying.

Keywords: Drying, coconut pulp, microwaves, infrared heating, microstructure

Vegetable Oil Organogels Developed with Mixtures of Monoglycerides and Phospholipids

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The development of organogels is the result of molecular self-assembly of low molecular weight gelators, through short-range intermolecular interactions (i.e., hydrogen bonds, van der Waals forces, etc.). This results in the formation of three-dimensional crystal networks that immobilize and structure organic solvents (i.e., vegetable oils). The phospholipids (PL) develop organogels in a vast variety of solvents resulting in gels with viscoelastic properties. However, high PL concentrations and, in some cases, the addition of a surfactant is required to form the organogels. There is limited information regarding the PL gelling behavior in vegetable oils. Within this context, we investigated the organogelation of safflower oil using mixtures of monoglycerides (MG) and PL. The results showed that independently, at MG concentrations lower than 3% or PL concentrations lower than 5% in the vegetable oil, the gelators do not form gels. Using a factorial experimental design using concentrations of PL and MG below 3% and 5%, respectively, we investigated the formation of mixed gels. For this study, the molecular interactions between the gelator molecules during organogelation were studied by infrared spectroscopy, polarized light microscopy, the determination of solid phase content (SPC), as well as rheological (G') and texture measurements (i.e., firmness and consistency). Neither G' nor the texture parameters showed linear correlation with the SPC, as expected for this kind of systems. However, mixed gels formulated with a combination of MG 2% and PL 0.25%, it resulted in the formation of viscoelastic gels with the highest firmness and consistency. Then, at these gelator concentrations a synergistic effect occurs between MG and PL. The results show that a low concentration of PL modifies the lamellar organization of MG resulting in the formation of microstructures with capability to trap oil within its three-dimensional organization, and thus developing an organogel. Infrared spectroscopy measurements indicate that the MG-PL interaction is somehow mediated through hydrogen bonds.

Keywords: organogel, safflower oil, monoglycerides, phospholipids.

Nutritional Composition and Functional Properties of Chickpeas Flours, Influenced by Thermoplastic Extrusion.

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Chickpeas (*Cicer arietinum*, L.) seeds were extruded in a twin-screw co-rotating pilot scale extruder Buhler® (BCTM-30). The extrusion process was carried out at different temperatures (Control untreated –GC; 125°C- HGE1; 130°C-HGE2; 140°-HGE3), controlled at the final chamber of the extruder. The physicochemical composition and functional properties of crude and extruded flours were analyzed. The chemical composition of the samples varies, mainly in the fat content, probably due to the mechanical effect that acts like a press, separating fat from flour. GC contains 21.01% and 5.84%; HGE1 18.29%, 1.54; HGE2 21.07% 1.39%; HGE3 20.63% 1.82%; protein and fat, respectively. Results imply that extruded chickpeas flours could be used as a protein source in food formulations without significantly increasing fat content. Furthermore, total starch and damaged starch were quantified in order to get a better understanding of the effect in functional properties such as water solubility index (WSI) and water absorption index (WAI), as well as oil absorption index (OAI). Results showed GC 48.72%, 0.54%; HGE1 44.68% 10.91%; HGE2 45.96%, 10.49%; HGE3 46.52%, 6.34%; total starch, damaged starch, respectively. Functional properties resulted GC 2.31%, 20.70%; HGE1 3.38%, 27.66%; HGE2 3.43%, 29.27%; HGE3 3.53%, 19.84%; WAI, WSI, respectively. WSI tends to increase proportionally as damaged starch content does due to the production of soluble carbohydrates from starch degradation; no significant differences between WAI was found among treatments. OAI results were GC 2.09%, HGE1 1.86%, HGE2 1.83%, HGE3 2.02%, where no correlation was found between damaged starch and this parameter, probably due to the capacity of the new configuration of starch to link to fat residues. WRI was determined at different temperatures (25°C, 60°C, 70°C and 90°C) to understand the effect of the starch damage on hydration and gelatinization tendencies. The peak WRI for HGE1 and HGE2 occurs at 60°C, whereas for GC and HGE3 at 90°C, probably due to the lower concentrations of damaged starch. Extruded chickpea flour could be a functional additive to the baking industry due to its high protein values and functional properties.

Keywords: Chickpeas, extrusion, flours, starch

Comparison of Tissue Chemical Composition of *Barbus barbulus* and *Barbus luteus* Fish Fillet in Karoon and Karkheh Rivers

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This study was conducted to determine chemical composition (protein, lipid, ash and moisture) of fish fillet from *Barbus luteus* and *Barbus barbulus*. This project carried out in Islamic Azad University, Ahvaz Branch. At the beginning nine fish from each species *Barbus barbulus* and *Barbus luteus* were catch from Karoon and Karkheh Rivers during the autumn. Biometry of fish has been carried and fillet samples were frozen and put into ice container and sent to laboratory for analysis. In laboratory contents of protein, lipid, moisture, ash, fiber and carbohydrate were test. The results indicated that the chemical composition of both fish in the two rivers was different ($p < 0.05$). The highest protein content was observed in the *Barbus luteus* from Karoon River. Lowest lipid content, highest content of moisture and lowest content of ash were observed in the *Barbus barbulus* from the Karkheh River.

Keywords: Karoon river, Karkheh river, Chemical composition, *Barbus barbulus*, *Barbus luteus*

Effect of Frozen Storage on the Quality Scallop *Atrina maura* Extracted in the Gulf of California, Mexico

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The extraction of scallops in the area of Bahía de Kino, Sonora, Mexico has intensified in the last 10 years, as this product increasingly more in demand in the national market because it is very appreciated for its size and delicate flavor. However, little is known about this bivalve mollusk, since it has not made a formal evaluation of the characteristics or composition of this resource. In this study, the effect of freezing at $-18\text{ }^{\circ}\text{C}$ on the quality of the species of scallop *Atrina maura* was determined, which was extracted by commercial divers in the coastal area of the Municipality of Hermosillo, Sonora, Mexico ($28^{\circ}37'00''\text{N}$, $108^{\circ}38'00''\text{W}$). The samples obtained were cooled immediately and received at $1\text{ }^{\circ}\text{C}$ in the laboratory for your analysis. Parameters were measured monthly for pH, water activity, color (L, a, b) and texture (g-f), as well as the total plate count (CFU/g) of psychrophilic bacteria, psychrotrophic, mesophilic aerobic and bacteria producing hydrogen sulfide storage for six months. The data obtained were subjected to an analysis of variance one-way, where the parameter variations were the days of storage, with a significance level of 0.05. The results indicated that during frozen storage, mesophilic bacteria remained without significant changes during the first 5 months, psychrophilic bacteria were decreasing, production of H_2S remained without significant changes and psychrotrophic bacteria had significantly varying behavior. The pH decreased significantly at the end of storage, while the values of A_w , texture and color showed no significant changes during the study period. Freezing is a good alternative for marketing Scallop, being able to aspire to their distribution in more remote places, under conditions of acceptable quality and with a long shelf life because now the product is handled and distributed in state fresh-the icing, limiting its marketing to other markets.

Key words: scallop, shelf life, quality, freezing

Physicochemical characterization of corn products changes in amylose content and the total starch

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The objective of this study was to evaluate different corn products and nixtamalized products using physicochemical analysis techniques in order to determine changes in amylose content and total starch due to processing and storage time. Four samples of different products were used, MAIZENA[®] corn starch, nixtamalized corn flours MASECA[®] and MINSAs[®] and corn tortillas from dough mill. Samples were purchased in the local market. To characterize samples were measured the next physicochemical characteristics: water absorption index (WAI), water solubility index (WSI), amylose content (AC) at 600nm (Hoover Ratnayake) and total starch (TS) at 510 nm (Goni). All analyzes were conducted in triplicate. Results of WAI were 1.68 in MAIZENA[®], 3.319 in MASECA[®] and 3.661 in MINSAs[®]. The results of WSI were 0.118 in MAIZENA[®], 1.879 in MASECA[®] and 2.492 in MINSAs[®]. For the amylose content in percentage, samples showed next values: 48.304 in MAIZENA[®], 30.710 in MASECA[®], 32.055 in MINSAs[®], 35.355 in mill dough, 37.710 in industrialized dough, 26.740 in handmade tortilla and 30.390 in corn flour tortilla. According to amylose content, starches they can be classified into different groups such as: waxy starch, low amylose about 1%, standard starch, medium amylose about 18-30% and starch with high amylose 45% or more. The amylose content was measured in handmade tortilla stored at 4 °C for 2 days, the results showed a decrease 26.74% in the second day and 17,596 on the third day of storage. Total starch content in the samples was 20.92% in MASECA[®], 20.31% in MINSAs[®], and 61.65% in MAIZENA[®]. The results in the total starch content in the mill dough, and industrialized corn flour were 73.12%, and 30.12% respectively. For tortillas made with mill dough 71.43% and 23.51% in tortillas made industrialized flour. The level of industrialization in maize products determines the final characteristics in the WAI and WSI, but especially the amylose content and the total starch content will provide functionality and sensory attributes in products.

Keywords: Maize, starch, amylose, spectrophotometric methods

Preparation and Characterization of Chitosan Films Formulated with Thyme, Rosemary and Oregano Essential Oils

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In this work, edible films made with chitosan, glycerol, and including or not the incorporation of essential oils of thyme (*Thymus vulgaris*), oregano (*Origanum vulgare*), or rosemary (*Rosmarinus officinalis*) were studied. The effect of incorporating the aforementioned compounds on edible films' moisture content, thickness, water solubility, water vapor permeability, density, water activity, transparency, color, and mechanical properties were evaluated. Edible films were prepared with chitosan 1% (w/w) by dissolving it in 1% acetic acid, under stirring for 30 min at 60°C; glycerol was added at 2% (w/w) as plasticizer, and then 0.1% (w/w) of each studied essential oil was incorporated (or not) into the formulation. To control film thickness, the same amount of each film-forming solution (30 mL) was poured into Petri dishes and then dried for 24 h at 35°C. Edible films were conditioned at 33% relative humidity before analyzing edible films' physical and mechanical properties. Every experiment was conducted by duplicate and each measurement was performed by triplicate. Analysis of variance was used to compare tested edible films' properties. Every formulated film was flexible, homogeneous, and transparent. The physicochemical properties of chitosan edible films were affected by the incorporation of studied essential oils. Incorporation of studied essential oils caused a significant increase ($p < 0.05$) of films' thickness, density, water solubility, and water activity, while significant decreases ($p < 0.05$) of moisture content, transparency, and water vapor permeability were detected; therefore, the barrier properties of chitosan films were improved by adding studied essential oils. Furthermore, minor color changes were observed. On the other hand, essential oils' addition caused a significant decrease ($p < 0.05$) in the tensile strength and Young's modulus of tested edible films; however, their elongation was increased. Chitosan edible films incorporated with studied essential oils can be used as an active packaging alternative due to the reported antimicrobial activity of essential oils of thyme, oregano, and rosemary as well as formulated edible films' physicochemical properties that are suitable for selected food applications.

Keywords: chitosan, edible films, essential oils, thyme, oregano, rosemary

Solid-Liquid Extraction of Phenolic Compounds from Jamaica Flower (*Hibiscus sabdariffa*)

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Jamaica (*Hibiscus sabdariffa*) flowers are an important source of bioactive principles such as phenols, which are chemical compounds that have shown a positive effect on health as nutrients in food. But traditional extraction conditions are not suitable, due to its sensitivity at temperatures above 40 °C and its easy oxidation. Therefore, in the present work different extraction conditions were established using three temperatures (15, 25 and 35 °C) and two particle sizes (T.P1 = 1.25mm and 0.595mm T.P2 =) to obtain performance. Distilled water was used as the solvent with a constant solid-liquid ratio 1:30 and stirring at 500 rpm. The extracted total phenol content was quantified using a UV / Vis spectrophotometer, by the direct method and by the method of Folin -Ciocalteu to determine the diffusion coefficient and the activation energy needed to carry out the process. The results were statistically analyzed using a two - way ANOVA to see significant differences between the replicates and repetitions. The results show that the extraction performed with a particle size of 0.595 mm has a lower yield (80.5%) compared to the particle size of 1.25 mm (993%) yield. The diffusion coefficient increases with decreasing particle size because conditions for T = 25 °C and TP = 1.25 mm, D = 2.16E-09 m²/s was lower than for TP = 0.595 mm, where D = 2.88 E-09 m²/s. Increasing the temperature to T = 35°C has an effect on the extraction process, increasing the diffusion coefficient (4.44E-09 m²/ s) but decreasing the yield (51%).

Keywords: Jamaica, Phenol, Solid-liquid extraction, Diffusion coefficient, Activation energy.

Ultrasound and Vacuum Application during Pork Meat Drying

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Currently, the quality of the dried products can be improved by decreasing the temperature during drying. Vacuum drying is widely preferred. In addition, some pretreatments are used in order to accelerate the process. Ultrasound has created interest because of its promising effect in the areas of food processing and preservation, as it is considered an emerging technology and a non - thermal process. The application of ultrasonic waves is based on acoustic energy or vibrational interrupting the continuity of the membranes; therefore, it increases the rate of mass transfer between the cell and its extracellular environment without damaging quality attributes such as color, flavor and structure of food. In the present study, processes ultrasound and vacuum were combined as a new drying technique using an ultrasound bath with a frequency of 40 KHz, 30 cm Hg vacuum, and 65 ° C. Pork loin sheets of 2x4 cm was used with two different thickness, 0.2 and 0.5 cm. In the results, drying curves were performed until 120 minutes drying. The final humidity for both thickness were 24 and 55%, respectively. Moreover, water activity (A_w) values were of 0.8289 and 0.9598. Color changes offering pork sheets during the process, were assessed by image analysis using the CIEL*a*b* scale in Photoshop. By a Leica stereomicroscope EZ4D in 12.5X, it was determined that the dried meat had not suffered structural damage using this new drying technique: Ultrasonic Vacuum (USV) Drying.

Keywords: Drying, Ultrasound, Vacuum, Pork, Color.

Evaluation of the Cryoprotectant Effect of Cryogels of Waxy Starch Incorporated With Ultrasound on Pork Meat.

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The aim of this study was to evaluate the effect of using cryo-gels of waxy starch on changes in thermodynamic properties, hardness, water retention and structural damage of pork meat, incorporating them by ultrasound as cryoprotectants during slow freezing. Pork tenderloin slabs (4x3x1 cm) were immersed and sonicated, at 40 kHz for 30 minutes, in a cryo-gel of waxy starch with one and four freeze/thaw cycles. Then, the slabs were frozen at -20 °C with two control samples. ANOVA one way was used to compare the results of the three replicates in the water holding capacity (CRA), the hardness, the initial freezing point (PIC) and the enthalpy of melting ice obtained by Modulated Differential Scanning Calorimetry (MDSC). It was found that the cryo-gel with four cycles of freeze/thaw presents the best response in all parameters evaluated. Untreated samples had 10.93% water loss, and 11.39% for samples sonicated. When cryo-gel is applied, the CRA increased to 9.97% water loss with one cycle and 9.23% at four cycles. The penetration resistance for untreated samples was 1.86 kgf and 1.74 kgf for sonicated samples. After freezing using cryo-gels and thawing at 25 °C, increasing penetration resistance was 3.1 kgf and 3.2 for one and four cycles, respectively. The PIC in untreated samples was recorded at -6.6 °C and in the sonicated samples at -9.65 °C, while samples with cryo-gel had a PIC of -9.6 °C for one cycle, and -8 °C for 4 cycles. The MDSC showed no significant difference in the enthalpy of fusion (203.9 J / g); the main difference appeared in the evaporation temperature of water in the samples were at 107 °C for the untreated sample, 80 °C for samples with cryo-gel four cycles, and 87.5 for the samples of one cycle and sonicated. Although there is no significant difference between the results for cryo-gels between one and four cycles, the effect of using cryo-gels is evident to improve the water retention capacity. However, the high increase in hardness can be perceived as a negative effect on the meat quality.

Keywords: Meat, Freezing, Ultrasound, Cryo-gel, Waxy starch.

Xanthan's Cryogel Protection Effect in Crystallization and Roast of Pork Meat

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Pork meat is a product that produces big ice crystals during conventional slow frozen; this crystal causes an intramuscular cell breaking and raises the levels of exudate fluids, and this affects tenderness and physical aspect of thawed meat. This is why there is a research for new methods of freezing food to reduce the damage caused. One solution of this problem is the cryoprotectors application that raises the number of crystals and low their size, to reduce the cell breaking. Adding ultrasonic energy makes the mass transfer easier, assuring a homogenous mixture of the cryo gel on meat. The aim of this work is to evaluate the Xanthan's cryo gel (0.5%) protection applied by 15, 30 and 45 minutes on an ultrasonic bath (40 KHz) in pork tenderloin slabs (4x3x2cm), frozen to -20°C for 24 hours and thawed at 25°C in a water immersion bath for 30 min. Physical and physico- chemical changes were evaluated, besides a thermal profile by recording the temperature during freezing using thermocouples type T that were also used for the freezing rate and initial freezing point determination. MDSC was used for protein denaturation. Changes in water-holding capacity were followed by a compression technique using a 2.5Kg weight between two acrylic plates that register a rising from 5 to 11-14% in exudate fluids. Hardness y and color were reduced with sonication; these were obtained using a penetrometer and image digital analysis in CIELab scale in Photoshop program. Sonicating 30 minutes at the same conditions of freezing and thawing was used as thermal treatment. Then, an infrared roast was used at 180°C for 15minutes and cooking at 70°C. It was determined that during freezing with cryo gel, pork meat received less structural damage, thus a lower exudate loss that benefits texture and firmness of the meat after cooking.

Keywords: Meat, Cryoprotectants, Ultrasound, Xanthan gum.

Polymer-based Cryogel Applications during Food Freezing Processes

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Currently, the industry is seeking new ways to protect food preserving its quality aspects, where systems based on polymers are a good alternatives to freezing, and thus control the size and number of crystals avoiding undesirable changes due this process. Four different polymers (poly-vinyl alcohol, xanthan, karaya and waxy starch), for four cycles of cryogelification in indirect contact with liquid nitrogen (-196 °C) were evaluated regarding rheological, microscopy, thermal and spectroscopy characterization. Enthalpy values (ΔH), specific heat (C_p), thermal transitions, rheological parameters, pore size, structural changes, degree of crystallinity and activation energy were obtained. The results were analyzed by measures of central tendency and dispersion, 1 and 2-way ANOVA, testing hypothesis and linear and nonlinear regressions. Significant changes ($P < 0.05$) in the structural level based on the number of cycles of freezing-thawing of each polymer, and a reordering in the polymer matrix were found, which indicates that each polymer has a particular behavior that defines its possible compatibility with the different biological systems tested, which in turn, changes depending on the internal accommodation of the structure and formation-breakdown interactions between molecules. Waxy starch has the best structural-functional characteristics in addition to high compatibility to be applied as a cryoprotectant system for food freezing, followed by xanthan gum and poly-vinyl alcohol. Besides, karaya gum was not viable for use as a possible cryogel.

Keywords: Biopolymers, Cryogels, Cryoprotectants, Freezing foods

Impact Of Freeze-Drying And Spray Drying Of Human Milk On The Fat Globule And Lipid Profile

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Human milk is the best food of newborn babies, it contains essential nutrients such as proteins, carbohydrates, fat, vitamins and minerals and bioactive factors that contributing to optimal infant development and are not found in cows' milk-based formulas. The most variable component is fat, which provides nearly 50% of the energy, and facilitates the transport and absorption of fat-soluble vitamins to the infant. Milk fat is composed by fatty acids some of them essential for brain and retina development; therefore, analysis of the lipid fraction of human milk is an important task, especially when milk is processed. Pasteurization is a process commonly used to preserve human milk in human milk Banks, however decreases nutrients and bioactive components; so it is necessary to evaluate new technologies to obtain safe human milk maintaining its nutritional qualities. The objective of this work was to study the effect of freeze-drying and spray drying on some characteristics of human milk fat, as an approach to evaluate these methods for the preservation and handling of human milk. The analysis of the physico-chemical composition of fresh and dried milk was made. Fat content, globule size and size distribution were measured. The fatty acid profile was analyzed by gas chromatography. Non-significant differences in the physicochemical analysis between the different processes were found ($\alpha=0.05$). There was a decrease of 23% in the fat content of spray dried milk. The globule size decreased considerably, varying from 2138 nm to 529 nm after drying. The size distribution of fat globules increased during drying from 0.24 to 0.45 in spray dried milk. With respect to the fatty acid profile, human milk samples had an elevated content of palmitic (27%), and oleic (30%) acids and significant variations for unsaturated fatty acids were observed in spray dried samples. The decrease on the fat globule diameter increase the surface area possibly improving the bioavailability of fat components. The methods of preservation used in this work did not affect the macronutrient content, nor were significant changes observed in the fatty acids profile.

Keywords: *Human milk, freeze-drying, spray drying, milk fat*

Assessment in Changes on Breast Milk Nutrients after Spray Drying

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Breast milk is considered the ideal food for newborns and infants during the first six months of life since it contains lactose, calcium, sodium, fatty acids, antioxidants, proteins, enzymes, hormones, vitamins, minerals and immunoglobulins. The concentrations of this nutrients can be affected by various processes used in breast milk banks and home in order to preserve this, such as storage and freezing. The aim of this study was assess the changes in macronutrient composition in breast milk after spray drying. Mature human milk samples were used in the study. A spray dryer LabPlant SD-Basic was used at a flow rate of 3.5 mL/min and drying temperature of 150 °C. Dried milk was resuspended in distilled water for analysis. Lactose, protein, fat, water content and pH were analyzed and the analysis of variance was used to compare composition in fresh and spray dried milk. After the drying process, no significant difference was found for lactose and protein content ($p>0.05$) with values of 5.2 g/dL, 1.7 g/dL, respectively and before drying 5.6 g/dL and 1.8 g/dL respectively, for pH there were no significant different before drying (5.8 in fresh milk and 5.5 after drying); however there was a decrease in the fat content after drying, finding values 2.46 g/dL in fresh milk and 2.13 g/dL in dried milk. The moisture content of the powdered milk was 1.3 %, which is within the range allowed by Codex Alimentarius. This study shows that is possible to obtain human milk powder without altering the composition of macronutrients and it is also the first report about spray drying as a method of preservation of human milk in Mexico.

Keywords: *breast milk, nutrients, spray drying*

Blanching of Tomatoes Using Microwaves

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Blanching is a unit operation in which fruits or vegetables are heated with the main purpose of inactivating enzymes. It is used as a preliminary step in conservation processes such as drying, freezing, and canning. However, blanching has an effect on quality attributes and nutritional value of the products. The aim of this work was to compare two blanching methods. Tomatoes (*Solanum lycopersicum* L.) cv. Grape were immersed in hot water and blanched using microwaves; On the other hand, tomato juice was blanched in a water bath (traditional). Surface response methodology was employed to optimize process conditions using the Design-Expert 7.0 software. Process variables were temperature (60-90 °C) and time (1-6 min), while the response variables were: total color difference (ΔE , tri-stimulus colorimeter), consistency index (K, viscometer), ascorbic acid retention (2, 6-dichlorophenolindophenol titration), and residual enzymatic activity of polygalacturonase (PG1, spectrophotometry). Criteria for the optimization of these variables were the lowest ΔE and residual enzymatic activity of PG1, and the highest values of K and ascorbic acid retention. For the comparison of methods, five replicates generated under the optimal conditions were used. In this stage, the response variables were the same as those used for optimization with the addition of the residual enzymatic activity of PG2 (spectrophotometry). The best process conditions for microwave blanching were 90 °C, 1 min [desirability (d) = 0.698] and for traditional blanching: 60°C, 1 min (d= 0.707). Results for microwave and traditional blanching were: $\Delta E = 14.7 \pm 2.14$ and 2.50 ± 0.68 ; $K = 0.32 \pm 0.02$ and 0.39 ± 0.01 Pa sn; ascorbic acid retention = 81.9 ± 0.45 and $86.9 \pm 0.08\%$; residual enzymatic activity of PG1 = 85.0 ± 2.97 and $97.1 \pm 0.33\%$; residual enzymatic activity of PG2 = 70.7 ± 4.31 and $90.5 \pm 2.01\%$. A better enzyme inactivation on both PG1 and PG2 can be achieved using microwave blanching, with a less impact on attributes (ascorbic acid and color) than expected, considering the high temperature gradient between methods. However, K value was slightly higher in traditional blanching.

Keywords: blanching, microwave, tomatoes.

Improved Shelf Life and Fertility in Eggs Layed by Hens Using SoluVet

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The eggs layed by hens are one of the most important foods in the current diet of many Latin-American Countries. The yolk of the egg is a mature ovum formed in the poultry ovary. The vitelline membrane surrounds the ovum and during its release from the oviduct several protecting layers are formed around it. Finally a double shell membrane and the calcareous shell, covered by the cuticle, complete the ovum protection. The cuticle is solidly adhered to the calcareous shell, sealing the shell pores and serving as a first barrier against microorganisms. The cuticle is composed by ovoporfirin, a protein that exhibits fluorescence under ultraviolet light, thus providing a mechanism to examine the integrity of the cuticle. Eggs are often cleaned with a citric acid solution; however, it may affect the cuticle integrity, thinning the calcareous outer shell, diminishing the egg natural defenses. In this contribution, the use of an electrolyzed, oxidizing commercial solution with neutral pH (SoluVet®) over the egg shelf life is examined. The oxidizing solution prevents the outer shell thinning and keeps the integrity of the cuticle, thus preventing microbial infection propagation.

Key words: Egg, Innocuity, Microbiology, Shelf life, Fertility

Gompertz Model Approach to Microbial Inactivation Kinetics by High Pressure Processing (HPP). I. Incorporating Effects of Come-Up Time

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Come-up time (CUT) defines the time to reach the target processing conditions (i. e. the desired temperature or pressure level). In high pressure processing (HPP), CUT may induce changes on the microbial population, enzyme activity and chemical compound concentration. Ideally, the kinetic analysis should be performed under isobaric-isothermal conditions by allowing the system to reach the pressure-temperature equilibrium. Unfortunately, this practice is not possible for HPP industry, where short processing times are needed to remain economically competitive. Kinetic models that incorporate CUT effects would be useful, and the analysis of inactivation data for bacteria ($n=919$ points, 60 survival curves) and spores ($n=273$, 12 curves) under isothermal conditions showed a Gompertz model (GMPZ) approach can be an adequate alternative. The parameter A was redefined as the difference between the initial population ($\log_{10} N_0$) and the lower quantification limit of the microbial plate count technique ($\log_{10} N_{lim}$), while exponential secondary models predicted pressure effects on the lag time (λ) and the maximum inactivation rate (μ_{max}). In low-acid media ($\text{pH}>4.5$), λ decreased exponentially with pressure, allowing to define a theoretical pressure level (P_λ) sufficient to initiate microbial inactivation during CUT. The parameter μ_{max} exponentially increased with pressure for all evaluated datasets. Furthermore, dynamic pressure effects during CUT were simplified by assuming isobaric conditions for process times less than t_{CUT} , allowing to obtain GMPZ parameter estimates using only nonlinear regression ($R^2\sim 0.938$, $\sigma^2=0.030-0.604$). The proposed approach is a simpler, promising tool for a more informative analysis of microbial inactivation kinetics in HPP, but its assumptions should be validated using controlled experiments and additional published data.

Keywords: high pressure processing (HPP); pressure assisted thermal processing (PATP); come-up time (CUT); microbial inactivation kinetics; Gompertz model

Gompertz Model Approach to Microbial Inactivation Kinetics by High Pressure Processing (HPP). II. Experimental Validation and Model Selection

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The approach to describe microbial inactivation kinetics by high pressure processing (HPP) with the Gompertz model (GMPZ) proposed by Serment-Moreno et al. (2016) incorporates the initial microbial load (N_0), lower quantification limit (N_{lim}), and simplifies the dynamic effects of come-up time (CUT). GMPZ successfully fitted HPP microbial inactivation data reported in peer reviewed sources, but additional experimental data was required for validation. HPP *Listeria innocua* inactivation data in milk was generated at 300, 400, 500, and 600 MPa and pressure holding times (t_{hold}) ≤ 10 min. Three mathematical expressions based on exponential, logistic-exponential, and inverse functions were evaluated to describe pressure effects on the lag time (λ) and the maximum inactivation rate (μ_{max}), whereas the asymptote difference (A) was fixed as $A = \log_{10}(N_0/N_{lim})$. Model performance was statistically evaluated, and validated with additional data at 450 and 550 MPa. All GMPZ models adequately fitted the inactivation of *L. innocua* ($R^2 \geq 0.956$) but sets containing a logistic-exponential function for $\mu_{max}(P)$ were superior ($R^2 \geq 0.97$). These GMPZ versions predicted that ~ 597 MPa is the theoretical pressure level (P_λ) when inactivation begins during CUT, which is mathematically defined as $\lambda(P=P_\lambda) = t_{CUT}$. As pressure increased, predictions tended to slightly underestimate the HPP lethality in the tail section of the survival curve. This may be an intrinsic property of the model due to the derivation procedure used to obtain GMPZ, but in practice it may be overseen by slightly extending t_{hold} . Overall, the modeling approach is promising, justifying further validation work with other microorganisms and media.

Keywords: high pressure processing (HPP); pressure assisted thermal processing (PATP); come-up time (CUT); microbial inactivation kinetics; Gompertz model

Partial Characterization of Root Meal *Cucurbita foetidissima* as an Alternative Source of Starch

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Starch is synthesized in the form of granules, stored in different organs of plants including leaves, seeds, tubers, roots and fruits. It is a raw material with a wide range of applications ranging from the delivery of food texture and consistency to manufacturing paper and packaging adhesives. Some authors have referred to the root of *C. foetidissima* with up to 52% of starch in the dry base composition, depending on the season; It is a wild plant that does not require expensive care and agronomic thrives with little water, so it could be a good source of starch. The aim of this study was the characterization of flour from the root, so samples were collected randomly on campus and chemical composition analysis in triplicate, followed by a grinding process the material previously dried at 60 °C for 48 h subsequent screening to discard the most fiber was made possible, then subjected to raw materials to the following analysis in triplicate and three temperatures (25 °C, 50 °C and 70 °C): DSC analysis, analysis of apparent viscosity, consistency index and index of flow behavior, these last two through the model of power law. Each set of results was subjected to ANOVA and student t-test ($p \leq 0.05$). Proximate analysis demonstrated the existence of a 33% starch as a component of interest. DSC analysis showed values $T_i = 59.35 \pm 2.41$ °C, $T_p = 63.58 \pm 3.08$ °C, $T_f = 71.19 \pm 4.54$ °C and $\Delta H = 5.64 \pm 3.81$ J/g. The apparent viscosity analysis showed a marked decrease in the shear stress at 70 °C compared to 25 °C treatment occurs. The consistency index falls from 7.54 ± 0.85 k at 25 °C to 2.33 ± 0.94 k at 70 °C, while the rate of flow behavior (n) increases from 0.54 ± 0.05 to 0.62 ± 0.09 at the same temperatures. Taken together, the results are not favorable for the use of root meal *C. foetidissima* for food applications as the material was analyzed, this compared to traditional commercial flours, which will be refined for elucidating purified starch properties.

Key words: starch, root, *Cucurbita foetidissima*, characterization.

Formation of cholesterol oxides in lipid systems made of edible oils and cholesterol during microwave heating

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Microwave (MW) heating of foods may cause the formation of cholesterol oxidation products (COPs). COPs formation depends on the conditions of MW heating and the composition of the food matrix. The aim of this work was to analyse the formation of major COPs from cholesterol incorporated into to palm, extra virgin olive, and soybean or fish oils during MW heating, and to monitor changes in peroxide value and fatty acid profiles. Model systems composed of mixtures of cholesterol and oil (0.4 mg of cholesterol/mL oil), were heated for 5 to 20 min in multimode, unimode MW ovens or convection oven at 180 °C. Maximal total COPs levels were reached depending on the type of heating system and oil matrix. Multimode MW heating caused greater COPs formation than unimode MW. COPs formation trends in the conventional oven were similar to those of MW heating, except for fish oil, in which significantly higher COPs were generated. Fatty acid profile and natural antioxidants influenced cholesterol and surrounding media oxidation during MW heating. Results indicated that soybean oil, compared with the other oils tested, did not promote cholesterol oxidation during MW heating, while the opposite trend was observed for extra-virgin olive oil and palm oil.

Keywords: Cholesterol oxidation, microwave heating, edible oils, lipid oxidation, fatty acids.

Effect of Microwave Heating on Phytosterol Oxidation

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The oxidative stability of phytosterols during microwave heating was evaluated. Two different model systems (a solid film made with a phytosterol mixture (PSF) and a liquid mixture of phytosterols and triolein (1:100, PS + TAG (triacylglycerol))) were heated for 1.5, 3, 6, 12, 20, and 30 min at 1000 W. PS degraded faster when they were microwaved alone than in the presence of TAG, following a first-order kinetic model. Up to 6 min, no phytosterol oxidation products (POPs) were generated in both systems. At 12 min of heating, the POP content reached a higher level in PSF (90.96 $\mu\text{g}/\text{mg}$ of phytosterols) than in PS + TAG (22.66 $\mu\text{g}/\text{mg}$ of phytosterols), but after 30 min of treatment, the opposite trend was observed. 7-Keto derivatives were the most abundant POPs in both systems. The extent of phytosterol degradation depends on both the heating time and the surrounding medium, which can impact the quality and safety of the food product destined to microwave heating/cooking.

Keywords: GC-MS; heating; microwave; oxidation; phytosterol oxidation products; triolein; β -sitosterol

Comparison of Nutritional Profile Commercial Juice Vitamin Ultrapasteurised Apple and Its Impact on the Heat Treatment of Conservation

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Apple has many nutritional properties because of their sugar content, mainly fructose and in smaller proportion glucose and sucrose. Besides having malic acid also contains ascorbic acid, which is considered as a quality attribute, and is therefore, generally quantified. The block registers contained approximately 10 mg of ascorbic acid per 100 g. this depends on the quality and type of the block. Ascorbic acid is an essential nutrient for humans that is found in fruits and vegetables, and is water-soluble. During the preparation of concentrated juices industry, treatments by which the juice is subjected are used, this promotes substantial changes in flavor, aroma loss besides eliminating nutritional factors. The main objective of this study was the determination of ascorbic acid content by HPLC in different commercial juices and apple juice processed at the School of Chemical Sciences. Since the treatment used for the production of juice, have an effect on loss of the nutritional of the product, the ascorbic acid content of the juice of an apple unshelled and without treatment was measured to determine the content which provides the apple in the region. The nutritional profile against ultra-pasteurized juices was then compared, both lost as the addition of ascorbic acid in ultra-pasteurized juices was determined. Two types of treatment that was clarified pasteurized juices and nectars pasteurized juices was done, samples of different brands was analyzed as: Jumex, Del Valle, Confrutta Smile and JUACH. Chromatographic analysis of the clarified juice turned out that the only one presented to an equitable amount of the nutritional tables was Del Valle juice as the average of what was found was 9.99mg/100g. Same in juice nectars juices Del Valle scored more ascorbic acid, together with JUACH exceeded those stipulated in the nutritional values listed. The result of the content of ascorbic acid in apple juice unshelled without treatment was 14mg/100g regions. The Norma NMX-F-045-1982 indicates that the maximum value of ascorbic acid that can be added to the apple juice is 15mg/100g; therefore, according to the values obtained, any juice exceeds this amount, being on the limit juice Del Valle with an average of 12.2 mg/100 g ascorbic acid.

Microbiological, sensorial and nutritional analysis of infant formulas packaged apple-based systems Retort Pouch

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The Retort Pouch is flexible and heat-resistant packaging that preserves food for a similar shelf life as cans. It offers potential advantages over other packaging of food products. The objective of this project was to conduct microbiological, sensory and nutritional analysis, and to verify the efficiency of sterilization flexible packaging in Retort Pouch with apple products directed to children. Two products were developed type pureed food in flexible packaging Retort Pouch, The first purees was named "Added", and the second "Conventional", which were subjected to a process of cooking and sterilization at a temperature of 121 ° C for 20 min. Sterilization equipment used was the prototype developed at the School of Chemical Sciences for sterilization pressure equalizing mechanisms. Subsequently, the nutritional value and microbiological analysis, as well as sensory analysis were determined and some comparative tests with a "Commercial" pureed were also performed. It was possible to observe in the nutritional analysis, the "Added" pureed, had a good retention of ascorbic acid, this is because vitamin C was added to the formulation, however, in the "Conventional" pureed is not added ascorbic acid, and values were low. For nutrients, shows that "Added", "Conventional" and "Commercial" pureed were within the parameters established by the NOM-113-SSA1-2012. Microbiological analysis was performed according to the Mexican Official Standards. The results showed that the sterilization carried out at 121°C for 20 minutes in both developed pureed, was successful, cultures were performed on account colonies which showed a value of <10 CFU/g or ml, which is the permissible limit set in the indicated standards. Sensory analysis was performed at 30 consumer judges; they scored five features, which were: appearance, color, odor, taste and finally texture. The judges, followed by the "Commercial" and finally the "Conventional", preferred the results showed that the "Added" pureed. The pureed made under the name "Added" stands out as the best pureed to public taste, was the one that scored better sensory scores, also that mutual cooking and sterilization was performed in Retort Pouch packaging was effective and confirmed by microbiological analysis, it is a safe food for consumption by young audiences.

Keywords: Analysis, Microbiological, Sensory, Nutritional, Retort Pouch, Food, Apple

Drying Kinetics and Physical Properties of Two Varieties of Peppermint Leaves (*Clinopodium douglasii*) Dehydrated at Pilot Plant Level

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The peppermint leaves are usually dried before processing in the infusions production. They are also dried to ensure its long shelf life. This study aimed to determine the drying kinetics and the physical properties of two varieties (VR1, VR2) of peppermint leaves (*Clinopodium douglasii*). Two batches (25kg/batch/variety) were dried in a steam trays dryer (CIATEJ's food processing pilot plant). The drying conditions established were: 50°C/6h, and carrying capacity of $2.89 \times 10^{-2} \text{kg/cm}^2$. The responses were quantified by measurements (triplicates) of color (L, a and b parameters) and moisture content (%) during each hour and the drying kinetics were studied until the system reached <9.0% of moisture. The newtonian model of exponential decay $X/X_0 = A \cdot 10^{(-kt)}$ was used, where k is the drying rate constant and A is a constant. This equation correlates the moisture ratio (X/X_0) as a function of time (t). The data was statistically analyzed by one way ANOVA and compared with Tuckey's test (significance of the model). Overall, moisture content did not show significant differences between varieties (87.26 ± 1.09 and $88.05 \pm 0.47\%$ for VR1 and VR2, respectively). In contrast, color parameters did present significant differences ($L_{VR1} < L_{VR2}$; $a_{VR1} > a_{VR2}$; $b_{VR1} < b_{VR2}$). VR1 and VR2 showed the color parameter a as the critical: in both cases it rapidly decreased (6-7units) during the first hour showing a high lost in the green color. Furthermore, b and L parameters did not present significant differences in VR1. Nevertheless, both parameters exhibited an important decreased (9 and 8units, respectively) during the first drying hour for VR2. The asymptotic behavior in the $\log(X/X_0)$ vs t curves, was reached after 2h and 4h, for VR1 and VR2 respectively, corresponding with the drying rate constants, $k_{VR1} = 4.45 \times 10^{-3} \text{min}^{-1}$ and $k_{VR2} = 6.50 \times 10^{-3} \text{min}^{-1}$, and with the A parameter ($A_{VR1} = 0.97$, $A_{VR2} = 0.50$ [dimensionless]). The drying kinetics showed high correlation coefficients ($R^2 > 0.85$). These findings could be explained by the bound water linked to the food matrix and to the small size of VR2 leaves, the latter by increasing the surface area in contact with the hot air during processing. These findings are relevant as drying VR2 (t=2h) represents lower costs in terms of energy, heat transfer, and operation time than VR1 (t=4h).

Keywords: drying kinetics, peppermint, pilot plant

Influence of a Guar Gum Bioactive Coating with Thyme Essential Oil on Fish Fillets Shelf Life.

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Edible coatings are safe, legal and sensory acceptable to food application and to which can be incorporated natural additives as antimicrobial, thickening, nutrients or bioactive agents that have the function to protect food from physical, chemical and microbiological damage that affect their shelf- life. Seafoods are among the most perishable of foods, and it is important to maintain quality. The aim of this study is to evaluate the effect of the guar gum bioactive coating with thyme oil on the quality of fish fillets during 15 days of storage at 4 ° C, as a means to prolong shelf-life. The experimental design was a randomized complete block. The results were analyzed with JMP 5.0.1 statistical package using an analysis of variance (ANOVA) and if any significant difference Tukey test was performed to compare means to $P > 0.05$. The quality parameters were analyzed by AOAC methodology. The quality parameters were protein, fat, moisture, ash, pH, color, total volatile basic nitrogen and microbiological analysis. The treatments studied were uncoated and coated fish fillets and were kept at refrigerated temperature (4°C) for a 15-day period. Statistical evaluation of the results of the physicochemical analysis showed significant difference ($P > 0.05$) between the use or not use of the coating, demonstrating that there is less deterioration in the coated samples in most quality parameters. There was no significant difference ($P > 0.05$) on ash and fat parameters. The microbiological analyses demonstrate that there was greater growth in the uncoated fillets than in the coated ones. This bioactive coating with thyme essential oil is effective against microbial deterioration and degradability of quality parameters for fish fillets therefore is an alternative to prolong its shelf-life.

Keywords: edible coating, guar gum, shelf life, microbial analysis, fish fillets.

Quality Evaluation and Characterization of Three Mexican Bean Products Prior to a Thermal Processing Design.

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The objective of this study was to characterize the quality attributes and parameters (proximate composition, mineral content, color, pH, acidity, total soluble solids –TSS- and vitamin A) of three Mexican bean products: fried, pork and mix prepared beans. All three formulations were packed in plastic containers to allow the design of a thermal process and further change of packaging to flexible retort pouch. Proximate analysis of the bean products was conducted according to standard methods of the AOAC for moisture, protein, fat, dietary fiber and ash content. Mineral content was evaluated by flame absorption spectrometry for calcium, magnesium, sodium, potassium, iron, copper, manganese and zinc. The pH and TSS (°Brix) of the samples were measured with a pH meter and refractometer, respectively. The vitamin A content was calculated from the total carotenoid content determined by spectrophotometry. All tests were conducted by triplicate and results were submitted to a mean comparison with Tukey test ($\alpha = 0.05$). The results for proximate analysis showed that the pork style beans had the highest protein and fat content (6.76 and 5.39%, respectively) while fried beans had the lowest protein content (5.45%) and mix means the lowest fat content (1.52%). Regarding mineral content there was no significant difference between the products for all minerals except Ca ($p = 0.002$), Mg ($p = 0.049$) and Na ($p = 0.048$). The pH values of the bean products were found between 6.4 - 6.6, thus being classified as low acid food products requiring high temperature for thermal processing. The mix beans presented the highest TSS 15 °Brix, and fried beans the lowest (11.2 °Brix) which can be attributed to the additional ingredients in the mix beans formulation. The vitamin A values were of 26.68, 378.04 and 606.05 IU per 100 g of product for the fried, pork and mix beans, respectively. The characterization of the quality variables and nutritional facts of these bean products will allow to reach a better and more precise thermal processing design when the packaging is changed to retort pouches, with aims to retain these attributes after commercial sterilization is achieved.

Keywords: beans, retort pouch, thermal processing.

Lab scale thermal processing design of three Mexican bean products packed in flexible retort pouches.

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The aim of this study was to design a thermal process at laboratory scale for three Mexican style bean products with final pH values between 6.4 - 6.6. Previously cooked refried beans, beans and spicy *chorizo* refried *beans* were packed in retort pouches and thermally processed to avoid the growing of *C. botulinum* species before consuming. Triplicate samples of bean products were heated to 80°C before packing in one pound (454 g) retort pouches. Wireless loggers (Data Trace MPIII) with one inch long probes were used during thermal process to record temperature a 1 min intervals at the cold spot of each one of the tested pouches. The pouches were sealed with an impulse sealer and placed in a heating oven at 90°C for 1 hour and then transferred to the lab scale batch retort for thermal sterilization. The process parameters were $T_{RT} = 121.1^{\circ}\text{C}$ at 15 psi, $T_w = 18^{\circ}\text{C}$, CUT = 15 min, initial temperature was variable for each one of the pouches. The heating at 121.1°C was sustained for 30 minutes and after cutting the steam supply, the cooling phase lasted 33 minutes. Bigelow's General Method was used to calculate de F_0 values for each product with $T_R = 121.1^{\circ}\text{C}$, $Z = 10^{\circ}\text{C}$ and $\Delta t = 1$ min. The F_0 values ranged from 8.0 – 10.0 minutes for the bean products given the processing parameters. The process proposed times are sufficient to assure the microbiological safety of the bean products either from *C botulinum* (botulism) and even *C. sporogenes* (spoilage) as it complies with the claim of $F_0 = 6$ min that has been established in commercial sterilization as a practice. Even so, further tests are required in order to scale up the thermal process to a commercial scale retort with steam-air mixture as heating medium and air overriding pressure to validate lab scale experimental results.

Keywords: Thermal process, thermal food processing, autoclavable bags

Emulsification and Encapsulation Process of Fat-Soluble Vitamins.

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Vitamins D and E are susceptible to environmental conditions which represents a common issue to be solved for achieving its handling and processing, thus maintaining its biological activity. Preparation of vitamin emulsions and its encapsulation by spray drying is an alternative for protection. Therefore, the aim of this work was to protect vitamins D and E through emulsification and encapsulation by spray drying, analyzing the presence of vitamins by Confocal Laser Scanning Microscopy and Nuclear Magnetic Resonance. The emulsion preparation was performed by mixture wall materials (gum Arabic, maltodextrin and modified starch), vitamins and type I water; later the emulsion was microfluidized at 69MPa. Then, the emulsion was fed into a spray dryer with two-fluid pneumatic nozzle at an inlet temperature of 180°C and 60, 80 and 100°C of outlet temperature. The samples of emulsion and powders were analyzed by Confocal Laser Scanning Microscopy (CLSM) for the compounds fluorescence; and Nuclear Magnetic Resonance (NMR) for the compounds structure. The results showed the presence of vitamins in the micelles and powder (encapsulation), analyzed by Confocal Laser Scanning Microscopy (CLSM). The presence of vitamin D was observed throughout the micelle (emulsion), although in powder, no clear differentiation of both vitamins was observed; however, the powder emission spectra showed peaks at different wavelengths (461, 500 y 519 nm), suggesting the presence of the different components. By the technique of Nuclear Magnetic Resonance (NMR), the structure, behavior (of each vitamin) and the presence of both vitamins in the emulsion was observed; however, due to proportions employed regarding the other components, they presented a single peak (between 2 and 3 ppm) which indicated the mixture of the compounds.

Keywords: Emulsion; vitamins; encapsulation

Impact of Refrigerated Storage and Cooking Methods on the Quality Characteristics of Green Leafy Vegetables

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Vegetables are critical parts of human diet all over the world. Agro-climatic condition of Pakistan favors the production of variety of vegetables for local consumption as well as for export purposes. Vegetables not only provide the nutrition to human body but also aid in the protection of certain diseases. Green leafy vegetables like spinach, cabbage, lettuce and fenugreek are also good sources of minerals, vitamin and also exhibit antioxidant potential. Vegetables are consumed after cooking because cooking improves their digestibility and sensory characteristics. Present study was designed to estimate the impact of refrigeration and cooking on quality characteristics of different leafy vegetables. Refrigerated and cooked vegetables samples were analysed for chemical composition minerals contents, carotenoids, ascorbic acid and antioxidant activity. The refrigerated and cooked samples were analysed for chemical composition, mineral contents, carotenoids, ascorbic acid, antioxidant activity and total phenolic compounds. Highest crude fibre contents were found in lettuce followed by cabbage, spinach and fenugreek, 2.040 %, 2.030 %, 1.96% and 1.54% respectively. Maximum crude fat contents were found in spinach followed by cabbage, fenugreek and lettuce 0.03%, 0.02%, 0.019% and 0.011% respectively. Highest moisture contents were found in lettuce followed by cabbage, spinach and fenugreek, 96.93%, 95.53%, 94.67% and 87.80% respectively. Maximum ash contents were found in lettuce followed by fenugreek, spinach and cabbage, 16.17%, 13.14%, 10.67%, and 0.64% respectively. Highest crude protein contents were found in lettuce followed by cabbage, spinach and fenugreek, 0.60%, 0.36%, 0.32% and 0.30% respectively. Maximum antioxidant activity was found in spinach followed by cabbage, fenugreek and lettuce, 64.95%, 54.48%, 40.52% and 34.47% respectively. Highest chlorophyll contents were found in spinach followed by fenugreek, lettuce and cabbage, 16.30 mg/g, 14.15 mg/g, 9.46mg/g and 4.48 mg/g respectively. Maximum total phenols were found in spinach followed by lettuce, fenugreek and cabbage, 2405.94 ppm, 121.56 ppm, 104.08 ppm and 76.12 ppm respectively. Highest ascorbic acid contents were found in spinach followed by fenugreek, lettuce and cabbage, 322.95 ppm, 48.34 ppm, 41.67 ppm and 36.07 ppm respectively. Maximum beta carotene contents were found in spinach followed by lettuce, fenugreek and cabbage, 98.93 ppm, 4.62 ppm, 4.59 ppm and 2.80 ppm respectively.

Keywords: Storage, Cooking Methods, Green Leafy Vegetables

Comparison of Quality Alginate Extracted of *Sargassum* spp. and a Commercial Alginate, for Microencapsulation of *Capsicum chinense* Extract

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The tourism industry of Quintana Roo is affected by the arrival of algae on the shores of the beaches, such algae decompose generating unpleasant odors, and the only solution given to the problem is their discard as trash. However, the economic potential of obtaining alginate and their applications in the food, pharmaceutical, and cosmetics industries is not considered. The aim was to evaluate the ability of alginate extracted (with and without formaldehyde) off *Sargassum* spp. against a commercial alginate, for the microencapsulation of habanero chile (*Capsicum chinense*) extract. For the extracted alginate *Sargassum* spp. the effect of the use of formaldehyde in the rehydration step (0.0 and 0.1%) was evaluated. The quality parameter (yield, color, turbidity, pH and viscosity) of the extracted alginate (CSA = Control *Sargassum* spp. Alginate, and FSA= Formaldehyde *Sargassum* spp. Alginate) were evaluated against a commercial alginate (CA= Commercial Alginate). Microencapsulation was performed using alginates with better quality (CA and FSA) in proportions from 20:80(1) to 30:70(2) (extract: alginate) and the encapsulation efficiency was subsequently evaluated. The results of quality evaluation were the following: the extraction yield was between 22.80% and 19.60% in the FSA and CSA samples respectively, the color in the CA, FSA and CSA samples were 327.66, 9073.33 20 800 color units respectively. The turbidity values were from 43.33, 2 500 to 1 243.33 FTU in the Ca, CSA and FSA treatments respectively. The pH was maintained in the range of 7 and 9 and the viscosities were of 463.33 (CA), 316. 66 (FSA) and 246.66 (CSA) mPa s. With regard to the encapsulation efficiency, the proportion 20:80 was better with 96.59% (CA1) and 95.95% (FSA1). Significant difference was found in all the evaluated parameters except in yield ($p \leq 0.05$). The extracted alginate was darker than the commercial alginate, however this does not affect the appearance of the microcapsules because the extract of *C. chinense* is of brown color.

Keywords: Microencapsulation, Alginate, *Sargassum* spp. and *Capsicum chinense*

Physicochemical changes and resistant-starch content in extruded cornstarch under storage conditions

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Effects of extrusion cooking and low-temperature storage on the physicochemical changes and resistant starch (RS) content in cornstarch were evaluated. The cornstarch was conditioned at 20-40% moisture contents and extruded in the range 90–130 °C and at screw speeds in the range 200–360 rpm. The extrudates were stored at 4 °C for 120 h and then at room temperature. The water absorption, solubility index, RS content, viscoelastic, thermal, and microstructural properties of the extrudates were evaluated before and after storage. The extrusion temperature and moisture content significantly affected the physicochemical properties of the extrudates before and after storage. The RS content increased with increasing moisture content and extrusion temperature, and the viscoelastic and thermal properties showed related behaviors. Microscopic analysis showed that extrusion cooking damaged the native starch structure, producing gelatinization and retrogradation and forming RS. The starch containing 35% moisture and extruded at 120 °C and 320 rpm produced the most RS (1134 mg/100 g). Although the RS formation was low, the results suggest that extrusion cooking could be advantageous for RS production and application in the food industry since it is a pollution less, continuous process requiring only a short residence time.

Keywords: Extrusion cooking, resistant starch, thermal properties, viscoelastic properties, cornstarch.

Chemical Composition of the Native Mexican *Pimenta dioica* Essential Oil

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Pimenta dioica (L.) Merr, commonly known as “allspice” or “Mexican pepper”, is an indigenous Caribbean tree, cultured in Mexico, considered of economic interest and great agroindustrial potential. Essential oil extracted from both leaves and dried berries may have several uses such as food industry, therapeutically properties and biological effects. The aim of the present study was to identify the chemical composition of the fruit essential oil of *P. dioica* from seven locations (R₁-R₇) in Mexico. Each site was selected based on edapho-climatic (R₁-Sierra Puebla, R₂-Soconusco, R₃- Chontalpa, R₄-Totonacapan) and altitude (R₅- low altitude, R₆- middle altitude, R₇- high altitude) effects on yield. The extraction was carried out by Clevenger type apparatus hydrodistillation method. The chemical composition of the oils was analyzed by GC-MS and separated on a HP-5ms capillary column. The highest oil yield was obtained from R₅ (2.00 ± 0.24%) cultivated in low altitude; whereas R₇ (1.24 ± 0.07%) cultivated in high altitude, produces the lowest oil content. ANOVA and Tukey's test (p≤0.05) performed on essential oil yields showed significant differences in R₃, R₅, R₆ and R₇. The GC-MS analysis displayed a total of 65 compounds. The eleven main chemical species found were eugenol, methyleugenol, β-pinene, eucalyptol, β-cis-ocimene, terpinene, linalool, terpinen-4-ol, L-α-terpineol, caryophyllene and α-caryophyllene. The native Mexican *P. dioica* fruit essential oil show a prevalence of oxygenate monoterpenes (40% to 57%) in all sites, except for R₁, were phenylpropanoid reached up to 50%. A high methyleugenol content was found in R₁ (88.49%), R₂ (30.76%), R₅ (53.82%), R₆ (55.76%) and R₇ (68.51%); but in R₃, eugenol was the principal component (42.95%). Chemical compound β-cis-ocimeno (3.74%) was found only in R₂, and may be taken into account as a chemical marker that characterizes it.

Keywords: *Pimenta dioica*; essential oil; hydrodistillation; eugenol, methyleugenol

Technologies for the conservation of corms of cocoyam (*Colocasia esculenta* L. Schott)

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The objective of this work was to develop technologies for the conservation of corms of cocoyam (*Colocasia esculenta* L. Schott) and to evaluate its nutritional characteristics, as well as to stimulate its production and consumption in the Mexican population. The cocoyam corms of the white variety were acquired in the local market of Tuxtla Gutiérrez, Chiapas, Mexico, were transported to the LIDPF, were washed, disinfected, the skin was eliminated to them, and they were scalded. Previous to the processing, was determined the proximal chemical composition to them. Three products with the corms were processed: dehydrated slices (two thicknesses of the slice and two temperatures of drying were considered), flour, and pieces of corms in brine (considered four treatments different). The proximal chemical composition of the fresh corms indicated a high carbohydrate content (82,8%), approximately 1,0% of proteins and fats. With respect to made products, the protein content in the drying slices and the flour are of 4,52 and 3,98%, respectively; was obtained high levels of crude fiber in the drying slices (7,88%) and flour (3.31%), with respect to the fresh corms (0,62%). The raw material and the made products displayed a pH near 6.0. The protein, fiber and mineral content (calcium and phosphorus mainly) present in the corms of cocoyam highly viable make their use and inclusion in the feeding, specifically in the rural populations, where problems of nourishing insecurity exist and its production concerning familiar orchards can be stimulated.

Keywords: cocoyam, drying slices, technologies of conservation, flour.

Study of Factors that Influencing the Production of Non-Centrifugal Sugar Cane

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Sugar cane in the region of the Huasteca (Mexico) is used for the production of refined sugar and lesser grade for the artisan production of non-centrifugal sugar cane. The objective of this work was to detect and to analyze the effect of the variables that directly influence the process of non-centrifugal sugar cane production, considering temperature, °Bx, pH and color of the final product. The determinations were measured using a thermometer, refractometer and potentiometer. The color was determined spectrophotometrically. It was observed that during the addition of lime significant changes to the pH obtaining a quadratic effect. Adding vegetable fat has important function as antifoam in the sugar concentration step. The temperature present three important stages throughout the process, the first phase which change from room temperature to 100 °C in 40 min, the second phase was held at 100 °C during 80 min and the third phase which showed a significant increase (1 °C/min) to a final temperature of 121 °C. Similarly, it was observed an increase of the °Bx due to the concentration of sugars. Once reached 40 °Bx the increase of this was exponentially, considering this point as a critical point during the production of non-centrifugal sugar cane. The initial pH of sugar cane juice was 5.3 and final pH was 6.2 observed a moderate increase in pH (7.0) 60 min because of the addition of lime. Based on the spectrophotometric scan (280-700 nm) the maximum wavelength of non-centrifugal sugar cane samples was 330 nm. Result of the measuring color to 330 nm was 0.166 ± 0.005 (25 mg/L). Finally, the total yield of non-centrifugal sugar cane was 174 ± 10 g/L of cane juice. The tests allowed to determine the main factors involved in the process.

Keywords: sugar cane not spin, brown sugar, standardization.

Rheological Behavior of Flamboyant (*Delonix regia*), Pixoy (*Guazuma ulmifolia*) and Leucaena (*Leucaena leucocephala*) Gums

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There is an increasing demand for ingredients with techno-functional properties by the food industry and the modern consumer, providing adequate thickening capacity or gelling in food systems to which they are added. They must meet the needs to improve and standardize quality attributes of products, stabilizing them during processing and storage, as well as replacing more expensive and less available additives in certain countries. Therefore the purpose of this study was to evaluate the rheological behavior of alternative sources of hydrocolloids (gums from seeds of flamboyant (*Delonix regia*), pixoy (*Guazuma ulmifolia*), and leucaena (*Leucaena leucocephala*) trees) to determine the feasibility of their use as a food ingredient. The rheological behavior (flow curves and viscoelasticity) of dispersions in water at 0.5, 1, and 1.5% (w/v) were determined at 25 °C, using a stress-controlled rheometer model AR2000 with a cone and plate system, diameter of 40 mm and angle of 2°, with a truncation gap of 52 nm. Only for the pixoy gum test, plate and plate system with diameter of 40 mm and a truncation gap of 150 nm was used. All determinations were performed at least in triplicate. Tests were run within the shear rate range from 1 s⁻¹ to 500 s⁻¹ and fitted to power law and Cross models; Amplitude strain sweeps were performed from 0.01% to 10% strain and a frequency of 1 and 10 Hz was used for all gum dispersions to determine the linear viscoelasticity zone. Frequency sweep tests at 1% strain were performed from 0.1 Hz to 10 Hz at least in triplicate. For pixoy gum test at 0.5% of concentration, a 0.2% strain was used. Values of flow index (n) indicated a shear-thinning behavior for all concentrations. The consistency index (K) values were higher for pixoy dispersions than for the others. The elastic modulus was greater than the viscous and scarcely depended on the frequency range studied in pixoy gum, associated with gel type behavior, whereas flamboyant and leucaena gums depicted a macromolecular solution behavior type.

Keywords: Hydrocolloid, *Delonix regia*, *Guazuma ulmifolia*, *Leucaena leucocephala*, rheology, viscoelasticity

Physical Characterization of Six Maize Genotypes and Changes in Viscoelastic Properties of Masa, Chemical Composition and Sensorial Analysis for Tortillas

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In Mexico, maize tortillas are considered the most important food for the population; in 2013, tortilla consumption was 7.4 million tons, which required about 5 million tons of maize grain that represent 17.3% of the total maize (28.9 million tons). However, in 2014, Mexico only produced 23.27 million tons of maize which was insufficient to meet the demand for corn; imported maize was used to make up the difference. This study evaluated physical characterization from parent lines (M-54, M55, and CML-242), two single crosses (M54xM55 and M55xM54), and one hybrid (H-70), the viscoelastic properties of masa (elastic (G') and viscous (G'') modules) and the chemical composition (protein, oil, fiber and ashes content), extensibility and sensorial analysis for tortillas. Maize grains were cleaned and physically characterized (dimensions, hectoliter weight, weight of 100 grains, flotation index and moisture content). Flotation index was higher in M-54, which designates a soft grain, while maize hybrid H-70 had the lowest flotation index because this grain is very hard. On the other hand, maize M-55 and M54xM55 have an intermediate hardness, while the inbred line CML-242 is classified as a hard grain. The hectoliter weight of M-54 was the lowest (about 73 kg/hl), while other types of maize obtained hectoliter weights ranging from 74–79 kg/hL. The weight of 100 grains was lower for M-55. Elastic and viscous modules indicated that masas from CML-242 and H-70 maize were higher than of the other maize genotypes. M-54 tortillas showed the lowest crude fiber content. Otherwise, tortillas obtained from the M55xM54 hard grain had the lowest fat content and extensibility, while H-70 tortillas showed an intermediate breaking point and extensibility. M-54 and M54xM55 tortillas were softer. In contrast, rigid tortillas were obtained from CML-242 and H-70. Sensorial analysis showed that the tortillas from H-70 hybrid and M55xM54 were the best rated in texture attributes, resistance at breaking and chewiness. Therefore, inbred lines M-55 and CML-242, parental single crosses of the hybrid H-70 could be used in the nixtamalized flour industry, while inbred line H-70 and M55xM54 is ideal for the tortilla and masa industries.

Keywords: Maize genotype, masa, tortilla

Electromagnetic Fields Exposure to Maize and Its Effect in Starch, Masa, and Tortillas of Nixtamalized Maize with Nejayote

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Nixtamalization process is very important in Mexico for the high consumption of tortillas, gorditas, tamales, and snacks. The process generates high amounts of nejayote which is drained away without treatment. Some researchers have reused diluted nejayote as water to nixtamalize maize and they evaluated rheological behavior in masas similar to masas without nejayote. On the other hand, other researchers exposed electromagnetic fields at maize and they reported that quality of masa and tortilla is better. Therefore, the objective was to apply electromagnetic fields to white maize of one single cross (M55xM54) and nixtamalization with nejayote to evaluate the effect in rheological and microbiological parameters of masas and sensorial analyses for tortilla. Maize grains were cleaned and physically characterized (dimensions, hectoliter weight, weight of 1000 grains, flotation index and moisture content). Next, these grains were exposed to electromagnetic fields at two different times. Extraction of irradiated and unirradiated maize starch was made and starch granules were observed by Scanning Electron Microscopy (SEM). Irradiated and unirradiated maize grains were nixtamalized with nejayote at two concentrations. Rheological parameters (elastic (G') and viscous (G'') modules) and microbiologic analysis were determined for masas and the sensorial analysis for the tortillas. Results showed morphological changes in starch granules at longer time of exposition with electromagnetic fields. Elastic and viscous modules indicated that masas from irradiated maize have highest values. Otherwise, masas from irradiated maize by 7 min and nixtamalized with nejayote at 50% showed lowest values. Applying electromagnetic fields in maize showed not significance difference in *Penicillium* growth. However, masas from nixtamalized maize with nejayote and exposed for 12 min with electromagnetic fields showed not fungi growth. Sensorial analysis showed that the tortillas from irradiated maize and this nixtamalized with nejayote were the best rated in texture attributes, resistance at breaking and chewiness. Consequently, application of electromagnetic fields in maize and nixtamalized with nejayote is a sustainable alternative to generate less wastewater, improving quality of the tortillas.

Keywords: Maize, nejayote, electromagnetic fields, masa, tortilla

Elaboration of a Traditional Smoked Sausage Using Rabbit Meat.

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Nowadays, the meat products are designed to be competitive in price, but the nutritional content of them is very low in most of the cases; for these reasons, a recent trend in some markets is the use of traditional methods in the production of meat products in order to meet the demands of the consumers who doesn't like the commercial food (because the additives and chemicals in their composition and their low content of proteins and vitamins). The objective of this work was the production of a traditional smoked sausage using rabbit meat. Meat of adult rabbits (New Zealand breed, provided by farm SANDOCORO) was milled and spiced, and then, we made a batch of several kilograms of handmade sausage using 100% natural ingredients purchased at local stores (cilantro, onion, cloves, pepper, salt and garlic), we only used apple wood and mesquite coal to make smoke. We used a three stages elaboration process: cure-stage, pre-cooked stage and smoke-stage; after that, we made a comparative study: smoke time (4, 5 and 6 hours) against the protein content of sausages (the Biuret method was used in analyze in triplicate), we used Excel^{MR} and Statistica^{MR} to perform all the statistical tests. At least under the evaluated conditions, the protein content increases over the 30% if we compare our smoky sausage with the cooked sausage after a smoking time of 5 hours; and if we compare our sausage with other commercial sausages, the protein content increases around the 150% in our sausages.

Keywords: Sausage, smoke, rabbit.

Detection of Adulteration of Sheep Milk with Cheese Whey by Western Blot

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The production and consumption of milk from sheep in Mexico and the world every time is increased because this has important advantages over cow's milk. Sheep milk contains higher levels of conjugated linoleic acid and omega-3 fatty acids, it is higher in vitamins and minerals than either cow or goat milk. All these nutrients exert health-promoting benefits including protection from heart disease. In brief, sheep's milk is extremely high in nutrients compared to other kinds of commercially available milk. A common practice of milk producers is its adulteration with cheese whey (CW). However, this affects milk processor industries because it decreases the yield of the products obtained. There are several methods for determining the presence of cheese whey based on the detection of a glycomacropptide that is present only in CW and not in milk. However, none of these methods is focused on the detection of sheep's GMP. In this work it was performed one immunoassay, the Western blot, to identify sheep GMP (GMPs) as indicative of milk adulterated with CW, using a polyclonal anti-GMP bovine (GMPb) antibody. The antibody detected two protein fractions (14.1 y 10.2 kDa) corresponding to GMPs, with different molecular weights from those of commercial GMPb (13.92 kDa and 9.78 kDa) The effectiveness of this procedure was demonstrated by Western blot analysis of processed and unprocessed milk samples, revealed with the polyclonal anti-GMPb antibody. No bands appeared when sheep milk sample does not have GMP. Besides, it showed that the antibody does not cross-react with other milk components. The western blot has a sensitivity of 0.5% v/v, with a full time development of 8h.

Keywords: Glycomacropptide, polyclonal antibodies, cheese whey, sheep milk.

Physical and Thermal Characterization of Acetylated Rice Starch for Film Elaboration by Casting Process.

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In the last few years, different biopolymers are used for packing food elaboration based in natural sources as starch. Therefore, the aim of this project is to develop biodegradable films on starch and mucilage of chia and nopal as alternative plasticizer. These materials (starch and mucilages) could be obtained as subproducts and considered renewable, abundant, low cost and environmentally friendly. For increase the native starch functionality is possible realize a structural modification for the introduction of functional groups such as acetyl and by the application of thermo-mechanical treatment as extrusion process. Starch modification provides storage stability, strength and flexibility, physical and thermal properties, due to hydrophobic character, necessary for elaboration of biodegradable films. Rice starch was isolated (IRS) and subsequently modified (MRS) by the addition of acetic anhydride by the extrusion process. The physical proprieties of the obtained starch were determinated (moisture, color, water absorption and solubility index, and texture profile analysis TPA). The results showed the effect of the change in the physical properties of rice starch. The moisture content of MRS was (8.837 ± 0.137 %) showing an increase compared to IRS (13.364 ± 0.131 %); this is due to thermo-mechanical treatment that was submitted by the extrusion process. In addition, significant change was observed in color in IRS ($L^* = 94.916 \pm 0.049$, $a^* = -0.046 \pm 0.025$, $b^* = 2.096 \pm 0.04$, white index = 93.286 ± 0.12), compared with MRS ($L^* = 90.366 \pm 0.049$, $a^* = 0.15 \pm 0.01$, $b^* = 5.0 \pm 0.006$, white index = 84.13 ± 0.018). An increase absorption rates was observed in MRS (10.04 ± 0.153 %) compared to IRS (3.251 ± 0.194 %) as well as a decrease in solubility index in MRS (4.105 ± 0.21 %) compared with IRS (2.235 ± 0.003). This factor is a quality index to corroborate the modification process. The textural properties is an important factor about gel properties shows the force of attraction was IRS (hardness(N)= 0.2571, Cohesiveness=0.6347, Adhesiveness(Ns)= -2.889, Springiness=0.803) compared with MRS IRS (hardness(N)= 0.23, Cohesiveness=0.708, Adhesiveness(Ns)= -7.134, Springiness=0.844) this result indicates do not have syneresis. The films obtained not present avoids and fractures in surface and the incorporation of mucilages increased the mechanical properties values. The values presented represent the mean and standard deviation (\pm) of 3 repetitions.

Keywords: acetylated starch, nopal and chia mucilage, starch characterization, starch film.

Green tomato (*Physalis ixocarpa* Brot.) pectin: Extraction and characterization

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Pectins as food additives are used as thickeners or stabilizers in foods, with an increasing global demand (4 to 5% annually). Green tomato (*Physalis ixocarpa* Brot.) is a vegetable which in Mexico is available year around. The objective of this research was to obtain pectins of green tomato waste and evaluate their physicochemical Pectin extraction was performed by the method of acid hydrolysis using 1% $C_6H_8O_7$ and 0.1N HCl. The variables of process were blanching time of green tomato (10 and 15 min) and the extraction time (15, 20 and 25 min). Physicochemical characterization included the uronic acids content by colorimetric assay, degree of esterification (DE) by titration t technique, molecular weight (MW) by Multi-angle laser light scattering (HPSEC-MALLS), neutral sugar compositions by high performance anion exchange chromatography with pulsed amperometric detection (HPAEC-PAD), gel strength, and antioxidant activity by DPPH assay. In regard to the results, uronic acids percentage for all samples was higher than 60%, the green tomato pectins correspond to high DE, being samples obtained with HCl that showed the highest DE (63-91 DE). The MW of this kind of pectin suggested a branched pectin since MW values ranged between 542 to 754 KDa; the neutral sugars analysis allowed to identify six sugars: fucose, rhamnose, arabinose, galactose, glucose and xylose, this latter being in a greater proportion of pectins extracted with HCl comparing with those extracted with $C_6H_8O_7$. Extraction treatment affected significantly the strength of gels and despite all samples are able to form gels, they presented different characteristics; in regarding the antioxidant activity, all samples exhibited a 50% higher capacity of trapping radicals of DPPH. The results could be concluded that in spite of the differences observed between treatments, the better extracting agent was the HCl, due to the properties of the pectin and yields obtained; the green tomato could be considered as a source of pectin and their characteristics shown that they can be used for the formulations of different foods under appropriated conditions, since all pectin samples showed have good gelling capacity.

Keywords: Pectin, green tomato.

Characterization of the Orange Essential Oil Microcapsules Obtained by Spray Drying Using Rice Starch as Wall Material.

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Microencapsulation provides protection of flavors against oxidation, temperature and volatilization. In this study microcapsules of orange essential oil were obtained through spray-dried technology. A mix design was developed by which emulsions at 30% solids using modified rice starch (MRS), native rice starch (NRS), maltodextrin (MDX) and protein (P) were used as low cost alternative wall materials. Rice starch was isolated, modified by extrusion process and characterized by evaluating its physical and thermal properties. Emulsions at 30% ratio of solids were prepared, homogenized and spray-dried at inlet and outlet temperatures of $180 \pm 5^\circ\text{C}$ and $85 \pm 10^\circ\text{C}$ respectively. Essential oil was added to the emulsions at 15% ratio with respect to solids. The results showed the highest microencapsulation efficiencies (98.82%, 98.69%, 98.58% and 96.31%) were obtained in the formulations with 50%, 62.5% and 100% of MRS which indicates that MRS creates a resistant wall material with higher encapsulation efficiency compared to commercial wall materials (N-LOK 96.06%). However, the highest efficiency was achieved in conjunction with another encapsulating agent (maltodextrin and protein) indicating the presence of a synergistic interaction between the two materials. The microcapsules obtained showed a moisture content between the correspondent values for microencapsulated products (3-6%) and a water activity (A_w) below the necessary for the microbial growth (<0.6). Through a response surface analysis the best formulations were selected which were characterized according to its microstructure (SEM) and the stability of the essential oil encapsulated (GC-MS) at 1, 7, 14, 21 and 28 days evaluating the presence of oxidation products. It was observed that formulations 2 and 5 showed the best microstructure characteristics with a spherical shape. With respect to stability, formulation 5 prevailed, since no degradation or oxidation products were observed in the encapsulated essential oil still at 50°C and at day 28 of treatment. Selected formulations were subjected to sensory evaluation by preparing a bakery product and a greater preference for products made with the formulations with $>50\%$ MRS without significant differences between these. These results showed that the use of modified rice starch is an alternative for obtaining high efficiency microcapsules at a low cost.

Keywords: microencapsulation, orange essential oil, starch

Effect of thermal process on the physicochemical properties of jumbo squid (*Dosidicus gigas*) muscle

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Jumbo squid (*Dosidicus gigas*), mainly captured in the Gulf of California, is one of the most important fisheries in Mexico; its muscle (white, low fat and without scales) is commercialized for human consumption as fresh-frozen or cooked. However, during this post-catch processing, a number of physicochemical changes occur in the flesh, which could result in modifications in the texture, changes basically related to myofibrillar proteins and its interactions with water, which are the major constituents of giant squid muscle. Therefore, in this study, changes in firmness, fibrils microstructure, colour, protein solubility and water-holding capacity of jumbo squid muscle (mantle, fins and arms) after cooking (100 °C/30 min) were evaluated. Fresh muscle of fins showed the highest shear force (hardness), with a significant decrease after cooking process (≈ 70 % after 30 min), while arms showed the lowest loss in firmness after 30 min at 100 °C (≈ 48 %). This behavior is related with the structural modifications in the myofibrillar and connective tissues of the three anatomical regions. Finally, the electrophoretic profile reveals that structural changes occur in the different types of proteins, causing changes in the muscle texture, due to modifications in solubility.

Keywords: Jumbo squid, muscle, cooking, proteins.

Stabilization of Extracts of *Aloe vera* Gel (*Aloe Barbadensis* Miller) by Ultraviolet Radiation

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Aloe vera is a plant with a viscous translucent gel that is composed of approximately 98% water and solid contains mainly polysaccharides of high molecular weight (60%) mainly acetylated glucomannan that provide nutritional and pharmaceutical properties in the gel so its demand has increased in recent years used as a functional ingredient in food processing. However, the gel upon contact with air begins process of deterioration due to enzymatic activity and spoilage microorganisms which negatively affect the overall quality of the gel so have developed various processing techniques that involve heat treatments but has demonstrated that causes irreversible changes in the polysaccharide gel. Therefore the challenge to preserve the natural properties suggests the application of innovative non-thermal technologies. UV irradiation has been used successfully in liquid food pasteurization achieving removal of microorganisms and reducing the activity of enzymes. The aim of this study was to evaluate the effect of UV-C irradiation doses and plants with different season crops of *Aloe vera* on the physicochemical properties of gel for the development of functional products. Plants with seasonal variation (Spring-Summer (SS) and Autumn-Winter (AW)) were obtained of Veracruz area and physical and chemical characterized. The gel of was milled, filtered, diluted in water at 10% and were applied different of irradiation UV-C doses and a heat treatment as control. Total and reducing sugars, total polyphenols, antioxidant activity, degree of polymerization of acemannan, aloin content and thermal properties were determinate in sample with and without treatment. The data obtained were analyzed using analysis of variance by Tukey test at $p < 0.05$. Moisture and ash contents were significant affect by season's crops of *Aloe vera* plants. Gel samples of SS showed higher content of total sugars, Tg and ΔH values ($p < 0.05$), while that gel samples AW had significantly higher values in antioxidant activity, polyphenol content and reducing sugars. The UV irradiation doses had a significant effect on the chemical composition and the degree of polymerization of acemannan in samples of gel but less than the heat treatment control. Therefore the UV irradiation represents an alternative to preserved characteristics of *Aloe vera* gel.

Keywords: *Aloe vera* gel, acemannan, UV-C.

Effect of Microfluidization on Rheological Behavior and Sugars Content of Honey

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Honey is a natural supersaturated sugar solution which is mainly composed of a complex mixture of carbohydrates and other minor constituents such as enzymes, organic acids, phenolic acids, flavonoids. Honey is usually heated to 60°C or above for inhibiting microorganisms, facilitating packing and delaying crystallization. The aim of the study was to determine the effect of microfluidization processing on quality of honey, namely, rheological behavior and sugar content. The fresh and unprocessed honey used in this study (pH of 3.80 ± 0.06 , 80 ± 0.1 °Brix and water activity 0.589 ± 0.07) was acquired from Guerrero, Mexico. The honey was heated at 50°C during 3 minutes as a pre-treatment and then was processed in an M-100Y Microfluidizer processor (Microfluidics, KU) with two sizes of interaction chambers (IC) IC_{Y-Z} (IC_{Y-Z} 87-200 μm) and IC_z (IC_z 200 μm). Rheological behavior of unprocessed and processed honey samples was determined by measuring viscosity using a Rheometer. The fructose and glucose content were determined by HPLC with IR detection. All the experiments were done at least in duplicate. Statistical analysis was carried out using XLSTAT. The results were compared using Tukey test at 5% confidential level. D-optimal factorial was performed using Design Expert software. The unprocessed and processed honey exhibited a Newtonian behavior showing a constant viscosity (η) independent of the shear rate. The IC_z showed the main changes in the viscosity of honey, The Z interaction chamber reduced the viscosity at the middle. This effect could be due to the crystal homogenization in the honey after processing by microfluidization. Fructose was the predominant sugar (40%), followed by glucose (34%) in unprocessed Mexican honey. The sugar composition depends highly on botanical and geographical origins, and other factors as the weather, processing and storage conditions. No significant changes in the sugar content of microfluidization treated honey were observed. Thus, can be concluded that the rheological behavior could be modified after processing by microfluidization and the sugar content cab be maintained.

Keywords: Microfluidization, honey, rheological behavior, sugar content

Optimization of Conditions for Obtaining Chitin and Chitosan by Lactic Fermentation of Waste Shrimp Heads

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The increase in the distribution and consumption of seafood in recent years leads to an increase in the amount of waste produced. Chitin is the majority derived from shrimp waste. Chitosan is a natural polymer obtained by deacetylation of chitin, and has important properties, which are attractive in the field of research. Conventional methods for obtaining chitin consume large amounts of reagents and water, large volumes of effluents, which cause environmental damage. An alternative for obtaining these compounds is a one biological-chemical method, where the lactic fermentation process helps to reduce the consumption of water, energy and reagents. The objective of this work was to optimize the conditions for obtaining chitin and chitosan by lactic fermentation of waste shrimp heads. Shrimp heads were crushed and fermented with milk whey and molasses. A rotatable central composite design of response surface methodology (RSM) was selected as optimization technique of fermentation step, the process variable were fermentation time (FT) and sugar concentration (SC). The minimum and maximum levels for FT and SC were 66/264 h and 13/35 °Brix, respectively. After fermentation process, it's carried out a chemical treatment with 1 M NaOH for 1 h, 1 N HCl for 1 h, 10% sodium hypochlorite for 1 h and 50% NaOH for 4 h, at temperature of 115 ° C, to transform chitin in chitosan. The response variables were deacetylation degree (DD), ash content (C) and yield (R). For the optimization, it was searched the maximum value of deacetylation degree and yield, and the minimum ash content value. The best combination of process variables was 108 h and 8.7 °Brix to FT and SC, respectively. Under these conditions, a chitosan was estimated with a deacetylation degree of 86.3%, yield of 2% and ash content 0.29%. The experiment with the optimal conditions was performed to validate the predictive models; chitosan obtained had the following characteristics: deacetylation degree of 83%, yield of 2.03% and ash content 0.23%. Through the process of biological-chemical optimized it was possible to obtain chitosan from shrimp heads with better characteristics than reported by several authors and similar to commercial chitosan.

Keywords: Chitosan, Lactic Fermentation, Rotatable Central Composite Design, Optimization

Clarification of Stevia Aqueous Extracts Using Different Resins

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During the purification of stevioside for its commercialisation as a food sweetener, the aqueous extracts of stevia must go through a clarification process. One of the most commonly used methods is the precipitation with inorganic salts eliminating pigments and phenols that give the black colour to the aqueous stevia extracts, followed by ion-exchange chromatography to eliminate the residual salts. The precipitation with salts produces large quantities of contaminating wastes with lime, iron or aluminium and the ion-exchange chromatography produces eluents with low percentages of stevioside, which must be concentrated. This work presents an alternative to skip the precipitation and obtain a greater concentration of steviosides. The goal was to evaluate the use of different matrices as an alternative for the clarification of these aqueous extracts of stevia. Three types of resins were used, amberlite FPA 90 C1, Dowex TAN-1 and Diaion WA30, the polymer PVPP and the activated carbon. The evaluated parameters were the loss of colour at 420nm, the turbidity at 670nm and the stevioside concentration. The analysis showed that there is a meaningful difference between the materials used to clarify. The resins FPA 90 C1 and TAN-1 eliminated more than 98% of the colour and the turbidity. The activated carbon and the PVPP eliminated 90% and 95% respectively. The extracts eluted with the resin WA30 acquired a yellowish colour and use ethanol for the stevioside recovery. With respect to the stevioside concentration, 47% of the sweeteners were recovered with the amberlite FPA 90 C1, whilst the Diaion WA30, the PVPP, and the TAN-1 recovered 35%, 34% and 33% respectively. Thus concluding that the best alternative to clarify stevia aqueous extracts is the amberlite FPA 90 C1, eliminating salt precipitation during the clarification process.

Keywords: Stevia, clarification, resin, stevioside

Sensory and Rheological Properties of Thickened Beverages with Pregelatinized Starch to be used for the treatment of dysphagia.

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Dysphagia is the difficulty for swallowing solids and liquids, which may result in malnutrition, dehydration and pneumonia. Thickened beverages are habitually used in the clinical treatment of dysphagia since a higher bolus viscosity slows its transit, which would diminish the risk of aspiration. However, there is the lack of commercial products designed for dysphagia management in the Mexican market. The aims of this study are to obtain the rheological properties (shear viscosity, dynamic characterization and extensional viscosity) as well as the sensory properties of beverages thickened with pregelatinized starch. On one side, Rheology helps to understand how the bolus is deformed through the swallowing process, thus, the food bolus is expected to be not only subjected to shear stresses but also to elongation ones. Consequently, security will be acknowledged comparing the rheological properties of the thickened pregelatinized starch beverages, with Barium Sulfate Suspensions reference which is considered as a “gold standard” to observe the transit of the bolus through the digestive tract. On the other hand, a sensory evaluation is suggested, in order to ascertain sensory properties, as well as the interpretation of liking responses to the acceptability of the modified beverages as patients dislike thickened liquids, because the use of thickening agents may suppress the main flavors of the base beverages and can impart slight off-flavors. In our study, the sensory profile will include a Flash Profile and an Internal Preference Mapping to obtain the liking average scores and the most accepted product. The results showed that adding 7% pregelatinized starch to soymilk and lactose-free milk, makes a honey like consistence dysphagia oriented beverages, both with an enriched sensory profile, as well as a product well evaluated by consumers “like slightly” in overall liking, and as a “safe” product. Additionally, the modified fluids presented non-Newtonian behavior in both, shear and extensional flows; and it was observed that they fitted into the power law model.

Keywords: mucilage, dispersing agent, bariatric surgery, vegetable protein.

Heat transfer in the pasteurization process of watermelon juice added with α -tocopherol nanocapsules in a scraped surface heat exchanger.

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A parameter estimation approach was applied to characterize the heat transfer of Scraped Surface Heat Exchangers (SSHE) specifically designed for the food industry, in this case watermelon juice samples were pasteurized. The nanocapsules of α – tocopherol were obtained by the emulsification – diffusion method. The dispersion was evaluated by its particle size (PS), polydispersion index (PDI) and zeta potential (ζ). The scanning electron microscopy evaluation confirms the presence of capsular structures. Complete factorial design ($\alpha=0.05$) was used to study the effect of the independent variables — volumetric flow ($3 - 5.4 \times 10^{-6} \text{ m}^3/\text{s}$), steam pressure (50 – 150 kPa) and rotor speed ($2.4 - 4.8 \text{ s}^{-1}$) with constant water flow cooling (8 L/min) to 4 °C on the convective heat transfer coefficient (h) and overall heat transfer coefficient (U). Colburn's method is an adequate benchmark for evaluating energy transfer because it can be applied to industrial design. Multiple logarithmic regression to express the Nusselt number versus Reynolds and Prandtl number which is considered a simple empirical modification velocity analysis focused on heat transfer. Nanocapsules had an average particle size of 244 nm with a PDI of 0.09, indicating a submicronic size with narrow particle distribution. The ζ was of -42.19 mV suggesting a physical stable dispersion with low probability of aggregation. For the convective heat transfer coefficient has values between 2000 – 3000 $\text{W}/\text{m}^2 \text{ }^\circ\text{C}$ with an effect direct of steam pressure and volumetric flow in lineal and interaction terms ($p \leq 0.05$) and the overall heat transfer coefficient has values between 550 – 700 $\text{w}/\text{m}^2 \text{ }^\circ\text{C}$ with an effect direct of steam pressure and volumetric flow in lineal and interaction terms ($p \leq 0.05$). Use of nanocapsules of α -tocopherol does not influence significantly on the heat transfer coefficients in the pasteurization process in a SSHE.

Keywords: Heat Transfer, Nanotechnology, α – Tocopherol, Watermelon Juice

Mucilage of *Opuntia ficus indica* Production, Characterization and Application as a Dispersing Agent of Vegetable Protein Suspensions

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Mucilage is a typical component of the Cactaceae family which has potential uses as an additive for several industrial products, including those of the food and pharmaceutical industries. The composition of *Opuntia ficus indica* gums give gelling capabilities to the products as they modify the viscous properties of the fluids or may be used as stabilizer of water-oil emulsions or to avoid flocculation. All these properties have increased the economic interest for the use of this hydrocolloid in the formulation of some foodstuffs, but mucilage powder of *Opuntia ficus indica* is not commercially available. Conventionally, mucilage extraction and purification operations have been carried out with aqueous solutions by an organic solvent method, which increases its cost, reduces efficiency process and cut the feasibility of its use in the food industry. In the present work, the powdered mucilage has been obtained by a free solvent process involving dry milling of the cactus, vacuum filtering and spray drying of the condensed cactus juices. Chemical characterization of the obtained mucilage was then carried out by thin layer chromatography after an acid hydrolysis. It was found that the polysaccharide is composed of arabinose, galactose, rhamnose, xylose and galacturonic acid. The presence of those components was also quantified by a laser microscope. At the same time, the use of the mucilage as dispersing agent, GRAS type, was proposed in hypoenergetic formulations of vegetable protein for patients with bariatric surgery. Therefore, dispersion tests were carried out using vegetable, cereal and leguminous flours in milk, juice or water. In the case of milk, the use of a thermography camera was implemented due to its opacity, so the dispersion efficiency could be determined in this alimentary matrix.

Keywords: mucilage, dispersing agent, bariatric surgery, vegetable protein.

Oxidation of cholesterol during microwave heating in a model system

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Thermo-oxidation of cholesterol has been widely studied on model systems and/or food subjected to different types of heating modes; however, few of them have utilized microwaves (MW). Considering the extensive use of MW ovens and the potential negative impact of cholesterol oxidation products (COPs) on human health, there is a need to understand the impact of MW heating on COPs formation in food. The amount and type of oxysterols generated during heating will depend on several factors, such as food composition and structure, fatty acid (FA) profile, heating conditions (temperature, time). The aim of this work was to study the effect of MW heating on COPs formation in two model systems having different levels of unsaturation. Each model system contained pure cholesterol (1%, w/w) dissolved in two edible oils, which were selected according to their FA profile: saturated FA oil (coconut oil, CO) and polyunsaturated oil (soybean oil, SO). The model systems were heated in a domestic multimodal MW oven for 0, 1.5, 3, 6, 12 and 20 min, at the maximum power (1000 W). Lipid oxidation was evaluated at each sampling time, by measuring peroxide value (PV) and COPs formation, respectively. PV remained constant during SO heating, while CO exhibited an oxidation induction time of 6 min. COPs formation also showed an induction time of 6 min in both model systems (SO and CO) and from this time onwards, an exponential trend was observed. In particular, the total amount of COPs at 20 min was 12 and 5 times greater than at 6 min in CO and SO, respectively; 7 α -hydroxycholesterol and 7 β -hydroxycholesterol were the main products together with both 5,6-epoxycholesterol epimers.

Keywords: cholesterol, oxysterols, model, thermo-oxidation, microwave

Study of thermal processing of husk tomato (*Physalis ixocarpa* Brot) paste and its effect in physicochemical properties

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Husk Green tomato (*Physalis ixocarpa* Brot.) or “tomatillo”, is a widely consumed product in Mexican salsas”, due to its distinct acid flavor . Tomatillo processing , has not been studied in spite of being used in different commercial products thus there us a lack of information on this area so this work is oriented toward the study of thermal processing during the production of tomatillo paste on its physicochemical properties. The processing applied included the cold and hot break methods commonly used for tomato processing, given the similarity in both products. The temperatures tested were three: Cold Break of 65°C and Hot Break, of 95°C and an extra temperature of 80°C. In addition, tomatillo size was also included: (whole and crushed vegetable), and roasting (200°C for 15min). After the thermal treatments were applied, the juice was extracted from the pulp and concentrated in a rotoevaporator (17inHg) until soluble solids reached 24 Brix°. Paste samples physicochemical characterization included: enzymatic activity of pectinmetilesterase (PME); polyphenoloxidase (PPO); antioxidant activity by DPPH and FRAP assay, total polyphenols and chlorophylls. The rheological characterization of samples included flow behavior, and activation energy analysis. The results were analyzed by Tukey $p \leq 0.05$. All samples presented an antioxidant activity greater than 40% and less than 60% of scavenging radical DPPH; results for FRAP assay show a reduction of antioxidant activity (30% and 7%). There was a decrease (30 to 10%) in total polyphenols for all treatments except for 80°C. Chlorophylls were reduced in 90% for all treatments. The results show that the concentration processing decreased the PPD enzymatic activity more that 50%, the thermal and concentration processing did not inhibit the activity of the PME. Regarding activation energy, values vary between the ranges of 11414.92 Joules for the 65°C paste and 46573.45 Joules for the 95°C paste, which indicates that the 95°C treatment produce the most stable paste. All the pastes show a shear thinning behavior, small yield stress, and the best fitting was the Carreau-Yasuda model. This study suggests that thermal treatments give tomatillo pastes different characteristics that can be used for diverse applications similar to tomato products.

Keywords: Paste, green tomato, rheology.

Evaluation of Physical and Mechanical Properties Sheepmeat hamburger carrageenan and Soy Protein Isolated added

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Sheepmeat is consumed in Mexico mainly in “barbacoa” (90%) and few studies have been done around new options to promote the diversification of products. The aim of this study was to evaluate the effect of grinding meat with different sieves and adding different combinations of kappa carrageenan/soy protein isolate (CK-SPI) in physical and mechanical parameters of burger vacuum packed. We worked with meat from the hindquarter of sheep race Columbia, 4 months old. Eight lots of burgers were prepared, 4 lots for each diameter sieve (0.6 and 1 cm) and 3 of each diameter were produced, adding 2% CK-SPI: 1) 25/75, 2) 50/50 and 3) 75/25, and 4) without CK-APS (Control). Five burgers 40 g approximately each batch were molded, were vacuum packaged and stored under refrigeration at 4 ° C until assessment. Were assessments a_w , water holding capacity (WHC) hardness, color profile parameters (CPP) (CIE L^* , a^* , b^*) and returns before and after cooking on grill, at the start were performed, after 24 h and 7 days of preparation. The results were analyzed with Minitab 16.1.0. by analysis of variance (ANOVA) 2-way ($\alpha = 0.05$) for the properties of all lots. CPP were assessed with a general linear model. All lots improved their performance and stability when CK-SPI added. WHC results ($P < 0.01$) and the best results when grinding done with 10mm and ($P < 0.05$) when comparing between diameter sieves; a_w showed no statistical difference ($P > 0.05$) between formulations, however was ($P < 0.01$) for the same formulations; for hardness there are highly significant differences ($P < 0.01$) between treatments being the highest values when CK/SPI 25/75 added. The evaluation of CPP, the effect of Blooming led to increases in all values of L^* , a^* and b^* after 30 minutes rest before their evaluation on hamburgers packaged without vacuum, without statistical differences.

Keywords: Sheepmeat, Burguer, Kappa carragenan, soy protein isolate, grinding sieve

Restructured Chicken Nugget Stabilized with Kappa Carrageenan and Soy Protein Isolated

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Chicken meat keeps the lead in meat consumption in Mexico, with a preference for pieces like breast, leg and thigh, a situation that promotes the existence of chicken meat low commercial value, which is a challenge for the meat industry. It is desirable to propose new alternatives and presentations as restructured products, by developing different presentations of meat products with added functional ingredients that provide product features that meet market requirements. Therefore in this project the effect of using mixtures of kappa carrageenan-soy protein isolate (KC/SPI) in developing a restructured chicken product like nugget. Were prepared three different batches added with kappa carrageenan/soy protein isolated (25-75%, 50-50%, 75-25%) and two different grinding sieves (6 and 10 mm) were used. physico-chemical parameters were determined: water holding capacity (WHC), hardness and yield was obtained gives each batch. An analysis of variance of two-way data obtained with the software Minitab 16. The higher hardness was obtained in the lot with 75/25 KC/SPI and 6 mm sieve was performed. Higher yields and better values CRA with 25/75 KC/SPI, with 6 mm sieve. Restructured products were stable to frying.

Keywords: Chickenmeat, Nuggets, Kappa carrageenan,, soy protein isolate

Effect of Ohmic Heating Processing on the Color Stability of Model Beverage Colored with Pigments Produced by *Penicillium purpurogenum* GH2

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The study of natural pigments for use in food has been increased by the growing demand of healthy products and their potential applications as an alternative to synthetic food colorants. Nowadays, filamentous fungi are being investigated as readily available sources of chemically diverse colorants due they do not have seasonal impediments and could be produced in high yields. However, the implementation of these colorants requires detailed research of aspects of stability and the conditions governing the processes of degradation in order to obtain baseline data for the design and optimization of processes. The aim of the present work is to evaluate the impact of ohmic heating processing conditions on color stability of a model beverage colored with pigments produced by *Penicillium purpurogenum* GH2. Pigments extract were obtained by liquid fermentation (Czapex-dox modified medium, pH 5-6). A beverage model system (sucrose: 110 g; citric acid: 5 g; potassium sorbate: 0.18 g; glutamine: 0.057 g, per liter) was pigmented with a red extract and adjusted to pH=4.0. The concentration of red pigments was quantified by measuring the optical density at 500 nm by using a spectrophotometer (UV 2550, U-Visible UNICO, USA). The stability experiments were carried out in an ohmic heating system at different temperature (60-90 °C) and time (0-75 min) using variable voltage. The degradation pattern of pigments was well described by fractional conversion and Arrhenius type model ($R^2=0.99$) with a non-zero equilibrium value. The k -values ranged from 0.0011 to 0.0088 min^{-1} and D -values from 2100.71 to 261.1032. Red pigments presented good stability (94.80-67.18%) after 75 min of treatment with a z -value of 33.80 °C and E_a of 71.03 kJ mol^{-1} . According to the results, *Penicillium purpurogenum* GH2 pigments demonstrated good levels of stability under ohmic heating process showing promising results for future applications in heat pasteurized food systems.

Keywords: Fungal pigments, ohmic heating, stability

Effect of ozone processing conditions on the color stability of model beverages colored with microbial red pigments

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Color plays an important role in the acceptability of foodstuffs and is a basic aspect for the assessment of quality. Colorants are added to food to enhance or replace lost color and to minimize the variation in the product. Recently, *Penicillium* pigments have gained attention as alternative natural colorants. However, the stability of natural pigment has been a major challenge for food application. Until today, the traditional heat treatment remains the most widely used in preservation processes. In recent years, research has focused on assessing the impact of non-thermal technologies in the nutritional components and quality aspect in response to consumer demands. In this context, this work focuses on assessing the effect of ozone treatment on color stability of a model beverage colored with red pigments produced by *Penicillium purpurogenum* GH2. A beverage model system (sucrose: 110 g; citric acid: 5 g; potassium sorbate: 0.18 g; glutamine: 0.057 g, per liter) was colored with pigments extract and adjusted to pH=4.0. Pigments were quantified measuring the optical density at 500 nm by using a spectrophotometer (UV 2550, U-Visible UNICO, USA). Experiments were carry out in a bubble column with an inbuilt diffuser using a flow air of 0.12 lpm. Extrinsic parameters of ozone concentration (0.031-0.064 mg/min/ml O₃) and treatment time (0-10 min) were evaluated. The changes in pigment concentration were fitted well to fractional conversion model (R²=99%). Significant reduction of red color (70 %) was observed at maximum levels of ozone concentration and treatment time. The *k*-values range from 0.068 to 0.119 min⁻¹ and *D*-values of 33.84 to 19.43 min. Reaction rate constant was found to increase exponentially with ozone concentration (R²=98.5%). On the other hand, the pigments showed a low stability at maximum processing conditions evaluated. Nevertheless, an acceptable degradation levels were observed at necessary processing conditions to achieve the mandatory 5 log reduction of most pathogenic species so far studied. Thus, the obtained results could be considered as a reference data in a future industrial implementation to pigment studied in processes including ozone technology.

Keywords: Ozone, stability, natural pigment

Optimization of Corn Starch Acetylation and Succinylation Using Response Surface Methodology

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Corn starch is promising for formation of edible biodegradable films especially for food applications. Starches present several disadvantage, such as, insolubility in cold water, lack of clarity, easy retrogradation during storage, and the absence of lipophilic groups, which could limits its industrial application. Native starch can be chemically modified to improve its functionality and to expand its uses. Succinate and acetylated starches produced by esterification of native starch with chemical reagents (e.g. succinic and acetic anhydride) are important modified starches (MS). MS have been obtained with different methods and reaction conditions like the extrusion process (EP). MS have applications which are regulated by their characteristics, such as the degree of substitution (DS). The objective of this study was to find the optimum conditions to obtain MS by acetylation and succinylation using EP with an alimentary DS (<0.2 , <0.05 , respectively) with low affinity to water, employing the response surface methodology. For this, the effect of reagents concentration (RC) (acetylation, 0-13%) (succinylation, 0-3%), extrusion temperature (ET) (80-160°C) and speed screw (SS) (100-200 rpm) were evaluated. The variable responses were DS, water absorption index (WAI) and water solubility index (WSI). It was found that the optimum conditions to obtain acetylated starches were RC = 7.88%, ET = 80°C and SS = 100 rpm, presenting values of DS = 0.2, WAI = 7.66 g/g and WSI = 6.18%. On the other hand, the optimum conditions to get succinate starches were RC = 1.36%, ET = 80°C and SS = 175 rpm, obtaining values of DS = 0.05, WAI = 5.28 g/g and WSI = 10.37%. These results showed that it is possible to obtain modified starches by acetylation and succinylation using the extrusion process with alimentary DS and low affinity to water. The acetylation method was the chemical modification that presented the lower values of WAI and WSI in starch, indicating that it could be employed in the manufacture of products with high resistance to water, like edible biodegradable films.

Keywords: Modified starch, extrusion process, acetylation, succinylation, low affinity to water.

Effect of Processing Conditions and Composition on Emulsions Formed with Soy Protein Isolated and Maltodextrin

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In food and pharmaceutical industry emulsions are often use for the encapsulation of active molecules (antioxidants, vitamins, enzymes, microorganism, omega 3 and 6 fatty acids). By dispersing the ingredients into droplets in a continuous phase is formed an interface, that can act like a barrier against oxidation and allow controlled release of active agent. Due to its composition, emulsions are an instable system affected by: concentration, droplet size, charge and interfacial interactions. The aim of this work was to determine the wall material-active agent ratio and homogenization velocity that produce the most stable emulsions, using maltodextrin and soy protein isolate like wall materials and chia oil like active agent. By analyzing the stability index, droplet size distribution, emulsion droplet size, conductivity, pH and color. A D-optimal design was applied to analyze the effects of composition and homogenization velocity on stability emulsion. The variables with mayor influence on droplet size were the mixture composition of wall materials and the interaction wall material – homogenization velocity. Stability index was only affected by the mixture composition. Through the D-optimal design and the desirability function, it was determined that the most stable emulsion must be contain 7.6 % soy protein isolated and 22.4% maltodextrin and it must be prepared at 20000 rpm.

Keywords: Emulsion, stability, biopolymer, droplet size.

Optimization of Supercritical Carbon Dioxide Extraction of Antioxidants from Oats (*Avena sativa* L.)

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Oat has numerous health benefits due to its fiber content and antioxidant compounds, such as avenanthramides, and polyphenols. Thus, oat is a potential source of added value compounds with a growing interest on food, pharmaceutical and cosmetic industry. Supercritical fluid extraction (SFE), a method where the solvent is taken beyond its critical temperature and pressure, is an alternative to conventional extraction methods to extract antioxidant compounds. The aim of this study is to develop and optimize an extraction process to obtain added value compounds from oat by supercritical carbon dioxide and ethanol as co-solvent. As preliminary experiment, a full factorial design was conducted to evaluate the pretreatment on raw material. Which consisted of an alkaline hydrolysis (NaOH 1 M) at 40 °C for 90 min. Then the SFE was carried out on a SFT-110 equipment, evaluating the effect of the pressure (2000 – 9000 psi). Temperature of 60 °C and ethanol concentration of 80% were established. The extractions were performed during 2 hours, with 6 g of oat, 30 mL of ethanol, at CO₂ flow rate of 24 mL/min. Total polyphenolic content (TPC), oxygen absorbance capacity (ORAC), and quantification of compounds by HPLC were evaluated as responses. Significant differences among means were determined by ANOVA. Tukey test was used to determine significant difference at $p < 0.05$. Results showed that variables of pressure and pre-treatment and their interaction were significant to the extraction. The higher values of the response variables were reached at 9000 psi, followed by the pressure of 2000 psi. The highest value of TPC was 1.728 ± 0.031 mg GAE/g oat, while the ORAC was 43.72 ± 9.291 μ mol TE/g. About the quantification of the compounds, p-coumaric acid ($6.353 \pm$ mg/g) and ferulic acid (5.520 ± 180.19 mg/g oat) and vanillin (154.754 ± 6.527 μ g/g oat) were the highest compounds found on extracts. Results indicate that the combination of pressure and pre-treatment enhance the yield of extraction. The obtained values were higher than those reported on conventional methods. As a result, SFE can be an alternative to extract specific added value compounds from oats such as p-coumaric and ferulic acid.

Keywords: Optimization, supercritical fluid extraction, co-solvent.

Optimisation of Nonthermal Extraction of Antioxidants from Oat (*Avena sativa L.*)

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Obtaining value-added compounds from biomass has gain interest in the last decades, especially from inexpensive raw materials. Because of the health benefits they bring, cereal grains are use in daily diets around the world. Among these cereals, oatmeal is a rich source of soluble fiber, protein, and unique antioxidants such as avenanthramides. These compounds can be extracted by leaching varying pressure and at low temperature; as a result, added value compounds are not subject to thermal degradation. The aim of this work was to develop a no thermal extraction process with pressures above 1atm to obtain added value compounds from forage oats. Extraction equipment was similar to development scale, and considering variables such as solvent mixture composition (methanol/water and ethanol/water) and number of cycles. All this while keeping constant pressure (8.88 atm) and room temperature (25°C). Extraction parameters where adjusted for processing 2 kg of oat in 14 L of solvent for each extraction. Extracts total polyphenolic content (TPC), oxygen absorbance capacity (ORAC) and height common oat antioxidants (HPLC) were analysed by a surface response methodology (SRM). For the case of methanol extracts, mixtures with 14% wt. methanol showed the highest TPC (1.342 ± 0.008 mg GAE/g), while 86% wt. mixture composition gave the highest ORAC (47.212 ± 13.83 $\mu\text{mol TE/g}$ oat). Ethanol/water mixtures showed similar behaviour where mixtures with 50% wt. and 40 cycles gave the highest TPC (1.6 mg GAE/g oat) and ORAC ($90.206 \pm .6028$ $\mu\text{mol TE/g}$ oat). The highest antioxidant compounds quantified in the extracts were Vanilic acid, vainilline, p-cumaric acid and avenanthramides type 2f. Results show that solvent mixtures with high percentage of alcohol benefited the extraction of antioxidants contained in oat. The number of cycles was not as significant for the extraction of antioxidants compared with the importance of selecting the appropriate solvent mixture. As a result, extraction scaling may be feasible by controlling solvent selection, cycles and keeping a pressure higher than atmospheric.

Keywords: Optimization, process development, solvent extraction, pressure.

Spray Drying of Habanero Pepper (*Capsicum chinense*) Ethanolic Extract

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Habanero pepper ethanolic extract presents two main groups of bioactive compounds (BC), carotenoids (Cr), which give the characteristic color and capsaicinoids (Cp) that give the characteristic pungency. For the BC recovery and preservation, drying processes are used. One of the best option is to use the spray drying coupled to a heat pump in a closed cycle configuration employing nitrogen or other inert gases. The aim of this study was to evaluate the effect of spray drying process variables, on the retention of bioactive compounds of habanero pepper extracts. The ethanolic extract was obtained by contacting of dehydrated habanero with an ethanol: water mixture (70:30). The drying was carried out in a spray dryer (BÜCHI B-290) coupled to a heat pump (BÜCHI B-295) and a dehumidifier (BÜCHI B-296) at various inlet temperatures (T_{in} 130 and 140 °C) and outlet temperatures (T_{out} 60 and 70 °C), using nitrogen as drying gas. Maltodextrin DE10 and a mixture of Maltodextrin: precipitated silica (95:5) were used as carrier material (CM), at two concentration levels (66.6% and 80%). The bioactive compounds evaluation was performed by UHPLC-FI (Cp) HPLC-DAD (Cr). The results showed that T_{in} had significant effect ($p < 0.05$) on the moisture content (1.47-4.85%), and on capsanthin retention (56.64-54.995%). T_{out} had no effect on moisture, but CM had significant effect on moisture, capsanthin (64 - 31 %) and capsaicin (79.5 -23.8 %) yield, and over the process performance. The water activity of the powders was lower than 0.41, so it is expected that these dehydrated products have good stability.

Effect of the Addition of Microcrystalline Cellulose, High and Low Acyl Gellan Gum in the Rheological Behavior of Dairy Product Yogurt Type

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Yogurt is a lactic ferment where *Lactobacillus bulgaricus* and *Streptococcus thermophilus* ferment the milk's sugar transforming it into lactic acid, and precipitating the casein from milk, resulting in the obtention of a weak gel. The use of polysaccharides or gums can contribute in the stabilization of the system and reduce the syneresis that causes a phase separation. Cellulose is a biopolymer of glucoses joined by 1- β links, is the principal component in vegetal wall and the microcrystalline cellulose is α -cellulose depolymerized and purified. Gellan is an anionic polysaccharide obtained from bacteria *Sphingomonas elodea* composed of a repetition of 4 monomer units of glucose, glucuronic acid, glucose, and rhamnose. In this study, lactic ferment added with microcrystalline cellulose and, binary blended microcrystalline cellulose and, high and low acyl gellan were obtained, with the objective to determine their rheological behavior. A rheometer LS100 of Paar Physica with a plate plate geometry PP20 was used. The main results point out that yogurts have a flow behavior index <1 , so that are considered as fluids non-Newtonian of shear-thinning type. This behavior is adjusted to the Ostwald de Waele model ($R^2 > 0.998$). The higher viscosity of yogurt (1461mPas) was obtained when binary mixtures of high acyl gellan with microcrystalline cellulose and low acil gellan with high acil gellan gum were added before the fermentation, an increase of 144.44% and 294.01% compared to the controls. The addition of microcrystalline cellulose to yogurt allowed an increase of 52.7% of consistency coefficient. The linear viscoelastic region was determined, 2.14 to 16.17×10^{-3} mNm, when G' and G'' are independents from the amplitude. The frequency sweep shows that $G' > G''$ in all the fermented, inclusive the yogurt with microcrystalline cellulose presented the fewer value of G' (239.78 Pas), a difference of 208% in respect with G'' . The yogurts studied have a solid viscoelastic behavior that are able to recover after a stress or strain is applied; in the Creep recovery curve obtained, the binary blended of gellans showed the highest recovery (82.28%).

Keywords: yogurt, gellan, microcrystalline cellulose, fermentation, rheological behavior

Plant Growth Evaluation through Hydrolysis of Urea by *Proteus mirabilis* and Comparison with other Nutrient Sources

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Proteus mirabilis, common member of the digestive tract microflora, is capable of producing large quantities of *urease*, which cleaves urea into carbon dioxide and ammonia. This bacterium ensures conversion of organic nitrogen by 90%. The primary objective of this study aims to find alternatives for accelerating growth in certain vegetables such as *Coriandrum sativum*, *Spinacia oleracea*, and *Apium graveolens*. The treatments used in this study were urea hydrolysis in urine by the microbiological agent *Proteus mirabilis* for the production of ammonia, CO₂, and H₂O; the use of salicylic acid and the use of the Mexican fertilizer "Bio-Fertilizer, Nevado, K". Four systems were implemented for planting. One functioned as a control and the others to study the methods described above. In each device each vegetable was planted by triplicate. Six weeks after sowing, growth measurements, stem diameter, root growth and leaf number were taken. Furthermore, chlorophyll *a*, *b*, and total were quantified by the Lichtenthaler method to compare different nutrient sources used against a cilantro plant purchased in the supermarket. The total chlorophyll content was found in a range of 46.80±1.43 to 70.07±4.67 mg 100 g⁻¹. Statistically equal values (p < 0.05) between fertilizer "Nevado K" and the commercial plant were obtained; as well as the control group, the group with the addition of salicylic acid, and the group exposed to urea hydrolysis by *Proteus mirabilis*. Plants exposed to ammonia and CO₂ showed a 2 cm smaller root system, and a 2 cm larger stem than those exposed to other treatments. By making the nutrients act directly in the roots, there was a better use of the substrates, causing cell differentiation not focused on root growth, but targeting the development of other plant structures. In conclusion, hydrolysis of the urea in the urine can be regarded as an effective source of nutrients for plant growth acceleration and biotechnology research.

Keywords: *Proteus mirabilis*, Urea, Chlorophyll, Stem, Fertilizers

Effect of Thermal Processing on Milk-Based Drinks Fermented With Kombucha Consortium and spiked with phytosterols

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Fermented dairy foods are a complete food because they have essential nutrients and other compounds that provide health benefits. Furthermore they are a good vehicle for transporting prebiotics, liposoluble vitamins and various compounds of nonpolar nature as phytosterols. However, few studies have been done on them, using fermenting kombucha mushroom, which is a good starter able to obtain a product similar to yogurt and kefir features. An inoculum mother from biomass formed by the Kombucha mushroom and sterile milk which ferment at 25 ° C until a pH of 4.6 was obtained, microbiological analysis of acetic bacteria was done 2×10^4 and yeasts 3×10^3 . From this inoculum mothers 4 types of milk 2 ultrapasteurized (UHT) and 2 pasteurized (HTST), skimmed and lactose-free for both products were fermented, was kinetics of pH and acidity data were analyzed with one-way ANOVA and not found statistical differences, to choose one milk so the decision was made by a sensory analysis led groups with a total of 10 panelists, who helped us pick a fermented milk's taste in this case pasteurized milk lactose-free.

Keywords: pasteurization, shelf life, phytosterols

Assessment of the Content of Ascorbic Acid in Red Pepper (*Capsicum annum* L.) Heat Treated by Using Two Drying Methods

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Actually eating fruit and vegetables has been related to a decrease in the incidence of oxidative stress linking diseases known as chronic degenerative; these include obesity, diabetes, some cancers and those associates with aging. These beneficial health effects have been attributed to compounds known as phytochemicals such as ascorbic acid, flavonoids, tocopherols, carotenoids, etc., which are substances found in fresh fruit, vegetables and dry fruits. Among the vegetables, the *Capsicum* genus is considered that contains the higher amount of ascorbic acid (vitamin C), with an average of 150 mg /100 g in fresh fruit. Ascorbic acid is considered one of the more effective and less toxic natural antioxidants and it is normally used as an index of nutritional quality, due to its nature compared to other nutrients present in the food. The ascorbic acid degradation depends on several factors including oxygen, light and temperature. The main objective of this research is to determinate the effect from two drying methods in the vitamin C content in sweet red pepper. The present researching work was carried out in three stages: the first of these was the determination of parameters of quality of fresh pepper; the second one was the drying process by natural and forced convection. Finally, the last stage consisted of an analysis of vitamin C of dried pepper. The results show that the most amount of ascorbic acid is present in red pepper dried by forced convection (870mg/100g), followed by natural convection (439mg/100gr); compared with fresh pepper (106mg/100g). The statistical analysis of data was carried out using the computer program Statistical Analysis System (SAS version 9.0) by a factorial design to determine the variance analysis and Duncan test to determine mean differences.

Keywords: ascorbic acid, red pepper, drying methods

Physical and chemical properties of cookies supplemented with orange sweet potato flour stored under different conditions of relative humidity

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Sweet potato (*Ipomoea batatas* L.) contains from 25 to 30% of total solids, where 60 to 70 % is starch. Sweet potato flour can be used as a non-conventional source to prepare confectionery. The aim of this study was to evaluate the behavior of physical and chemical properties of whole wheat cookies supplemented with orange sweet potato flour (50%) under different storage conditions. The cookies were elaborated, characterized and were stored at 75%, 43% y 9% of RH. The total characterization was carried out from the initial and at the end of the storage. From the results it can be observed that the addition of orange sweet potato flour to the wheat flour (50/50) provoked changes on the texture and give a light increment on the fiber, ash and resistant starch at the end of the storage. The total starch content in the cookies were found in the range of 30 to 46%. Throughout the time of storage it was measured moisture content, water activity and texture. Moisture content tended to diminish throughout time (6.45 to 3.4), in the case of water activity, it diminished from 0.33 to 0.22 when storage was carried out at 43% RH, and at 75% RH any significative difference was observed. In respect to texture, there was higher values when the cookies were stored at 43% RH (26.45-33.45 N), in the same sense, storage at 9% RH present an increment in texture (26.45 to 30.34N), no significative difference was observed at 75% RH. Cookies prepared with 50% whole wheat flour and 50% orange sweet potato flour stored during 25 days at 75% RH, 50 days of storage at 43% RH and 120 days at 9% RH, the cookies presented stable parameters, but with a tendency to increase.

Keywords: Cookies, sweet potato flour, texture, starch

Characterization of *Sechium edule* starch as wall material in microencapsulation by spray drying

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The wall material for microencapsulation should have a high emulsifying activity, high stability, and tendency to form strong and fine compounds during drying and not allow separation lipid emulsion during dehydration. *Sechium edule* starch, can be a source to provide material wall with particular properties in microencapsulation. The aim of this study was to characterization physical (moisture content, water activity and morphology), rehydration (wettability and solubility time) and powder properties (bulk and tapped densities and cohesiveness) of *Sechium edule* starch obtained by spray drying. A pilot scale spray dryer with cocurrent operation was employed for the spray drying process, the inlet air temperature was 205°C. The moisture content and water activity in the *S. edule* starch were 6.47 ± 0.97 % d.b., and water activity 0.439 ± 0.002 , respectively. The starch granules morphology was observed by scanning electron microscope (SEM). The starch granules showed oval shapes and truncated, this presented smooth surfaces. Meanwhile, wettability and solubility of starch were 33.00 ± 7.00 s and 81.50 ± 12.02 s. The tapped density (0.61 ± 0.02 g/mL) is influenced by the particle size and shape. The form factor are in a range values, presented oval shape. From the bulk and tapped density is obtained the starch compressibility and cohesiveness, commonly expressed as the Carr's index (20.40 ± 1.67) and the Hausner ratio (1.25 ± 0.03), respectively. So it concludes on the characterization of the techno-functional properties of *Sechium edule* starch that will use as wall material in microencapsulation.

Keywords: Wall material, *Sechium edule* starch, microencapsulation

Process Scale-up for the Production of a Prebiotic Caramel Assisted by CFD

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Prebiotics are non-digestible ingredients that promote the growth of the microbiota in the colon, increasing consumer's health. Diffructose anhydrides (DFA) isomers are a fructooligosaccharides family having prebiotic characteristics. There is a process to produce caramel with a concentration higher than 50% of DFA at laboratory scale (100 ml). The process uses fructose syrup and an ion exchange resin as catalyst. The relative high viscosity ($> 1 \text{ Pa}\cdot\text{s}$) and the presence of a biphasic system difficult heat and mass transfer in the bulk, so the process scale up must consider agitation as the fundamental operation parameter. So, in this work CFD technique (Computational Fluid Dynamics) is used to analyze the bulk hydrodynamic behavior and to propose a strategy to the process scale-up. A typical discontinuous stirred tank was considered. The geometric and dynamic similarity criteria (Re , Fr , Np and constant impeller tip speed) were used to determine the stirring conditions using 4 types of agitators. From simulation results, the Critical Representative Plane of Agitation (CRPA) was identified as the region of lower agitation rate. Then, two parameters were proposed to analyze the results using image analysis: the Suitable Agitation Region (SAR) and the Stagnation Region (SR). It was determined that they represent 12 and 2% of the CRPA, respectively, at laboratory scale. On this basis, the simulation results, for a scale-up ration of 1:10, show that it is possible to obtain a similar agitation characteristics using a semicircular stirrer at 100 rpm. This represents an average rate of 0.016 m/s as well as SAR and SR values of 46 and 2%, respectively. As SAR is higher of value obtained at laboratory scale, simulation results predicted ah hydrodynamic behavior more adequate for the scaled reactor. The results show that CFD technique is a useful tool in scale-up operations in food engineering.

Keywords: CFD simulation, stirring scale-up, prebiotics.

Enhancing Functionality with Improved Antioxidant Activity of Chía (*Salvia hispanica* L) Seeds by Optimizing the Extrusion Conditions

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Chia (*Salvia hispanica* L.) seeds have been consumed since ancient times by Mesoamerican people. Chia was one of the main crops of pre-Columbian societies, surpassed only by corn and beans. It is an emerging plant-derived nutraceutical, and due to its balanced composition of dietary fiber, proteins, ω -3 fatty acids, antioxidants, vitamins and essential minerals has the capability to prevent many metabolic diseases. Extrusion cooking is a high-temperature, short-time process in which moistened, expansive, starchy and/or proteinaceous food materials are plasticized and cooked in a tube by a combination of moisture, pressure, temperature and mechanical shear, resulting in molecular transformation and chemical reactions, that presents a number of advantages over other food-processing techniques in terms of continuous process with high productivity and significant nutrient retention, owing to the high temperature and short time required. The aim of this study was to optimize the extrusion conditions of chia seeds that would maximize the antioxidant activity (AoxA) and the total phenolic content (TPC). To optimize the extrusion process, response surface methodology was applied over two response variables (AoxA, TPC). A central composite rotatable experimental design with two factors [Extrusion temperature (ET, 70 – 140°C) / Screw speed (SS, 10 – 60 rpm)] in five levels was used; 13 treatments were generated. The extruded from each treatment was dried (50°C/8 h) to obtain extruded chia flours (ECF). The best combination of extrusion process variables for producing optimized ECF (OECF) with the highest AoxA [10,359 μ mTE/100g bs] and TPC [542 mgAGE/100g] was ET= 72°C/SS=14 rpm. The extrusion process increased AoxA and TPC in 84% and 32%, respectively. The extrusion process is an effective strategy to increase TPC of chia seeds for enhancing functionality with improved AoxA.

Keywords: Chia, Antioxidant activity, Extrusion process, Optimization, Response surface methodology

Development and Nutritional Evaluation of Chorizo “Sausage” of Soy Hawaiian Style

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This research was conducted at the Universidad Autónoma Agraria “Antonio Narro”, where a nutritious food was developed based on a traditional formulation of chorizo “sausage”, replacing pork meat with texturized soy, and adding to the formulation pineapple chunks, jalapeño pepper and onion, obtaining a new product called Chorizo “sausage” of Soy Hawaiian Style (vegetarian sausage). Two formulations were evaluated, the first one a Hawaiian sausage with pork, and the second, a Hawaiian sausage made from 100% texturized soy, both compared against a soy vegetarian sausage commercial brand “Sabori”. A compositional analysis was performed as a way to determine the chemical and nutritional content of each sample according to methods AOAC 1990 (Association of Official Analytical Chemists). The variables evaluated were total dry matter, moisture, ash, protein, ether extract, fiber and minerals. This formulation of Chorizo “sausage” of Soy Hawaiian Style developed has a pleasant sweet taste due to some of the ingredients such as pineapple, onion, and jalapeño pepper. The innovative product called "vegetarian Hawaiian Chorizo" sausage was wrapped in a synthetic gut and had 24 hours of maturation at room temperature with a shelf-life of 30 days under refrigeration. The qualitative characteristics of the new product were: total dry matter 92.96%, ash 6.53%, protein 21.12%, fat 1.30%, and fiber 6.28%, these values are very similar in terms of protein content, are low in fat and high in fiber compared with the commercial products of pork and soy. The result of this research is an innovative product of good nutritional quality for all public.

Keywords: Hawaiian vegetarian sausage, soy sausage, nutritious food, vegetarian chorizo, Hawaiian style sausage

Design of Cooling Chambers Assisted by CDF

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Refrigeration is a technique widely used on food preservation. However, its use involves high energy consumption. This work proposes a methodology to design cooling chambers. So, the temperature distribution was evaluated into a model cooling chamber using computational fluid dynamics (CFD), with the purpose of reducing energy consumption, without compromising the food quality. The room considered on this research, is built of concrete, cork and sawdust, measuring 3.4x2.2x2.6 m. Multiple design variables were proposed on the initial configuration model: flow rate, fan position, addition of baffles, shelves position and different insulating materials. Control points (PC), 27 in total, were homogeneously distributed into the chamber, in order to obtain temperature and air velocity profiles. The coefficient of variation (CV) and the average values were used to quantify uniformity of temperature, air velocity and heat loss. The temperature results show CV values varying from 3.83% to 15.17%, air rates from 68.24% to 111.21%, while heat loss is in a range of 50 to 73 W. From the simulation results, design heuristic rules can be established. Some of these rules are: the temperature control sensors must be installed near the shelves (higher temperature and recirculation zones), typical temperature gradients for hot points are in a range of 1.3 to 2.3 °C and must be considered in the chamber design. In order to reduce heat loss, the modification of insulating material is necessary because this is the main factor for influencing heat loss. The better materials obtained in this study are rockwool and polystyrene that allow to reduce in 30% the heat loss. It is evident that the modification of the design variables for cooling chambers has an impact on hydrodynamics. So, the effect of these variables cannot be assessed independently and it is necessary to provide heuristic rules to reach the configuration that will result in a better heat transfer behavior and chamber performance.

Keywords: simulation CFD, refrigeration, energy saving.

Supercritical Carbon Dioxide Extraction of *Piper auritum*

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Supercritical fluid extraction of thermolabile volatile compounds from *Piper auritum* was applied. The oil extraction was performed for pulverized material with a particle size of $400 \pm 20 \mu\text{m}$ at two temperatures (40 and 50°C) and at two pressures (103.42 and 172.37 bar) The extraction yield was calculated, the antioxidant activity (ABTS method) was evaluated and the chemical composition of the oil was analyzed by gas chromatography - mass spectrometry. The yields were obtained between 2.37 ± 0.05 and 3.09 ± 0.12 g oil / 100 g dry solids. The highest extraction yield has been achieved in the case of extract obtained using carbon dioxide at pressure of 172.37 bar (2500 psi) and temperature of 50°C The antioxidant activity was found between 1.30 ± 0.05 and 11.65 ± 0.5 mg Trolox equivalent / g of oil and between 1.09 and 10.16 mg ascorbic acid equivalent / g of oil. A few compounds were dominant in analyzed extracts: isosafrole, α - copaene and phytol. Phytol was major compound in extracts present. Antioxidant activity of extract obtained using carbon dioxide at 172.37 bar and at temperature of 40°C was approximately five times higher than antioxidant activity of essential oil obtained by steam distillation. Obtained results indicated that supercritical extraction of *Piper auritum*, can be considered as more effective method for volatile non-polar components extraction and preparation of extracts with high antioxidant activity, in comparison to classical steam distillation and hydrodistillation procedures.

Keywords: Supercritical extraction, *Piper auritum*, antioxidant activity.

Effect of Process Variables of Spray Drying in Closed Loop on Bioactive Compounds of *Moringa oleifera* Leaf Extracts

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Moringa oleifera is used in traditional medicines in many tropical and subtropical countries. Phenolic compounds, carotenoids and ascorbic acid are the major constituents. The ethanolic extracts from moringa leaves, exhibit antiradical activity in some model systems as the DPPH and ABTS assays. The aim of this work was to evaluate the effect of spray drying in closed loop at different inlet (130 and 140 °C) and outlet (60 and 70 °C) temperatures on bioactive compound retentions (total phenols, total carotenoids, ascorbic acid) in ethanolic extracts from *Moringa oleifera* fresh leaves, using nitrogen as drying gas. The drying was carried out in a spray dryer (BÜCHI B-290) coupled to a heat pump (BÜCHI B-295) and a dehumidifier (BÜCHI B-296). Different amounts of maltodextrin DE-10 (1 and 2 grams) by gram of moringa solids in the extract were used as carrier material. Inlet and outlet temperatures of drying agent and the concentration of carrier material showed significant effect ($p < 0.05$). Increasing inlet temperature led to higher total phenol and ascorbic acid retentions and has negatively influenced on total carotenoid retentions. Increasing outlet temperature led to decreased total phenols and ascorbic acid retentions. Higher maltodextrin concentrations had positive effect on total phenols (93%) and ascorbic acid (48%) retentions. The powders obtained in this work showed high retentions of bioactive compounds, opening perspectives for its use as food additive and/or as a source of active principles in the pharmaceutical industry.

Evaluation of Drying Temperatures on Gluten-Free Pasta

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In this study three drying temperatures of gluten-free pasta, spaghetti shaped and formulated with wet semolina and unripe banana flour, were tested. The drying temperatures affect the cooking time, the cooking losses of solids and the texture of the samples. The two kinds of pasta were made by the rolling method: wheat semolina pasta (PTL) and unripe banana flour pasta (PHP). Hernandez-Aguirre (2012) established an optimal formulation for spaghetti unripe banana flour and proposed carboxymethylcellulose (CMC) as hydrocolloid. Three drying temperatures (40, 50 and 75 °C) and one air flow velocity (1.20 m/s) were evaluated. A convective air lab drying tunnel was employed, which senses and registers the air temperature, and the weight variation in the sample in real time. The set points of each parameter were adjusted manually. An ANOVA was applied with a significance level $\alpha = 0.05$ for individual samples among each drying temperature. The optimal cooking time obtained were 7.17 ± 0.98 , 7.67 ± 1.03 , 7.33 ± 0.52 min for PTL at 40, 50 and 75°C respectively, and 6.83 ± 0.75 , 6.50 ± 0.55 , 6.33 ± 0.52 min for PHP and the same temperatures, showing shorter cooking time for PHP. The cooking loss was smaller for PHP with 6.73 ± 0.29 % at 40°C, 5.79 ± 0.38 % at 50°C and 6.85 ± 0.83 % at 75°C. For the PTL the cooking loss were higher than the maximum allowed (12%): 13.96 ± 0.29 %, 15.13 ± 0.27 %, except for the 75°C dried pasta, 11.10 ± 1.08 %. The analysis of the hardness in the pasta showed values between 48.96 ± 22.29 and 74.54 ± 14.16 N for PTL. For PHP values between 41.94 ± 9.87 and 56.91 ± 16.31 N. The best conditions for processing PTL were for temperatures of drying between 50 and 75°C, but closer to 50 °C, because cooking time, cooking loss and hardness have a good trend on these conditions. For PHP the temperature of drying of 75°C was better, because cooking time, cooking loss and hardness have the optimal results.

Keywords: banana flour, pasta, drying

Surfactant Mediated Extraction of Total Carotenoids and Antioxidant Activity from Tomato Fruit

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The objective of this work was the study of the extraction of total carotenoid contents and the antioxidant capacity from fresh tomato by the application of surfactants formulations instead of conventional solvents (acetone, hexane, methanol). The effect of aqueous surfactant formulations (Tween 20, Tween 80 and Triton X-100) were explored and the most appropriate surfactant concentration, pH, salt concentration, incubation time, extraction efficiency and finally, the antiradical activity of carotenoids recovered by surfactant was determined. The experiment revealed that extraction efficiency and antioxidant activity depend upon extraction system and concentration of surfactant used. Among all the extracting systems employed, a pH 2.5, 15% Triton 100 (v/v), incubation temperature of 66 °C and saturation samples with NaCl 35% (v/v), showed the highest extraction efficiency of carotenoids (78.4%) respect to a conventional extraction, and antioxidant activity (64.2 %) respect to fresh tomato. The values of total carotenoids and antioxidant capacity decreases in order Triton X-100>Tween 80>Tween 20. Optimization of experimental extraction parameters would allow an increase of extraction efficiency and could built the basis for an economical production of natural antioxidants.

Keywords: extraction, surfactant, total carotenoids, antioxidant activity

Nutritional and Textural Properties of Tepari Bean (*Phaseolus acutifolius*) Cultivated in Nuevo León, México

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Mesoamerican region is the center of *Phaseolus* genus. This pulses group is known for common bean (*Phaseolus vulgaris*) but has a large diversity poor known. Tepari bean (*Phaseolus acutifolius*), is a highly adaptable crop; would rise with warm weather / low water environments. Tepari bean is cultivated mainly in Sonora and Sinaloa and some places of Mexican frontier but mostly by self-intake. Unfortunately, tepari bean is being forgotten, losing genetic diversity and the option of a crop that can withstand the conditions of climate change. The aim of this study was determine nutritional and textural properties of tepari bean (*Phaseolus acutifolius*) cultivated in Nuevo León, México. Nutritional values of humidity, ashes, protein, lipid and crude fiber were evaluated while A.O.A.C. official methods. Average of three determinations was reported. Textural properties were determined in unsoaked/8h soaked seeds using a Texture Analyzer (Model XT2i; Stable Micro Systems Ltd., England) through texture profile analysis (TPA) test for 70% of compression at a test speed of 2.0 mm/min. Hardness, cohesiveness, chewiness and adhesiveness were calculated. Average of ten determinations was reported. The nutritional composition obtained was 4.95% ashes, 1.44% lipid fraction, 2.99% crude fiber, 23.21% protein fraction and 60.0% total carbohydrates. All values were similar to another *Phaseolus* species, as *P. vulgaris*. About TPA, unsoaked seeds reports hardness=310.45N, cohesiveness=0.177, chewiness=2.325Kg and adhesiveness=0.22Kg·s; soaked seeds shown hardness=83.15N, cohesiveness=0.158, chewiness= 0.233Kg and adhesiveness=0.12 Kg·s. The TPA shown a significantly difference ($p<0.05$) between unsoaked and soaked tepari beans; being in both cases, more similar to cowpea than common bean texture profile. Due to results, it is highly important evaluated physical and cooking properties of tepari bean to assess commercial and nutritional potential for human population.

Keywords: tepari bean, pulses, TPA, alternative crops

Effect of drying in papaya fruit (*Carica papaya* var. Maradol): colour and ascorbic acid conservation.

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Carica papaya fruit is a tropical fruit known for its nutritional value such as minerals, fiber, papain enzyme, and vitamins content such as vitamin A and C. Exportation quality standards demand specific size and weight among other characteristics. If the fruit does not fulfill these requested standards, the product is rejected and ranked as a third quality product. The objective of this study was to evaluate the effect of drying papaya (convective drying and spray drying) in preserving colour and ascorbic acid content. Papaya fruit was disinfected and peeled to obtain the flesh free of seeds. Pulp was blended until paste and then was mixed with maltodextrin (5-10% w/v), ascorbic acid (0.1% w/w), and citric acid (0.2% w/w). Convective drying was carried out at 50 °C until humidity was lower than 7%. Spray drying operational conditions was 160 °C air-drying temperature, 90 °C outlet temperature, and 130 ml/min feeding velocity. An experimental design 2² (2 factors, 2 levels) was applied to evaluate convective drying; spray drying only was tested with 2 treatments. The data was statistically analyzed by one-way ANOVA. Colour was the most evident change observed. All four convective powders were dark brown (L* from 53.97±4.66 to 68.65±1.52; a* from 4.72±0.49 to 20.56±0.99; and b* from 20.56±0.84 to 37.83±0.52) as a result to sugar browning and Maillard reactions. On the other hand, spray-dried powders had a light orange colour (L* from 84.53±0.95 to 84.98±0.25; a* from 6.57±0.21 to 7.31±0.11; and b* from 19.94±1.01 to 20.16±0.98) thanks to maltodextrin and rapid drying process. Rehydrated convective powders remained dark brown while spray dried powders regained natural orange papaya colour. Ascorbic acid content conservation was also evident in spray dried powders. In convective powders content was measured from 20.80±3.16 to 38.12±1.21 mg ascorbic acid equivalent/100g, while spray dried powders were from 49.71±2.79 to 98.64±1.23 mg ascorbic acid equivalent/100g. Papaya spray dried powder resulted with better colour characteristics than convective powders. Also ascorbic acid conservation was observed in spray dried powder. Processing papaya fruit as powder by spray drying technology seems to be an alternative to process rejected exportation products.

Keywords: *Carica papaya*, drying, colour conservation, ascorbic acid

Germinated Chia (*Salvia hispanica* L.) Flour with High Protein Content, Phenolic Compounds and Antioxidant Potential Bioprocess Optimization

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Chia (*Salvia hispanica* L.) is native to Central Valley of Mexico and Northern of Guatemala (3,500 B.C.); and it was used to prepare nutritional foods and drugs, as well as cosmetic creams by Mayans and Aztec civilizations. Chia seed is a good source of protein (15-25%), carbohydrates (26-41%), dietary fiber (18-30%) and lipids (30-33%); these last one are constituted by 60% α -linolenic (ω -3) and 20% linoleic (ω -6) fatty acids. Also, chia seed is a great antioxidant source due to the presence of polyphenols, such as phenolic acids (Rosmarinic, chlorogenic, caffeic, gallic) and flavonols (Quercetin, myricetin, kaempferol), which protect against cardiovascular diseases and cancer. The aim of this work was optimize the germination bioprocess of chia seeds to obtain a functional flour [Optimized Germinated Chia Flour (OGCF)] with maximum values of total phenolics compounds (TPC), hydrophilic antioxidant activity (HAoxA) and protein content (PC). Response Surface Methodology was used as optimization tool. A rotatable compound central experimental design with two factors [Germination temperature (GT=20-35°C), germination time (Gt=10-300 h)] and five levels (13 treatments) was applied. Chia seeds were placed inside plastic trays with absorbent paper, previously moisturized with 50 mL of 100 ppm sodium hypochlorite dissolution. The sprouts were dried (50°C/8 h), cooled (25°C) and ground to obtain germinated chia flours (GCF). The best combination GT/Gt to obtain OGCF with TPC (675.7 mg galic acid equivalents (GAE)/ 100 g, db), HAoxA (111,367 μ mol trolox equivalents (TE)/100 g, db) y PC (27.1 g of protein/100 g, db) was 20.9 °C/300 h. In optimal conditions, the germination bioprocess is an effective method to increase the PC, TPC and antioxidant potential of chia seeds; the OGCF could be utilized as antioxidant natural source in functional foods.

Keywords: Chia, Antioxidant activity, Total phenolics compounds, Protein content, Optimization

Extruded Quinoa (*Chenopodium quinoa*) Functional Flour with High Antioxidant Activity and Total Phenolic Content. Optimization of Extrusion Process

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The quinoa (*Chenopodium quinoa*) seeds have been used for centuries as a food / medicine by pre-Columbian cultures of South America (Inca Empire) since 5,000 years BC. Quinoa seeds contain 12-23 % protein, dw; these proteins have profiles / levels of complete essential amino acids, which are similar to casein (milk protein) biological value. In quinoa seeds have been identified bioactive compounds as polyphenols (phenolic acids, flavonoids), carotenoids, phytosterols, squalene, ecdysteroids, which present beneficial health effects. Extrusion is a high temperature / short time technology which has been applied to cereals and legumes for producing a wide variety of products. The extrusion process improves protein digestibility and nutritional value of the raw material. The aim of this stud was to optimize the extrusion conditions of scarified quinoa seeds that would maximize the antioxidant activity (AoxA) and total phenolic content (TPC). To optimize the extrusion process, response surface methodology was applied over two response variables (AoxA, TPC). A central composite rotatable experimental design with two factors [Extrusion temperature (ET, 50 - 160 °C), screw speed (SS, 50 - 240 rpm)] in five levels was used; 13 treatments were generated. The quinoa seeds were conditioned before extrusion. The extruded from each treatment were dried (50°C/8h), and ground to obtain extruded quinoa flours (EQF). The best combination of extrusion process variables for producing optimized EQF (OEQF) with the highest AAox [5,483 µmol TE/100g (dw)], and TPC [252 mg GAE/100g (dw)] was ET = 92.3°C/SS=167 rpm. The extrusion process increased AoxA, and TPC in 21, and 24 %, respectively. The extrusion process is an effective strategy to increase the TPC of quinoa seeds for enhancing functionality with improved AoxA.

Keywords: Quinoa, Antioxidant activity, Extrusion, Optimization, Response surface methodology

Development and Sensory Evaluation of Strawberry (*Fragaria Vesca*) and Chilacayote (*Cucurbita Ficifolia*) Candy

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Candies and confectionery market in Mexico represents a niche of great interest for investment. In this Mexican typical candies they are disadvantaged in domestic consumption compared to non-traditional candies, reserving for tourism and export. However these have an added value as well as the use of natural ingredients in its preparation, they are icons of the local cuisine, so they offer an opportunity for innovation based on industry trends. “Ates”, in order to launch a product to the national market segment: Given this development a sweet strawberry and chilacayote as proposed innovation to Morelia traditional. The objective of this work was to develop and evaluate a sweet strawberry and chilacayote in four flavors: Chile-chamoy, coffee, chocolate and tequila. A strawberry and chilacayote base formulation was developed from which three formulations for each flavor were performed varying the amount of flavorings in 2% 5% and 8% of the total weight. A panel simple hedonic scale whose variable was flavor and with the participation of 100 evaluators untrained, an analysis of variance one way (ANOVA) and analysis was conducted proximal of the formulation with greater acceptance, conducted a sensory analysis for the three formulations of each flavor. The proximate analysis of the accepted formulations was very similar among the four flavors. The formulations mostly accepted were 2%, 5%, 5% and 10% for the flavors: chile-chamoy, coffee, tequila, chocolate respectively, and taste more acceptance was the chili-chamoy. Conclusion: The new product offers a different traditional sweet that goes according to the avant-garde tendencies of this market sensory experience.

Keywords: Innovation; Traditional candies; Strawberry and chilacayote.

Effect of Red Cactus Pear Powder on Pigmenting Yogurt

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The coloration of the red cactus pear is due to betalains; these are pigments that give red-purple and yellow-orange coloration. One way to harness the potential of pigmentation of betalains and its use in the formulation of foods high consumption. However is necessary to evaluate the changes that could cause. The aim of this study was to evaluate the effect on the physical and chemical properties in yogurt pigmented with red cactus pear powder (RP). The powder was obtained from juice of red cactus pear, through spray drying (160 °C inlet temperature, 90 °C outlet temperature and at 4.5 bar air pressure) was obtained using as auxiliary β -glucans (30% w/v). In RP obtained was evaluated a_w , water solubility index (WSI) and color parameters (L^* , a^* and b^*). Then RP was used as colorant in the formulation of yogurt. The yogurt was made from milk and RP was added (0, 0.6, 1.3 and 2% w/v) and a commercial yogurt was obtained. In the yogurt color (L^* , a^* and b^*), pH, moisture, density, apparent viscosity, syneresis, and betalains content were determined. The RP present $0.34 \pm 0.01 a_w$, 0.79 ± 0.6 WSI, while L^* , a^* and b^* were 48.22 ± 0.78 , 28.57 ± 0.47 and 17.83 ± 0.34 , respectively. The results analyses shown that moisture (85%) and pH (4.1) were not affected significantly ($p < 0.05$) by addition and increasing of RP. While, a greater RP addition significantly increase ($p < 0.05$) the apparent viscosity of yogurt (4.67-5.14 Pa·s) compared to the control (4.25 Pa·s), but shown lower apparent viscosity that commercial yogurt (11.37 Pa·s). a^* , b^* , density and syneresis showed significantly increase ($p < 0.05$) by greater addition of RP, finding that using percentages of 1.3 and 2% present a tendency to red significantly ($p < 0.05$) equal that obtained in commercial yogurt, but with higher tendencies to yellow color. By the other hand, a slight increased density and increased syneresis due to the greater addition in the RP is obtained. Moreover as expected betalains content increased significantly ($p < 0.05$) by greater addition of RP. The RP can be used in the manufacturing of yogurt.

Keywords: red cactus pear, natural pigment, yogurt

Effect of the Composition of Amylase in the Glass Transition Temperature in Hard Candies.

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In preparing hard candies, proper selection of the components of the mixture and incorporation of compounds of high molecular weight, allow to obtain sweet with high mechanical stability, to achieve this goal should be taken into account certain parameters, the most important is is the glass transition temperature (T_g) which is a physicochemical property that limits the glassy state of gummy in hard candies and therefore influences the final quality of the products. Control and alteration of the T_g can be achieved by varying such factors as the water content and the addition of different compounds with different molecular weights. The aim of this study was to evaluate the effect of the composition of amylase in T_g with respect to the composition of: fructose, dextrose, mannose, lactose, sorbitol and mannitol. To this end samples were prepared with different compositions and mixed at a temperature of 120 °C for 15 minutes, The glass transition temperature was evaluated using a differential scanning calorimeter TA Instruments Model Q100 modulated (New Castle, DE, USA), which were performed three sweeps temperature from -50 to at 120 °C heating rate 10 °C / min for each sample, thus the T_g values were obtained. For mixtures of fructose and dextrose very similar values of 17.9 °C and 16.3 °C respectively they were obtained, however for mixtures with mannitol and sorbitol values were different, as values of 13.9 °C was obtained and -6.1 °C respectively, finally in the case of mannose value was 39.8 °C and lactose 64.26 °C. So we can see the higher molecular weight substances favor obtaining T_g values higher than the low molecular weight substances. Generally, one can distinguish the T_g as a quality control parameter that can be used to optimize the quality, stability and properties of the hard candy.

Keywords: hard candy; the glass transition; differential scanning calorimeter

WHEY BUTTER USED AS RAW MATERIAL

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Throughout time, man learned to transform the milk to keep it longer, and to change their consumption patterns. It is not easy to find raw material from which so many different products are obtained as in the case of milk. Approximately 85% and 90 % of it is discarded as whey, cheese and when 60% is produced when the case of the manufacture of butter. Generate whey is considered a major problem in the food industry due to the high degree of contamination that causes the average. The aim of this study was to develop a typical sweet (coconut candy) with acceptable sensory qualities, using the whey from cheese and/or milk plants (buttermilk). Moreover, the concentration of sucrose in the formulation was reduced using soy solids in order to produce a healthy product. The experimental design studied the effect of variables "type of whey used" with two levels of variation (cheese whey and buttermilk) and "concentration of soybean flour" in formulating the sweet (coconut candy) with two levels of variation (30 g and 50 g); on the quality characteristics of the final product. A sensory evaluation descriptive analytical applied using a hedonic scale of 0 to 9 points. It was found that the sweet (coconut sweets) made with buttermilk butter, had greater acceptance. The variable "type of whey used" significantly affected all quality attributes typical sweet (taste, color, smell, texture and overall acceptability), in contrast, the variable "concentration of soybean flour in the sweet" did not significant effect for either of them. Finally it was observed that all the elaborate formulations, had an acceptance above 68%.

Keywords. Buttermilk, whey, coconut candy, handcraft candies

Mass Transfer Modeling and Water Diffusivity Estimation during Drying of Stone Fruits

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A mass transfer model was proposed to describe the moisture evolution during drying of stone fruits (drupes), where product is considered to be a solid formed by two concentric spheres of different radii. Insulated and convective boundaries were considered at spheres interface and product surface, respectively. The model was analytically solved under different values of inner radius and mass Biot number. Experimental validation included water diffusivity estimation during drying of peeled and unpeeled plum (60°C) by using a simple linear regression approach with both current model and well-known sphere solution. Statistical significance of water diffusivities was evaluated through their 95% confidence intervals (95% CI). With current approach, water diffusivities were identified as 1.59×10^{-9} (95% CI = $1.54 \times 10^{-9} / 1.64 \times 10^{-9}$) and 1.04×10^{-10} m²/s (95% CI = $1.00 \times 10^{-9} / 1.08 \times 10^{-9}$) for peeled and unpeeled plum, respectively. Moreover, results indicated that water diffusivity is overestimated (38 and 28% for peeled and unpeeled plum, respectively) when volume occupied by inner stone is not considered in calculations. While applied to a convective drying process, current results may be generalized to describe mass or heat transfer in other processes, such as osmotic dehydration, heating or cooling.

Keywords: Analytical solution; Drying; Mass transfer; Stone fruit; Water diffusivity

Preparation and physicochemical and morphometric characterization of Pickering emulsions with amaranth starch.

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Pickering emulsions are characterized by containing two immiscible liquids stabilized by solid particles as the surfactant agent. Recently, Pickering emulsions have gained interest in food science and technology. The technological and scientific background is largely unexplored. In this study, a physico-chemical and morphological characterization of oil-in-water (30% canola oil) emulsions, stabilized exclusively by food grade particles (native amaranth starch (NS) and modified amaranth starch (MS)) was performed by high shear stirring (ultraturrax) at 11,000 rpm for 1 min. Data on the size of the micelles, zeta potential, and emulsion stability were obtained. Increasing the concentration of NS particles from 2% to 30% w/v generated smaller micelles (1067 and 637.3nm respectively) good stability (2.40 at 30% w/v). In the case of MS micelle size increased with their concentration (1205.3nm at 2% and 1465nm at 30% w/v) and good stability (3.73 at 30% w/v). The zeta potential was influenced by the particle concentration (the higher the concentration, the lower the zeta potential) Staining of starches and oil was also performed for observation in a confocal laser scanning microscope where the formation of micelles was demonstrated. The present study showed that the manipulation of the interfacial microstructure of emulsions, based on the formation of a thick interface of food grade particles around the micelles of oil. (Pickering emulsions), is an effective approach to protection lipids.

Keywords: Pickering emulsion, amaranth starch, solid particles

Physicochemical Changes of Pepsin-Solubilized Collagen in Jumbo Squid (*Dosidicus gigas*) Muscle After Cooking Process

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Collagen is the major connective tissue protein and one of the main constituents of the giant squid (*Dosidicus gigas*). It plays an important role since it is responsible for the union between various cells, hence there is a close relationship between its behavior and muscle firmness during cooking. Therefore, in this study, changes in pyridinoline content (the major cross-linking molecule in collagen fibers), thermal resistance and solubility of the connective tissue of jumbo squid muscle (mantle, fins and arms) after cooking (100 °C/30 min) were evaluated. Pepsin-solubilized collagen (PSC) was extracted and compared with the insoluble collagen (IC). A decrease in the thermal resistance of PSC and IC was found after cooking process. Furthermore, pyridinoline content in mantle affects the solubility of the different collagen fractions during the cooked period. Finally, the electrophoretic and aminoacids profiles reveals that structural changes occur in the different types of collagen, causing changes in the muscle texture, due to an increase in the thermal resistance of connective tissue and decrease in solubility.

Keywords: Jumbo squid, muscle, cooking, collagen.

Research Proteolytic Compounds of Fruits *Bromelia karatas* and *Bromelia pinguin*, Endemics Fruits Grown in Nayarit, México

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The proteases are obtained mainly from microbial and animal sources, however plant enzymes are becoming increasingly important due to its hydrolytic action in a wide range of temperatures and pH. Plant proteases are employed in diverse industries such as tenderization, tooth whitening, cheese industries, and baking industry. This proteases are classified in four classes: serine-proteinases (EC 3.4.21), cysteine-proteinases (EC 3.4.22), aspartic-proteinases (EC 3.4.23), and metallo-proteinases (EC 3.4.24). Bromeliaceae is a plant family characterized by produce large amounts of peptidases of which many have been isolated. In this sense highlight the proteases of *Bromelias* family, group they belong to the fruits of *Bromelia karatas* (*B karatas*) y *Bromelia pinguin* (*B pinguin*). The fruits of both plants had been investigated previously, however had observed difference between fruits from Cuba and Puerto, so it is interesting to study the bromelias of Nayarit, Mexico. In this work proteases both the fruits of bromelias are studied. Research began with the study of proteases of these endemic plant through extraction, precipitation and concentration by diafiltration to be subsequently fractionated on the one hand with size exclusion chromatography and the other with exchange chromatography ionic; also there were analyzed for electrophoresis, zymogrammes and isoelectric focusing. The results show that extracts of both fruits are composed of a group of proteases with molecular weights of about 60 kDa, but different PIs, which are found in quaternary structures needed to present proteolytic activity and to denature are segmented into fragments of about 20 and 10 kDa. The data found are important because it starts with the generation of knowledge of these endemic plants that may allow greater use both in the industrial area and in health

Key words: plant proteases, endemic, *Bromelia karatas*, *Bromelia pinguin*.

Analysis of Shrinkage and Deformation Characteristics during Drying of Gel Model Systems

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Shrinkage and deformation (SD) characteristics during convective drying of gel model systems shaped as square strips (9.53 mm × 9.53 mm × 80 mm) and longitudinal sections of circular cylinders (12.7 mm × 140 mm) were investigated. Samples were air dried at 70°C with an air velocity of 2 m/s. Changes in contour shape, perimeter, and cross-sectional and specific areas of samples were obtained by analyzing the digital images of perpendicular product slices. Product contours were averaged to extract the relevant characteristics of dried samples while compactness and roundness were used as shape factors for evaluating product deformation. Water diffusivity was corrected or not for product shrinkage and estimated via a linear regression approach. Results demonstrated that although shrinkage occurs from the beginning of drying, product deformation was only noticeable after the free moisture fraction was below 0.3. Water diffusivities for all studied geometries were estimated in the narrow ranges of 6.7-7.6×10⁻¹⁰ and 2.0-5.2×10⁻¹⁰ m²/s without shrinkage and corrected for shrinkage, respectively. The proposed protocol can be used to successfully extract the SD characteristics of dried products for their use in detailed simulations.

Keywords: Deformation; Drying; Image analysis; Shrinkage; Water diffusivity

Chemical Changes in Nixtamalized Tortillas with different Nejayote and Calcium Concentrations

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Nixtamalization process is important for physiochemical, nutritional and sensory characteristics of corn-based products including the removal of the pericarp and incorporation of calcium into the kernels. This process generate high amount of wastewater (nejayote), which pollutes the environment. Recent investigations have documented that nejayote contain antioxidant, carotenoids, anthocyanins, flavonoids, ferulic and other phenolics. Hence, the aim of this research was to evaluate total phenols (free and bond) and chemical composition (protein, fat, ashes and fiber) of nixtamalized tortillas with nejayote. Experiments design with two factors and three levels of variation was applied. The factor concentration of nejayote in the tortilla was processed as followed: nixtamalized tortilla without nejayote: the control tortilla (TC), nixtamalized tortilla with nejayote diluted TN1 (50:50 nejayote/water) and nixtamalized tortilla with nejayote diluted TN2 (70:30 water/nejayote). The factor two was concentration of calcium (0.8%, 1% and 1.2%). Total phenols and chemical composition (protein, fat, ashes and fiber) of nixtamalized tortilla with nejayote were analyzed. Statistical analysis for free and bond phenols showed significant difference among calcium and nejayote concentration, and its interactions. Mean analysis between TN1 1.2% and TN2 1.0% showed no significant difference. Likewise, TN1 1.0 and TN2 1.2 % do not show significant difference. Moreover, treatments TC 0.8%, 1.0% and 1.2% were significantly different with treatments TN1 1.2%, TN2 1.0%, which presented the highest values of free phenols. Conversely, free and bond phenols content lowest was for TMC 0.8 %. Results of protein, fat, ashes and fiber showed significant difference among calcium and nejayote concentration. In addition, to nixtamalizar with nejayote increases phenols content, this could improve human health, because some research of epidemiological suggests consumption of phenolic and antioxidants compounds prevent chronic and degenerative diseases including cardiovascular disease.

Keywords: Nejayote, Free phenols, Chemical composition, Calcium

Effects of Microfluidization Process on the Micelle Size and Zeta Potential in Oil in Water Emulsions (O/W)

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In food industry, oil in water emulsions (O/W) are usually produced using high-energy methods, such as microfluidization. These methods generate intense disruptive forces that mechanically breakup the oil phase into tiny droplets that are dispersed within the aqueous phase. In this work, O/W emulsions were obtained by microfluidization process using corn oil in the oily phase with gum arabic as wall material and type I water in the aqueous phase. D-optimal surface response design (Software Design Expert Version 7.1.0) was used with different concentrations of wall material: corn oil (5:1, 3:1 and 1:1) as a categorical variable, and microfluidization pressure (6,000/10,000/14,000 psi) and microfluidization cycles (1, 2 and 3) as numerical variables. The response variables were the micelle size (PS) and the zeta potential (ζ) (Z Sizer, Malvern Nano S-90, USA). The PS and ζ varied in the range between 318.67 and 1231.33 nm and -32.8 to -43.1 mV, respectively. From the surface response, 2FI equation were obtained with a $R^2=0.84$. For PS, the gum arabic concentration was the variable that had the greatest influence, finding that increasing the gum arabic concentration result in a decrease of micelle size. The PS obtained in the experiments was reduced from 1231.33 to 318.67 nm and increased to 493.13 nm for the first and second microfluidization cycles, respectively. The ζ values indicate a good electro-kinetic stability between particles. The values of P less than 0.05 indicate that model terms are significant, the operating pressure, the number of microfluidization cycles and the gum arabic concentration had strong effects on the particle size of the resulting emulsions ($P<0.5$).

Keywords: Emulsions; microfluidization; micelle size.

Supercritical Carbon Dioxide Extraction of Capsicum Oleoresin and Capsaicinoids

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The diversity of crops that exist in Mexico, it is important to seek alternatives to add value to the fruits or cultivated plants, making the country the largest exporter of green chilies worldwide and the sixth of dried chilies. Capsicum oleoresin has complete essence of its features like pungency and color. The pungent components of Capsicum genre include least five compounds known as capsaicinoids (capsaicin, dihydrocapsaicin, nordihydrocapsaicin, homocapsaicin and homodihydrocapsaicin). This paper proposed the objective of evaluating the effect of pressure, temperature and flow of supercritical carbon dioxide on the extraction yield and concentration of capsaicinoids of arbol chili (*Capsicum annuum* L). The extraction was carried out under conditions of pressure and temperature above the critical point of CO₂, 71 bars and 31 °C, using an equipment with capacity of 500 ml in the extraction vessel. An orthogonal experimental design type with star 22 and the center point replicates was applied, at a pressure of 200 to 400 bars, temperature of 40 to 70 °C and flow of 5 to 25 g/min CO₂. The sample was dried and ground to an average particle diameter of 0.322 mm. two response variables, performance and concentration of total capsaicinoids were contemplated and to make the analysis of the results was observed that the pressure is a critical parameter for both response variables obtaining the highest yield of 10.1% (m/m) with a flow 5g/min of CO₂ and the highest concentration of 27.278 mg/kg of total capsaicinoids in conditions of 400 bar and 70 °C. Another variable assessed was the change of flow under conditions of 300 bar and 55 °C, and found that the best extraction flow for yield was 15 g/min obtaining yields of 12.5 to 13.0 % and for greater concentration of total capsaicinoids are it determined that a flow of 10g/min CO₂ was the most convenient.

Keywords: supercritical extraction, capsaicinoids, capsicum oleoresin

Physical Properties and Morphometric Parameters in the Popping Process of Popcorn (*Zea mays*) By Digital Image Analysis

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Expansion is a common phenomenon in process chain on food, thermal, pharmaceutical industries, among others. It has been developed to optimize production and life of foods such as cereals and mainly popcorn maize, allowing quality parameters to improve storage and efficiency. Furthermore, knowing the physical properties of a food improves consumer acceptance. Relations between the morphology of popcorn and physical properties is a very complex object of study and poorly studied due to their heterogeneity. The production and consumption of popcorn has increased over time in major forms of consumption like domestic, ready for consumption and industrial. The aim of this study was to determine the relationship between the physical properties and morphology of popcorn by digital image analysis (DIA). 470 popcorn kernels were conditioned into an oversaturated solution of NaCl and then popped on a hot-air popper model OFP501COKE (Nostalgia ElectronicsTM LLC.). The physical properties analyzed were sphericity, kernel volume (V_p), kernel Surface area (S_p), and angle of repose. The morphometric parameters were area, perimeter, circularity, Feret, aspect ratio, roundness and solidity using ImageJ software for DIA. The data were analyzed with analysis of variance (ANOVA) and a completely randomized experimental design. Results showed that, the physical properties of popcorn were dependent on the parameters analyzed. The morphology of popcorn is classified in mushroom, unilateral, bilateral and multilateral depending on its appendices. The physical properties relating to the morphometric parameters showed clusters that allows popcorn classification. Morphologies have common parameters such as V_p , S_p , area, perimeter, and circularity. The physical properties of each morphology were the result of the energy dissipated during the expansion process. Therefore, by expansion phenomenon different geometric structures can be classified by their physical properties and morphometric parameters, contributing to quantitative analysis and understanding of the possible structures formed.

Keywords: popcorn, morphology, image analysis, quality parameters)

Preliminary Study to Obtain Stable Nano-emulsions –based Delivery Systems of Green Mandarin Essential Oil (*Citrus reticulata*)

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The study of emulsions is gaining great interest and importance because there is a wide range of development processes as well as products such as real applications we use every day. Within this field of study the use of nano-emulsions has major advantages over emulsions, because the small droplet size can extend the application range, with an improved kinetic stability as compared to emulsions. This research focuses on the formulation of oil-in-water nano-emulsions (O/W) comprising green mandarin essential oil droplets, stabilized with a natural biopolymer and nonionic sorbitan-based surfactants, which have been prepared by high pressure homogenization processing (M-110P Microfluidizer, Microfluidics, Newton, MA); formulation parameters and processing conditions were varied in order to assess the effect of droplet size of the nano-emulsions. Pre-emulsions were passed up to 10 passes through the high pressure homogenizer (1500 bar) and 3 different nano-emulsions formulations were prepared. The results of physical stability and droplet size distribution, the best nano-emulsion formulation has a lipid phase composition of green mandarin oil and soybean oil in ratio 2:1, and fixed concentrations of 0.4 wt% of chitosan solution along with 1.5 wt% of surfactant, which presented an average droplet diameter of 50.24 ± 0.25 nm and a PDI 0.24 ± 0.01 . These values were obtained when the emulsion was processed 7 passes, and in particular, it was noted that an increase of number of passes favored a smaller droplet size. These results can contribute to a more rational and functional design of nano-emulsion-based delivery systems for citrus essential oils, however further research is necessary in order to evaluate the desired function within the food system.

Keywords: mandarin essential oil, nano-emulsions, droplet size

Antioxidant Activity of system silica-based nanoparticles functionalized with citrus nonvolatile fractions.

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The Nanotechnology have been widely used in the design of food ingredients. The addition of new natural ingredients in our everyday foods is gaining popularity. Different studies have demonstrated that nanoparticles (NPs) are very effective in stabilizing several types of bioactive molecules; therefore, the aim of this study is to apply nanoparticle as a delivery system of natural antioxidant citrus nonvolatile fractions. In this sense, we report the synthesis and functionalization of silica nanoparticles with nonvolatile fractions from refined orange and lemon essential oil. Firstly, antioxidant activity (A.A) of the nonvolatile lemon (NVL) and orange (NVN) fractions were evaluated by DPPH and ABTS assays. DPPH values of NVL and NVN were 23% and 42% respectively. The antioxidant activity by ABTS of NVL and NVN were 41% and 67% respectively. The Silica nanoparticles were synthesized by Sol-Gel; they were then functionalized with NVL and NVN, using APTES as a coupling agent. A physicochemical characterization, by FTIR, confirmed an important interaction due to the formation of NPs Si/APTES/NVL and NPs Si/APTES/NVN by means of hydrogen-bonds ($3700-3000\text{ cm}^{-1}$). Asymmetric vibration of Si-O (1100 cm^{-1}) and asymmetric vibration of Si-OH (960 cm^{-1}) adducts further strengthening of APTES-functionalization through van der Waals forces. However, during surface functionalization, OH groups react with the APTES forming Si-O-Si bonds, peak decreases at 941 cm^{-1} . ORAC antioxidant activity NPs Si/APTES/NVL and NPs Si/APTES/NVN were obtained by a 1:20 dilution of a $1.5\text{ }\mu\text{M}$ initial solution; values were Si/APTES/NVL 68.1 % and Si/APTES/NVN 98.8%. The antioxidant efficacy of nanosystem compared to a standard antioxidant at the same concentration (for example A.A by ORAC BHT= 98%) has been proven to possess better bioactivity. This data supports the application of innovative material in the food industries.

Keywords: lemon, orange, silica nanoparticles, antioxidant activity

Physicochemical and molecular characteristics of pulse-derived protein ingredients, obtained in a pilot plant facility.

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A pilot plant scale process was used to isolate proteins from four starchy legumes (broad bean, chickpea, lentil and white bean). The physicochemical, functional properties and protein digestion characteristics of the parent flours and the extracted proteins were analyzed and correlated with their molecular characteristics quantified by Attenuated Total Reflectance Fourier Transformed Infrared Spectroscopy (ATR-FTIR). During the pilot plant protein extraction process we obtain a yield of 24.16 to 30.26% for white bean and broad bean respectively, with recovery values from 50.12 to 70.15% of the available protein for the same legumes. The protein amount ranged from 68.27 up to 86.58% for chickpea and broad bean protein materials respectively. The protein legume materials showed $\geq 80.59\%$ of protein digestibility according to an *in vitro* test. Recovered proteins showed residual phenolic compounds (from 0.02 to 0.85 mg of gallic acid eq. /100 g). Some functional characteristics of the proteins related with water and oil absorption were evaluated, founding water absorption indexes from 3.46 to 4.22 (for chickpea and broad bean respectively), while fat absorption index ranged from 2.34 to 3.32 for white bean and broad bean, respectively. The spectral analysis of the molecular structures of the proteins showed positive and significant correlations (by Pearson analysis) with some of its functional properties, which may be related with the Amide III group, and could have influenced emulsion and foam characteristics, which can be useful for specific food applications in which these properties are desired using a continuous pilot plant scale process.

Keywords: Pilot plant, legume flours, protein extracts, functional properties, ATR-FTIR.

Influence of drying method on bioactive compound content and visual quality of *Brassica* leaves

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Currently, the use of by-products of plant origin, such as tissues and leaves that surround fruits and vegetables, is a topic of great interest in agri-food research. Although not utilized, these plant parts may possess bioactive compound contents similar to those of the fruits themselves. Various studies show that a diet rich in vegetables from the *Brassica* family (mainly broccoli, cabbage, cauliflower, and Brussels sprouts) can contribute to preventing and reducing the effects of certain cancer-related conditions, thanks to being rich in phenolic and flavonoid compounds and other antioxidants. However, the amount of these compounds depends on several factors, including the specific part of the plant and its processing prior to consumption. In this sense, the drying method can significantly affect the physical, sensory, and nutritional properties of the products. Therefore, the aim of this work was to study the effects of drying temperature on visual and nutritional quality of the outer leaves of broccoli, cauliflower, and cabbage, by means of measuring their color and bioactive compound content, respectively. The samples were dried by two methods: freeze-drying (also known as lyophilization), FD (-40°C) on the one hand and hot air drying, HAD (30, 40, 60 and 70°C) on the other. Posterior to the drying process (both FD and HAD), the color of the final product was measured by computing its CIEL*a*b* color coordinates. Also, the content of phenolic and flavonoid compounds as well as total chlorophyll present in the samples were determined. Regarding color changes in the dehydrated leaves, an increase of HAD temperature provoked a significant reduction in the L*, a*, and b* coordinates (lightness, green and yellow color, respectively). Samples treated by HAD at 60°C yielded a phenolic, flavonoid, and total chlorophyll content that was equal and in some cases even higher than in samples treated by FD. These results suggest that FD is less detrimental to the visual quality of dehydrated products than HAD. However, the faster and more economical HAD method proves to be more effective in concentrating bioactive compounds in *Brassica* leaves, which could result in a cost-effective exploitation of these by-products.

Keywords: By-products, Freeze-drying, Hot air drying, Color, Bioactive compounds

Effect of the Composition of Amylase in the Glass Transition Temperature in Hard Candies.

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In preparing hard candies, proper selection of the components of the mixture and incorporation of compounds of high molecular weight, allow to obtain sweet with high mechanical stability, to achieve this goal should be taken into account certain parameters, the most important is is the glass transition temperature (T_g) which is a physicochemical property that limits the glassy state of gummy in hard candies and therefore influences the final quality of the products. Control and alteration of the T_g can be achieved by varying such factors as the water content and the addition of different compounds with different molecular weights. The aim of this study was to evaluate the effect of the composition of amylase in T_g with respect to the composition of: fructose, dextrose, mannose, lactose, sorbitol and mannitol. To this end samples were prepared with different compositions and mixed at a temperature of 120 °C for 15 minutes, The glass transition temperature was evaluated using a differential scanning calorimeter TA Instruments Model Q100 modulated (New Castle, DE, USA), which were performed three sweeps temperature from -50 to at 120 °C heating rate 10 °C / min for each sample, thus the T_g values were obtained. For mixtures of fructose and dextrose very similar values of 17.9 °C and 16.3 °C respectively they were obtained, however for mixtures with mannitol and sorbitol values were different, as values of 13.9 °C was obtained and -6.1 °C respectively, finally in the case of mannose value was 39.8 °C and lactose 64.26 °C. So we can see the higher molecular weight substances favor obtaining T_g values higher than the low molecular weight substances. Generally, one can distinguish the T_g as a quality control parameter that can be used to optimize the quality, stability and properties of the hard candy.

Keywords: hard candy; the glass transition; differential scanning calorimeter

Levels and profiles of phytochemicals and antioxidant activity of tortillas elaborated by extrusion cooking process from blue maize

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In Mexico, blue grain maize (*Zea mays* L.) is used to produce several kinds of foods, such as tortillas. The variability of anthocyanins and pigments present in blue maize may represent a potential supply for dyes and natural antioxidant products that can be used as a health promoter. The objective of this study was to evaluate the effect of lime-cooking extrusion process to determine the levels and profiles of phenolic compounds, anthocyanins, phenolic acids, and antioxidant activity in tortillas elaborated with blue maize. The blue tortillas retained 92 and 25% of the total phenolic content (sum of both fractions, free + bound) and anthocyanins, also, it was an increment on the antioxidant activity on 8% (ORAC) and 10% (DPPH), with respect to the unprocessed maize. Six phenolic acids were identified on both fractions, free and bound, in unprocessed maize and tortilla (ferulic, sinapic, syringic, vanillic and *p*-hydroxybenzoic acid), of which, ferulic acid was predominant (86% abundance), followed by *p*-coumaric and sinapic acid. However, the transformation of unprocessed maize to tortillas showed an increment on the concentration of these phenolic acids. For the anthocyanins profile, six different types were identified in unprocessed maize and tortillas: cyanidin-3-glucoside, pelargonidin-3-glucoside, peonidin-3-glucoside, cyanidin-3-(6"-malonyl glucoside), pelargonidin- 3- (6"-malonyl glucoside) and cyanidin-3- (6"-succinyl glucoside). As a general conclusion, the high content of phenolic compounds, antioxidant activity and cyanidin in blue maize tortilla, turned it as an attractive unprocessed material for food products with nutraceutical potential.

Keywords: Antioxidant Activity, Anthocyanins, Extrusion process, Phenolic acids, Maize, Tortilla.

Encapsulation by Spray Drying of Lemon Oil with Mesquite Gum – Nopal Mucilage Mixtures

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The use of mixtures of biopolymers is increasing in the development of food products in order to improve their functional properties. In this work was proposed the use of mesquite gum (MG), nopal mucilage (NM) and their MG-NM mixtures in different proportions (75-25; 50-50; 25-75), for evaluating their emulsifying and encapsulant properties. This study was divided three stages. The first stage consisted in a physicochemical and rheological study of MG-NM solutions at 30 w/w. A zeta potential (ZP) analysis allowed determine that MG-NM mixtures had more negative values than MG and NM. Also, viscosity curves allowed to know that MG-NM mixtures and NM had a pseudoplastic behavior and these were adjusted to power law model and through dynamic tests it was identified the prevalence of viscous modulus over elastic modulus. In the second stage, five emulsions of lemon oil (LO) were formulated with 40% (w/w) of total solids and core to wall ratio of 1:3. The emulsions with smaller droplet size were those stabilized with MG ($d_{4,3} = 1.53 \mu\text{m}$) and MG-NM 75-25 ($d_{4,3} = 1.49 \mu\text{m}$), as the concentration of NM in emulsions increased, the droplet size also did it, this was clearly observed through micrographs obtained by Laser Scanning Confocal Microscopy. A ZP analysis of emulsions allowed determine that the more negative values were obtained when the concentration of NM increased in the emulsions. The viscosity curves of the five emulsions had a pseudoplastic behavior and these were adjusted to power law model. In the third stage, the emulsions were dried by spray drying for obtaining microcapsules. After analysis of particle size, the microcapsules with the smaller particle sizes were MG ($d_{4,3} = 11.91 \mu\text{m}$) and MG-NM 75-25 ($d_{4,3} = 21.46 \mu\text{m}$), the lower concentration of NM in the microcapsule, the lower particle size. Likewise it was determined the retained volatile oil, thereby the higher oil retention was obtained by microcapsules of MG ($74.4 \pm 1.8\%$) and MG-NM 75-25 ($70.3 \pm 1.7\%$). Finally, an oxidation kinetic of the microcapsules was done to compare the different wall materials in reference to oil protection.

Keywords: Mesquite gum, Nopal mucilage, rheology, emulsions, microcapsules

Effect of Cooking on the Content of Bioactive Compounds in Peppers

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Fruit of eight pepper types (Poblano, Chilaca, Caribe, Bell, Habanero, Manzano, Jalapeño and Serrano) at different stages of ripening were thermally treated following household procedures. Samples of each pepper type were boiled at 96°C in a covered pan or grilled on a hot plate at 210°C. Treated peppers were evaluated for their content of several bioactive compounds and compared levels found in raw peppers. Contents of capsaicin, dihydricapsaicin, total phenolics, ascorbic acid, total carotenoids and β -carotene in raw peppers varied widely among pepper types. Losses of ascorbic acid and β -carotene caused by heat treatment ranged from minimal to high. Moderate losses in capsaicinoids were induced by boiling while grilling caused a significant increase in the content of these compounds. Boiling and grilling sequentially increased the total phenolic content in pungent peppers. Total phenolic content in Bell peppers was reduced by heat treatment. Serrano peppers were rich in many bioactive compounds.

Keywords: Antioxidants, *Capsicum spp*, Healthy vegetables, Nutraceuticals, Thermal treatment

Characterization and Emulsifying Properties of Tamarind Seed Mucilage Obtained by Spray Drying

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Mucilages extracted from seeds are sources of natural hydrocolloids with low-cost offering a low-calorie intake turning it in an ideal product for the development of health foods with beneficial properties to human consumption. The seed mucilage is a natural polysaccharide composed of β -(1,4)-D-glucan backbone substituted with side chains of α -(1,4)-D-xylopyranose and (1,6)linked [β -D-galactopyranosyl-(1,2)- α -D-xylopyranosyl] to glucose residues, where glucose, xylose and galactose units are present in the ratio of 2.8:2.25:1.0 as the monomer units and with a molecular weight of 720 - 880 kDa. The aim of this work was to characterize (thermal and morphological) and to evaluate the emulsifying properties of tamarind seed mucilage in order to enhance the potential applications of this hydrocolloid. Thermal analysis of the mucilage was done with TGA and DSC which showed that the mucilage was thermostable until 315 °C. The mucilage showed irregular shape, concave and shriveled surface, which are typical characteristics of spray dried products. Most of the particles showed no apparent cracks or fissures. Swelling index of tamarind seed mucilage was determined at temperatures of 25, 45 and 65 °C, pH values of 3, 7 and 12 and salt concentrations (0.5, 20 and 50 mM) founding that higher temperature, higher pH and lower concentration of salt improved these properties. The oil holding capacity using corn oil and water holding capacity diminished when temperature increased (25, 45 and 65 °C). The emulsifying stability evaluated by the E24 emulsification index at 25 °C was 43.75 \pm 0.35% indicating that this mucilage could be used as emulsifier. Creaming index using corn oil at different volumetric fractions (0.001, 0.005 and 0.01) at 25 °C was higher (values from 1.43 to 5.26%) at higher oil fractions. Therefore, the mucilage can be considered as a potential emulsifier in food industry.

Keywords: Tamarind seed mucilage, Thermal properties, Emulsifying properties, Spray drying

Synthesis and characterization of biofilms based of chitosan - pectin and reinforced beet extract for the coating food

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The conventional food packaging generate a lot of wastes, besides manufacturing these is increasingly expensive, however they have a great demand. An alternative to reduce the environmental impact caused by wastes from packaging or containers petroleum, is combining petroleum-based materials with natural materials or replace entirely by natural materials such as: natural polymers, these have different properties, the most prominent are biocompatibility and biodegradability. Another option is to use products wastes, especially the food industry, for suitable materials for manufacturing food packaging. Films that cover food must meet a main function is to contain and protect food, to be a viable option in replacing conventional. In addition to having good properties, thermal, mechanical and morphological. Polymers as chitosan extracted from crustaceans shell with antimicrobial properties, biodegradable, biocompatible. As well as the pectin is extracted from citrus, biocompatible, biodegradable, semipermeable to gases and gel forming properties. Compounds such as antioxidants help slow the rate of respiration of food, as well as the neutralization of gases or volatile compounds. Therefore, the objective of this research was to synthesize biofilms on the basis of chitosan, pectin and beet extract and select reinforced blends with good structural and morphological properties. The films were characterized by FT-IR and SEM. The structural properties based films were observed by SEM, pectin showed a cross-sectional area in layers, while films to chitosan base and films composed of chitosan 75 % - pectin 25 % showed a smooth cross-sectional area. The presence of functional groups present in the pectin is corroborated groups were: COOH and C=O and C-C bonds, in chitosan were: NH and CH₃ and C-C bonds, on the other hand in hybrid films COOH, C=O, NH and C-O and C-H bonds are found with FT-IR. It was concluded that the use of these agro-industrial wastes applicable for formulating coating materials for the food is of great environmental and economic benefit.

Keywords: chitosan, pectin, antioxidants, coating food.

Rheological and Thermal Properties of Native Starch from Apple Fruit During Ripening

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The aim of this work was to evaluate the effect of development and fruit ripening on the thermal and rheological properties of starch from apple fruit. 'Golden Smoothie' apples were harvested at 50, 60, 70, 80, 90, 120, and 140 days after full bloom (DAFB). Starch was isolated by wet milling. The physicochemical properties (total starch and amylose percent determination) were studied and the thermal and rheological properties were determined using differential scanning calorimetry (DSC), and flow curves at steady state, respectively. All experiments were done totally aleatorized and subject to analysis of variance (One-way ANOVA) using the Tukey test to determine significant differences among mean values ($p \leq 0.05$). Total starch concentration was constant in all starches isolated at different harvest time; however, the amylose percent increased with fruit ripening. The onset (T_o), peak (T_p) and conclusion temperature (T_c), and gelatinization enthalpy (ΔH_{gel}) of apple starch varied ($p < 0.05$) with fruit ripening. The lowest values were observed after 90 DAFB, when amylose percent was high. The decrease in T_p and ΔH_{gel} could be due to high level of crystallinity within starch molecules. All starches isolated exhibited typical curves of non-Newtonian behavior, where viscosity decreased as function of shear rate (shear thinning behavior), with behavior indexes < 1 ($n < 1$). All flow curves were properly fitted to the Ostwald de Waele model (also known as Power's Law; $R^2 > 0.99$). The consistence indexes (k) did not show definite trend; however the values observed were higher than reported in corn starch. Besides being affected by amylose-amylopectin ratio, starch rheological properties, are influenced by the size and shape of starch granules. Apple fruit showed a not transient synthesis-degradation process, which offer starches with thermal and rheological properties higher than found in some conventional sources. These properties could find application in the food and pharmaceutical industries.

Keywords: Apparent viscosity, shear thinning behavior, amylose, gelatinization enthalpy

Equimolar evaluation of $\text{Ca}(\text{OH})_2$ and calcium salts on rheological and structural properties of maize endosperm

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In Mexico the tortilla is a staple food. Its elaboration process is known from about 3500 years ago. Despite its age, still new researches are being carried out to understand the physical and chemical changes that occur during “nixtamalización” and to improve the process and final product quality. This thermal-alkaline treatment causes, among other things, starch gelatinization, which is mostly concentrated in the endosperm of corn grain. The objective of this research was to evaluate, using rheological and structural techniques, degradation of maize endosperm components, using $\text{Ca}(\text{OH})_2$ and calcium salts in equimolar concentrations during the process mentioned. Corn grains (Celaya variety) were used. The endosperm was ground and sieved (mesh 60). Five viscosity measurements were performed per treatment (Rapid Visco Analyser (RVA)) evaluating the addition of $\text{Ca}(\text{OH})_2$, CaCO_3 , CaCl_2 y $\text{C}_6\text{H}_{10}\text{CaO}_6$ keeping the same molar concentration (0.112 M), and a control treatment. The residue obtained of RVA test was dehydrated (24h, 40°C), ground, sieved and analyzed by Fourier transform infrared spectroscopic (FTIR) to determine changes in the components of endosperm. The maximum viscosity ranged between 5456 and 7385 cP, showing significant differences ($p < 0.05$) between all treatments, increasing when $\text{Ca}(\text{OH})_2$ was used. This viscosity decreased when the calcium salts were used. The FTIR spectra showed degradation of some components, especially of starch, for treatments with $\text{Ca}(\text{OH})_2$, based on the modification of the bands 3600, 2150, 2080, 1950, 1875, 1540, 1080, 990, 933, 860, 765 and 710 cm^{-1} , associated mainly with water, amylose, amylopectin and to stretching C-C bonds, C-O and the glucose ring, while treatments with calcium salts showed a modification in bands equivalent to treatment without addition of salts. Finally it is concluded that rheological and structural techniques employed, can be used to determine the starch degradation of maize endosperm during nixtamalización.

Keywords: endosperm, corn, calcium salts, equimolar, FTIR

Optimization of Spray Drying Process for Developing an Infant Formula Similar to Breast Milk

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Infant formulas (FI) in the market are made from cow's milk, therefore, differ in composition with respect to breast milk (BM). The protein content is higher in FI; however, the biological value of these proteins is less than BM. The objective of this study was to optimize the process conditions for spray drying process in the production of an infant formula with β -casein A₂ and rich in α -lactalbumin, in order to liken it as possible to human milk. Response surface statistical design was used, with two factors: percentage of solids and temperature. The one-way ANOVA test was used to compare the effect of treatments. The response variables were: moisture, solubility, brightness and peroxide value. The variable that showed statistically significant difference was the value of peroxides, with mean 6.9 and $p=0.001$. The temperature increase and feed solids content favored peroxide's synthesis, the highest values were 3.34 meq / 100kg. Other variables behavior we observed only trends, so we can notice the effect of the factors analyzed. The solubility increases as the temperature and percentage solids increase, the values obtained were greater than 99% in all treatments. Under high temperature and concentration of solids conditions, they produced lower levels of moisture in the powder (3.8%). The brightness decreases when the exposure time of the particles at high temperature increases. The optimization conditions founded were: inlet temperature 120 ° C and feed solids content of 40%, under these conditions the solubility, moisture, brightness and peroxide value were 99.95%, 4.46%, 93.04%, 2.37 mEq O₂ / kg, respectively. The protein composition in the elaborated infant formula (FE) was: 37.1% caseins, 23.1% of α -lactalbumin and 21.3% of β -lactoglobulin. The similarity of β -casein in FE with β -casein A₂ isoform was 99.82%. This research achieved optimized drying conditions and elaborate an infant formula similar to BM.

Keywords: infant fórmula, breast milk, optimization

Antiradical Capacity of Functional Cookies Added With Phenolic Extract of *Mangifera indica* Bark

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Mangifera indica L. (Anacardiaceae), commonly known as mango, is cultivated in some Mexican States as Chiapas, Nayarit, Sinaloa and Veracruz, among others. The main varieties are Haden, Tommy Atkins, Ken, Keitt, Manila and Ataulfo. There has been increasing interest in the study of mango phenolic from mango fruits, peels, seeds, leaves, flowers and stem bark due to their antioxidant and health-promoting properties. The majority compound is Mangiferin, a hydroxylated xanthone C-glycoside, highly concentrated in bark. In this study, *Mangifera indica* bark, Manila variety, was collected at Cotaxtla Veracruz, México. The milled bark was extracted with ethanol aqueous 70%, obtaining an extract yield of 29% w/w. This extract was added at flour to make cookies, at portion of 0.1% (M 0.1) and 0.5% (M 0.5) w/w. The biscuits were subjected at 280 ° C for 8 minutes for baking. The total phenolics content by Folin Ciocalteu and scavenging capacity of DPPH radical were measured in control sample (without extract) and M 0.1 and M 0.5. HPLC chromatogram was used to detect the stability of mangiferine after baking. Total phenol concentration in cookies control was 190.8 mg GAE/g, M 0.1 was 255.2 mg GAE/g and 281.9 mg GAE/g for M 0.5. The inhibition of DPPH radical were 56.1%, 61.6% and 67.7% in control, M 0.1 and M 0.5 respectively. Mangiferina could be identified as the main compound in cookies. The addition of low amounts of mango bark extract may improve phenolic and functional properties.

Keywords: Functionals cookies, *Mangifera indica* bark, phenols, antiradical activity, HPLC

Antimicrobial Capacity of Lactic Acid and Different Grapefruit Seeds Extracts against *Salmonella* spp. for Develop a Chitosan Edible Films

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Chitosan is a biopolymer that has been proved to be nontoxic, biodegradable, biofunctional, biocompatible and with antimicrobial effect. It is being used as edible film to extend the shelf life of fruits without affecting their color or flavor. To dissolve chitosan it is necessary to mix it with diluted solutions of organic acids like acetic acid. Therefore to obtain edible films of improved characteristics it is necessary to combine chitosan with additives like essential oils. The objective of this work was to determine the Minimal Inhibitory Concentration (MIC) by macrodilution method, of Lactic acid (natural $\geq 85\%$ Sigma Aldrich) and several grapefruit seed extract (Citrus powder and liquid, oleo species S. A. de C. V.; Killerbac and CMET, liquid; Empresa Cítrica) to develop a chitosan edible film with antimicrobial properties. MIC of the materials were determine against six strains of *Salmonella* resistant to rifampicin (Rf^+ , 100 $\mu\text{g}/\text{mL}$) isolated from avocado farms: *S. Agona* and *S. Anatum* (irrigation water), *S. Bardo* (composting), *S. Newport* (avocado peel), *S. Typhimurium* recovered from tomato and *S. Typhimurium* isolated from a clinic case. These strains were maintained in tryptone soy broth with incubation at 35°C for 24 h. Experiments were done in triplicate. Lactic acid and grapefruit extract exhibited a MIC with statistically significant difference ($p < 0.001$) among them for the strains tested. CMET (56.8 $\mu\text{g}/\text{mL}$) and lactic acid (337 $\mu\text{g}/\text{mL}$) showed the higher antimicrobial activity in comparison with Killerbac (416.1 $\mu\text{g}/\text{mL}$), Citrus powder (2,003.5 $\mu\text{g}/\text{mL}$) and Citrus liquid (15,003.5 $\mu\text{g}/\text{mL}$). Moreover, the mixture of lactic acid-CMET exhibited synergistic antimicrobial effect (130 $\mu\text{g}/\text{mL}$). These results indicate that lactic acid and CMET are synergistic and suitable additives for develop chitosan edible films with higher antimicrobial properties.

Keywords: Antimicrobial capacity, grapefruit seeds extract, chitosan, edible film

Establishment of a Pilot Processing Unit Agave Derivatives in San Mateo Ozolco, Puebla.

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Maguey sap or "aguamiel" that is considered a food has been used for health ancestrally, today we know more closely the benefits of its composition, so industrially the result of this knowledge has been the developed and patented of different processes for the production of syrups rich in fructose, or alcoholic beverages type beers as well as plant extracts. However, all these products come from one or two areas of our country. Outside of these producing areas and those with designation of origin, there are villages where the main economic activity was and is the cultivation of maguey, the decline in the culture of consumption of these products carries an inertial manner an economic and social lag for these people, this is the case of San Mateo Ozolco in the state of Puebla. Product development (unpatented) based maguey sap is an alternative to capture the mead that is currently produced in the study area and through market research, analysis hedonic acceptance of developed products and sales projections; it is possible to recover gradually maguey crops from San Mateo Ozolco and generate a strategic recovery model maguey crops. This paper shown the results of the first stage of investigation on the establishment of a pilot processing unit Agave derivatives.

Keywords: agave, industrialization, draft

Evaluation of physico-chemical and rheological properties of a creamy yogurt added with *Lactobacillus plantarum* Microencapsulated with *Aloe barbadensis* Miller

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Yogurt is a very popular functional dairy product and the rheology is one of the most essential component in its quality and important for the consumer preference. Probiotic bacteria are used in production of functional foods and play an important role in promoting and maintaining human health, so encapsulation is used as a way to protect bacteria against severe environmental factors. The objective of this work was to design and evaluate a yogurt with *Lactobacillus plantarum* microencapsulated with Aloe vera. *L. plantarum* was used as probiotic, combined to an alginate matrix with, without Aloe, encapsulated by extrusion, and added to a yogurt produced with antibiotic free cow's milk, *S. thermophilus* and *L. bulgaricus*. Treatments were: 1) Control yogurt without microcapsules, 2) yogurt with free probiotic (*L. plantarum*), 3) yogurt with *Lactobacillus plantarum* microencapsulated without Aloe, 4) yogurt with *Lactobacillus plantarum* microencapsulated with Aloe. Physicochemical and rheological properties were evaluated. A Color was determined by a Minolta 300 Colorimeter expressed as Luminosity, Chroma and Hue, acidity was measured with NaOH 0.1 N titration calculating lactic acid percent. Rheological parameters were realized with a concentric Rheometer Rheolab QC Anton Paar with CC39 geometries. Experimental design was a one way factorial with 5 repetitions and data was analyzed with an ANOVA with a 0.05 significance level. Results obtained show no significative difference either in the physiochemical or rheological properties, so it can be assumed that the probiotic encapsulation added to a yogurt does not affect them besides and yogurt had a pseudoplastic behavior with all treatments. It is recommended to determine a sensorial analysis and viability for probiotics.

Keywords: Yogurt, probiotics, microencapsulation, rheological properties.

Pectin films obtained by electrospraying and casting methodology. A comparative study.

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The development of micro and nanostructured materials in the food area becomes more important every day. These materials are usually prepared by two techniques: "top-down" and "bottom-up" and as part of the last one, electrospraying has been proposed for the production of nanoparticles, nanofibers and nano-capsules, and could be a good alternative for development of edible and / or biodegradable films, topic that has been scarcely studied. Electrospraying technique was used for the production of pectin films obtaining transparent and flexible products with thicknesses of $23.4 \pm 3.04 \mu\text{m}$ and requiring a lower pectin solution volume ($2.67 \times 10^{-3} \text{ mL}$) than casting ($5.97 \times 10^{-3} \text{ mL}$) to produce films of the same area and thickness; the physical, structural and thermal characteristics of these films were evaluated. Electrosprayed films were slightly more transparent, and with smoother surface than those obtained by casting, but with more and smaller internal pores, resulting in different film densities (0.7 g/cm^3 electrospraying, 1.7 g/cm^3 casting), that could be linked to the larger water vapour permeability value obtained. These changes could be related to a physical phenomenon, seeing as the percentage of crystallinity and melting temperature remained invariable for both films. These results show that the electrospraying technique has potential in areas where the pass of gases is required.

Keywords: Pectin, electrospraying, edible films

Improvement of starch extraction process from jicama using physical methods.

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Jicama (*Pachyrhizus erosus*) is a native crop from Mexico and Central America, and part of the genus *Pachyrhizus*, which includes other species such as jacatupé and ahipa. Different studies about this tuber reported a low content of protein, as well as the presence of inulin and fructooligosaccharides, and a large amount of starch; however, the reported values of starch yield for this crop are variable and can be the result of the type of jicama used, the growing conditions or the extraction method applied. On the other hand, it has not been found reports that mention or evaluate the percentage of extraction of jicama starch using physical methods, so the objective of this work was to study the effect of different process conditions (soaking and sonication times) and the addition of sodium bisulfite on the extraction yield percentage of starch. The results showed that at 45 min of soaking time, with the addition of sodium bisulfite but no agitation, produce the largest starch yields (17.68%) with a significant differences at larger soaking times. Regarding sonication times, a maximum value (15.88%) was found at 30 min of process, having smaller yields at longer or shorter times. These low extraction values were related to the conglomerated starch granules amyloplast structure as observed by SEM micrographs, and to the presence of a resistant cellular wall. More studies, including chemical and enzymatic procedures are suggested.

Keywords: yam starch, yield extraction,

Structural changes of jicama starch during gelatinization and its effect on the glycemic index.

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The effects of thermal treatment on jicama starch and their relationship with granule size, percentage of crystallinity and glycemic index were studied. A jicama starch dispersion treated at different temperatures (60, 65, 70, 75 and 80°C) was characterized by dynamic light scattering, differential scanning calorimetry (DSC), microscopy, X-ray diffraction and glycemic index. Jicama starch granule presented different diameters varying from 3-21 μm and polyhedral and spherical forms. Larger starch granules tended to gelatinize before small ones, while the aspect ratio (AR) in native starches reached values from 0.89 to 1. The degree of starch gelatinization (GD) was evaluated based on AR data, observing good correlation ($R^2=0.999$) with the GD determined by DSC. Native jicama starch exhibited CA-type X-ray diffraction pattern, while those thermally treated, showed a transition from the CA-type to CB-type, decreasing their crystallinity (20.8-11.5%) at higher temperatures. Jicama native starch presented high glycemic index, increasing this value with thermal treatment (90.2-97.7%) and showing high correlations with the degree of gelatinization based on aspect ratio ($R^2=0.977$), DSC gelatinization enthalpy ($R^2=0.969$) and crystallinity ($R^2=-0.988$). A Mathematical model was proposed to determine the glycemic index as function of the aspect ratio. However, more studies are required to validate this information.

Keywords: Glycemic index; Jicama; Starch gelatinization degree; Starch morphology

Crumb sponge cake structure and texture relationships. Effect of whey protein addition.

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Sponge cake is one of the most consumed sweet bakery items as a result of its porous structure, which determines its commercial functionality due to its ability to retain liquids such as milk syrup. The development of this type of product is based on the use of egg white foam, hence the replacing of this protein by whey concentrate or isolate becomes an alternative to give a better use to this byproduct of milk industry. The aim of the present study was to determine the relationship between the crumb structure (pore area, pore density and circularity) evaluated by image analysis, the texture of the cake (firmness, cohesiveness, elasticity and resilience) and the level of substitution of egg white (0% to 100%) by whey protein. Results showed that both the crumb structure and texture were modified by the addition of whey proteins, improving these characteristics up to a 25% substitution level, while higher percentages (50% and 100%) affected negatively the texture of the product, being a harder, less cohesive, less elastic and resilient product. The replacement of egg white protein by whey promoted changes in the pore shape and this effect could be related to the viscosity and surface tension of the emulsion and the elasticity of the pore wall.

Keywords: Whey protein, cake, microstructure.



IV. FUNCTIONAL FOODS

Device of *Lactococcus lactis ssp. lactis* and *Lactobacillus acidophilus* Immobilized on a Solid Support for the Production of a Fermented Drink

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Lactic acid bacteria (LAB) are attributed benefits such as reducing lactose intolerance, inhibition of intestinal pathogens among others. For this the LAB should be alive and metabolic active and in quantity enough. Therefore our aim was produce a device of immobilized *Lactococcus lactis ssp. lactis* and *Lactobacillus acidophilus* in cellulose which that submerged it different commercial milk it this was fermented, this way it is guaranty that the cells are alive, with metabolic activity and great amount. The device was prepared starting from a culture of *Lactococcus lactis ssp. lactis* BM147 incubated at 29°C/24 hours and at 37°C/24hours to *Lactobacillus acidophilus*, with this two cultures were mix 1:1 then impregnated cellulose strips 3 x 4 cm, were dried under vacuum between 37 and 10 kPa for 40 minutes, then we evaluated the amount of bacteria after the immobilization and dried process with plate count on APT agar. The devices were test in: powder milk, pasteurized and UHT were incubating for 30 hours at 29 °C and 37°C, during this period were measured pH, acidity and viscosity of the beverages. The acceptability of device were made compared the three types of fermented (with 10% saccharose added) This milks it were give 100 consumers, to evaluated the shelf life one with triangular sensory test stored 1 day and 6 months at 4°C. The preference of two different devices (*Lactococcus lactis ssp. lactis* and *Lactobacillus acidophilus* and other one only with *Lactococcus lactis ssp. lactis*) It was evaluated with 100 consumers using a triangular test. The results indicates that no difference was found between milks different fermented during 24 h it was obtained pH of 4.4 to 4.0, the acid lactic production were 0.98%, 1.26% and 1.11% to powder milk, pasteurized milk and UHT milk respectively. With respect to temperature influence more acid is produced at 37°C that to 23°C and 29°C. The viscosity of UHT milks was two times more that another's milks. In the sensorial evaluation the best preference was to UHT milk. In conclusion, the device is useful to production of fermented milk with UHT milk and ensuring the presence of probiotic bacteria. The device stored for 6 months at 4°C does not affect the pH or acidity and preference of the final product.

Keywords: Fermented, Drink, lactic, bacteria, device

Application of astaxanthin as natural pigment in gluten and egg free pastas.

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Pasta is a food matrix, which has acceptance, wide consumption, low cost and long shelf life and it can be properly formulated for a specific population such as people with sensitivity to egg or with celiac disease. Astaxanthin from *Haematococcus pluvialis* and *Phaffia rhodozyma* is a pigment with a well-known antioxidant activity that can be a substitute of the natural carotenoids from the yolk. The aim of this study was to apply and determine the stability of astaxanthin in an egg and gluten-free (GF) pasta. Astaxanthin oleoresin from *H. pluvialis* (HP) or *P. rhodozyma* (PR) was incorporated in pastas made with GF flours (corn, rice and a mix of vegetables) added with whey protein concentrated (WPC), gelatin (G) and albumin (A), alone or combined, as source of protein; and guar gum as an emulsifier. Five formulations for each oleoresin with GF flours, and proteins G, WPC, A, G+A and G+WPC, were done. The formulation of WPC as a source of protein showed the highest retention of astaxanthin with 97.69 ± 2.07 % for HP and 95.17 ± 0.03 % for PR. The formulation of G+WPC showed the highest antioxidant capacity retention with a value of 308.71 ± 12.32 % for HP, meanwhile the formulations of G with HP and PR and G+WPC with PR showed no retention of antioxidant capacity. Regarding quality parameters evaluated, weight loss (WL) and water absorption capacity (WAC), the formulations that showed the best results were G+WPC with values of 0.85 ± 0.21 % and 0.9 ± 0.14 % of WL for HP and PR oleoresins respectively, and 350 ± 10.10 % and 350 ± 10.10 % of WAC for G+WPC with HP and PR oleoresins respectively. In the color parameter b^* it was found that the formulations of G+WPC presented the highest value with 19.05 ± 0.21 and 17.99 ± 2.24 for HP and PR oleoresins respectively. Therefore, the formulation of G+WPC and HP was selected to make a GF pasta with a natural color and antioxidant capacity.

Keywords: astaxanthin, gluten-free pasta, natural pigment, antioxidant.

Characterization Polyphenolic Fractions Nonremovable Basidiomycete *Pleurotus ostreatus*

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The antioxidant capacities of active compounds from different sources, reported in literature, typically relate to extractable compounds analyzed in extracts or infusions of aqueous or those of organic nature. However, significant quantities and capabilities of bioactive compounds are usually not considered in biological studies because they are discarded as waste from the extraction or infusion, as non-extractable compounds. The aim of this study was to characterize the non-extractable fractions of the fungus *Pleurotus ostreatus* for possible use as antioxidant compounds. Study techniques include acid hydrolysis prior to the characterization step. The characterization includes determining phenolic content by the technique described by Folin-Ciocalteu, determination of flavonoids, analysis of antioxidant capacity by DPPH assay, as modified by Manzocco et al. (1998) and statistical analysis for comparison of mean values obtained from the different extractions using aqueous solutions of ethanol, methanol and ethyl acetate as organic solvents in a ratio of 80:20 (solvent: water). The results show greater amounts of phenols in the ethanolic non-removable portion, of the order of 648.34 ppm eq. Gallic acid, the flavonoid content of 570.42 ppm eq. catechin, being the predominant type of polyphenol in the ethanol and methanol residue. The antioxidant capabilities found in the non-extractable fractions of ethanol and methanol were 58 and 53% respectively (no statistical difference, $p < 0.05$). No non-removable portions were obtained with ethyl acetate, due to lack of soluble compounds therein, in the non-removable portion basidiomycete which explains the lack of data for said solvent. According to the results we can conclude that the non-removable portion of the basidiomycete *Pleurotus ostreatus* contains a good amount of antioxidant compounds (ethanolic and methanolic) to recover, and that their knowledge can be useful for better implementation and development of products from basidiomycete, despite not being from direct extraction recovery (without hydrolysis), as it is usually done.

Keywords: non extractable polyphenols, antioxidant capacity, *Pleurotus ostreatus*, phenolic content

Evaluation of Mucilage of Red Prickle Pear (*Opuntia ficus indica* L.) for Development of Functional Foods

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The prickle pear is a fruit with a 50 % of peel, contains fiber and bioactive compounds. The aim of this study was use the peel of red prickle pear and extracting the mucilage by magnetic stirring, the content of polysaccharides and the isotherm were determined for evaluate its application in foods. The peels were acquired from San Sebastian Villanueva in Acatzingo Puebla, they were washed and cut into slices of approximately one centimeter thick and were dried in a hot air dryer at 50 °C for 48 h. The dried peels were milled and sifted, the powder obtained was mixed with water during 30 min at 300 rpm and 50 °C. Dispersions were centrifuged for obtaining an extract. This was dried at 50 °C for 48 h until get a mucilage film. Cellulose, hemicellulose and lignin were determined using AOAC methods. The methodology of Palou et al. (1997) was used to determine the adsorption isotherm of the mucilage using the saturated solutions at 25 °C: LiCl (a_w 0.12), MgCl₂ (a_w 0.34), NaBr (a_w 0.60), NaCl (a_w 0.75), KCl (a_w 0.85) and BaCl₂ (a_w 0.90). The model used to describe the isotherms was GAB. The results indicate that with the used physical treatments, is possible obtain 40 % of mucilage of the red prickle pear. The cellulose content was higher than hemicellulose and lignin ($p < 0.05$) 35.6 ± 0.9 %, 22.6 ± 1.8 %, 9.6 ± 0.17 % respectively. This indicate the presence of fiber in the mucilage. The mucilage presented a low moisture gain. This behavior was confirmed with the adsorption isotherm, a good fit of the GAB model to the experimental data of the adsorption isotherm was obtained ($R^2 > 0.95$), as well as the GAB parameters and the monolayer values < 0.2 (H₂O g/ g db). The presence of polysaccharides as source of dietary fiber and the low water content in the mucilage, could permit its use for developing intermediate moisture foods or functional foods.

Keywords: mucilage, polysaccharides, isotherms and prickle pear

Capsaicinoids Recovered from *Capsicum chinense* Jacq as Possible Functional Food Additive: Extraction and Biological Activity.

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Currently, different studies have shown that the excessive consumption of synthetic additives produce a severe impact on the human health, as gastrointestinal, respiratory, dermatological and neurological adverse reactions. Therefore, the new tendency is to replace synthetic additives for natural compounds with diverse biological effects. Capsaicinoids, the responsible compounds of high pungency, are a type of secondary metabolites present in habanero pepper (*Capsicum chinense* Jacq), that express various biological effects such as anti-inflammatory, anesthetic, anticancer, gastric mucosa protector, antioxidant and antimicrobial capacity, and some of these effects are of interest for food industry. In an effort to give a new benefit to the *C. chinense*, the present work focused on the recovery of capsaicinoids and evaluation of their antimicrobial activity. The extraction was conducted by ultrasound-assisted extraction (UAE) method using mild condition and eco-friendly solvent (Ethanol, methanol and different concentrations of these with water). Various factors were evaluated (solvent concentration, solute: solvent ratio, fruit part), the best treatment was compared with traditional soxhlet extraction. The results showed that UAE method recover 80 percent of capsaicinoids in ten minutes versus Soxhlet method in five hours. The capsaicinoids concentration was evaluated by High Performance Liquid Chromatography (HPLC) methodology in the different treatments. The extraction process also recovered polyphenols and in all cases, the values were greater than 50 mg GAE/g dry basis by Folin-Ciocalteu's phenol method. The Minimal Inhibitory Concentration (MIC) was determined as antimicrobial activity and the extracts showed activities against *E. coli*, *S. aureus*, and *S. thiphymurium*. The results indicated that chili pepper extracts could be used as food additives due to its potential as food preservatives.

Keywords: *Capsicum chinense* Jacq, capsaicinoids, antimicrobial activity

Polyphenol Profile and Biological Activity from Sour Citrus Peel Flour (*Citrus aurantium*) Used as Food Additive

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Yucatan State is one of the leading producers of citrus including *Citrus aurantium* variety that is commonly used in traditional dishes and not fully industrially exploited. On the other hand, polyphenols are phytochemical compounds that have shown biological activities as antioxidant and antimicrobial activity related to their source. Nowadays, the tendency to look for natural additives to use in the food industry and the development of functional foods has led to the search of natural compounds that possess biological activities. The main objective of this work was to compare the efficiency of aqueous ethanol and water solvents for the extraction of polyphenolic compounds from citrus peel orange in order to obtain the major biological active extract to be used as a food additive, as well as the determination of the polyphenol profile. Peel flour was obtained from sour citrus orange and stored in darkness to preserve polyphenols. Extraction methodology involved traditional ultrasound-assisted extraction using aqueous ethanol 50% and water as extraction solvents. The ethanolic extract was concentrated under vacuum on a rotary evaporator at 50°C. Antioxidant activity was measured by the DPPH method and Minimal Inhibitory Concentration against *E. coli*, *S. aureus* and *S. thymurium* were determined as antimicrobial activity. Polyphenol profile was obtained by High Pressure Liquid Chromatography. Results indicated polyphenol concentrations around 50 mg from dried matter. Antioxidant activity was superior to 50% in the extracts obtained with both solvents evaluated. Antioxidant activity was also related to the solvent used in the extraction, and inhibitory microbial activity was detected against the 3 bacteria evaluated. Polyphenol profile showed the presence of 10 principal compounds, where Naringin, Neohesperidin and Morin represented the majority. The presence of biological activity of natural compounds from not exploited sources opens an important way to obtain natural additives that can be used in industrial food processing as an alternative to chemical compounds and new materials to produce functional foods.

Keywords: *Citrus aurantium*, biological activity, polyphenols profile

Human Milk conservation: Functional food for the newborn

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Human milk is an essential food for newborns because it offers numerous growth factors acting on the gastrointestinal, vascular, nervous and endocrine tract. Have been implemented in the world Human Milk Banks (HMB) in order to preserve this food by the process of pasteurization, however, this is not the only process that can give a safety quality and nutrimental to human milk, so we have developed a method of Spray Drying for "dehydration of human milk," which offers an alternative to commercial milk formulas, easy to use, with long shelf life, good nutritional and sanitary quality. Human milk was homogenized, adding 2 g/L of a prebiotic as encapsulate. A spray dryer model TP-S-15 was used, with a feed flow of 2 and 4 mL/h and temperatures drying 150, 200 and 250 °C. The powder was collected and samples were analyzed for protein, fat, moisture, sugars and microbiological analyzes, during two months of storage at room temperature. The results showed good stability, solubility and nutritional properties without significant variation, regarding fresh human milk, reducing the microbial load to 99%. This paper proposes a method of drying human milk as the only functional food for babies with breastfeeding problems or premature babies of the hospitals in Jalisco.

Keywords: Human milk, Spray Drying, safety, Human Milk Banks, conservation

Alginate encapsulation as a preservation method of pitaya fruit juice (*Stenocereus* spp.)

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The fruits from the *Stenocereus* genus (pitayas) may have yellow, red or purple pulp, whose color is due to the presence and concentration of betalains, water-soluble pigments with antioxidant properties and positive effects on human health. Betalains are divided into two groups: yellowish betaxanthins, and reddish betacyanins. Pitaya fruit juices have great sensorial acceptance; however, it is required new methods of preservation to extend the product shelf life, which in fruit matrix is 6 days. Encapsulation is a technology of packaging materials in semipermeable, spherical, and strong membranes; several polymers matrix are used for this purpose, alginate is one of the most widely used in food conservation, because allows preserving ready-to-eat food for long storage periods. The aim of this study was to evaluate the effect of alginate encapsulation over conservation of pitaya juices from *Stenocereus* spp. during storage period in refrigeration. Juice from yellow (*S. pruinosus*), red and purple (*S. stellatus*) pitaya fruits were added with 1.0% of sodium alginate and dropped into a 1.0% calcium chloride solution, where capsules were kept for one minute and then stored with isotonic solution (0.1M sodium chloride, 0.3 M sucrose) in a solution – capsule ratio of 3 mL/g. Color stability of capsules and betalain concentration in the solution were evaluated at 4°C in the darkness along 120 h of storage period. Capsules of yellow, red and purple pitaya presented diameter of 4.61±0.19, 4.70±0.16, and 4.59±0.14 mm, respectively; weight of 826±7.55, 975.33±3.51, and 831.00±74.67 mg; and volume of 0.075±0.06, 0.098±0.05, and 0.08±0.00 cm³. Equilibrium of pigment diffusion from the capsules to the media was reached within 24 h, affecting the chromatic parameters; in equilibrium Hue angles of yellow, red, and purple encapsulate were 45.42±0.37°, 33.39±0.58°, and 17.73±0.13°, respectively. On the other hand, Chroma values were 65.48±0.85 – yellow, 58.24±1.45 – red, and 54.83±0.35 – purple, indicating bright – saturated colors. Total betalains retentions were 86.43% - yellow, 91.61% - red, and 91.73% - purple. In conclusion, alginate encapsulation is a method that allows conservation of pitaya juices preserving betalain concentration with good color stability.

Keywords: *Stenocereus*, pitaya, betalains, alginate encapsulation

Corn Based Functional Food Fortified with Jalapeno Pepper (*Capsicum annuum*) by-product Ingredient

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The objective of this work was development a process to elaborate a corn chip fortified with jalapeño pepper by-product. Response surface methodology and a rotatable central composite design were used for the process optimization, having inclusion and frying times as dependable variables. The process variables were: inclusion percentage and frying times and the response variables used for optimization were: antioxidant capacity (AoxC), total phenolic compounds (TPC) and general acceptability (GAC). AoxC values obtained were between 345.39 and 432.07 $\mu\text{mol TE}/100\text{ g}$ of sample, conforming to a quadratic prediction model, the maximum values were localized in intermediate inclusion percentage and low frying times, in the case of TPC the values obtained were between 149.51 and 169.99 mg gallic acid equivalent (GAE)/ 100g of sample; also was adjusted to a quadratic prediction model, the maximum content was obtained at inclusion percentages high intermediate and high frying times. For general acceptability, the experimental values in a LAM scale were located between 51.02 and 75.06 being translated into expressions of "I do not like or I dislike" and " I like very much". The prediction model obtained was a cubic model. It was followed by an optimization using a numerical method of desirability getting a desirability of $D= 0.78$ where a certain percentage of inclusion and frying time (values are omitted due patent registration) an AoxC= 390.53 $\mu\text{mol TE}/100\text{ g}$, TPC= 168.73 mg GAE/ 100g and GAC= 75.06 will be obtained. In order to validate the optimization process obtained corn chip were prepared under optimum conditions and analyzed getting the experimental values of AoxC ($384.02 \pm 5.54\ \mu\text{mol TE} /100\text{g}$), TPC ($161.01 \pm 14.2\ \text{mg GAE}/ 100\text{g}$), and GAC (74.55 ± 1.28) these were similar to the values predicted in the optimization process, indicating that the optimum conditions for the elaboration of a corn chip fortified with by-product of jalapeno peppers were appropriate and reproducible.

Keywords: *Functional food, jalapeno pepper, optimization, validation.*

Preliminary Characterization and Antioxidant Activity of Mexican Propolis

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Propolis is a resinous substance collected by bees from sources such as plant exudates. Five Mexican propolis samples were obtained from the following states: Jalisco (1), Querétaro (2), Tamaulipas (3), Veracruz (4) and Zacatecas (5). These samples were weighted, labeled and frozen at -20°C until use. Initial characterization included: color identification using the panthone software, wax determination using methanol wash [96%], protein content determination using Kjeldahl method and mineral content using X-ray fluorescence (XRF). For the antioxidant activity, an ethanolic extract of propolis was prepared and transferred to amber vials and stored at room temperature for later use to measure polyphenol content with microplate Folin-Ciocalteu protocol using gallic acid (0.4-11mg/mL) as control. Antioxidant activity of ethanolic extract was determined by 1,1-diphenil-2-picrilhydrazil (DPPH) method. All analyses were done in triplicates. Propolis colors varied from yellow to dark brown. The wax content ranged from 13 to 33%, while protein values ranged from 12 to 18%. Elemental composition with XRF showed presence of the following minerals: 1: Cl, K_2O , CaO, Ti, Fe, Cu, Zn, Rb, Sr, Mo, Ag; 2: S, Cl, K_2O , CaO, Fe, Cu, Zn, Sr; 3: SiO_2 , Cl, K_2O , CaO, Fe, Zn, Sr; 4: S, Cl, CaO, Ti, Mn, Fe, Cu, Zn, Rb, Sr, Zr and 5: S, Cl, K_2O , CaO, Ti, Fe, Cu, Zn, Rb, Sr, Zr, Au. Total content of polyphenols ranged from 28 to 147 mg/mL and antioxidant activity varied from 0.8 to 49%, compared to galic acid. The mayor mineral diversity was observed in propolis from Jalisco while propolis from Zacatecas had the highest mineral content. These findings present evidence of the high diversity of components of natural propolis. Overall, the results of our study revealed wide variations between the different parameters measured highlighting the inherent diversity of sources from which propolis is collected. This is the first report of proteins and mineral content in Mexican propolis samples, a traditional remedy well known for its antimicrobial properties. This research was funded by SEP-CONACYT (CB 257171).

Keywords: propolis, protein, polyphenols, antioxidant, minerals

Use of Immobilized Lipase-Catalyzed Acidolysis for Enrichment of Palm Olein with Medium Chain Fatty Acids

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Incorporation of medium chain fatty acids (MCFAs) into triacylglycerols (TAGs) have provided better heat stability and oxidative. Furthermore, recent studies confirmed the potential of MCFAs to reduce body weight and fat, lipoprotein secretion and postprandial triglyceride response, intestinal injury and alcohol-induced hepatotoxicity. The purpose of the present work was to enrich palm olein (PO) with MCFAs by acidolysis catalyzed by immobilized lipase. Incorporation of MCFAs into PO was modeled with response surface methodology using as variables the effect of the mole ratio of substrates, enzyme loading and reaction temperature, then the best conditions for incorporation were determined. PO and MCFAs were used as substrates, Lipozyme RM IM de *Rhizomucor miehei* was used as the biocatalyst. For the acidolysis reaction trials, different enzyme loads (8, 16, 24, 32 and 40 %, with respect to the total weight of substrates), temperatures (45, 50, 55, 60 and 65 °C) and molar ratios of substrates (1:4, 1:8, 1:12, 1:16 and 1:20, PO: MCFAs) were employed. 3 g of the mixture of substrates were placed in 25 mL Erlenmeyer flasks and mixed with the immobilized lipase. The reaction was carried out in an orbital shaker operating at 300 rpm for a period of 24 h. Samples were withdrawn periodically to determine the incorporation of MCFAs into PO. Esterified fatty acids in PO were determined by methylation with sodium methoxide. The methyl esters were injected into a Perkin Elmer AutoSystem XL gas chromatograph fitted with a flame ionization detector, fitted with an Elite-225 PE capillary column. All experiments were performed in duplicate. All parameters had a statistical effect on the incorporation of MCFAs into PO by Lipozyme RM IM acidolysis reaction. All of the factors, enzyme loading, mole ratio of substrates, and temperature showed an increased effect on incorporation into PO. Maximal incorporation of MCFAs was attained with a mole ratio of substrates 1:16, enzyme loading of 32 %, and 60 °C. Under these conditions and after 6 h, an incorporation of 65 % was reached, a maximal conversion of ca. 77 % was reached after 24 h of reaction.

Keywords: Acidolysis; Medium Chain Fatty Acids; Lipases; Palm Olein

Healthy benefits and application in dining table of anthocyanins-rich foods

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Anthocyanins-rich foods are widespread presenting in many fruits and vegetables with red, purple or dark color such as berries, red grapes, dark rice, purple sweet potato and red cabbages. Anthocyanins are a kind of polyphenolic compounds and show higher antioxidant activities. They are of great nutritional interest because their intake has been estimated to be up to 9-fold higher than that of other dietary flavonoids. Some epidemiological data have suggested that increased consumption of anthocyanins lowers the risk of cardiovascular disease. Recent animal data showed that anthocyanins can prevent against obesity caused by high fat diet, and anthocyanins also can alter the cellular redox environment and modulate neuronal working. Molecular data revealed that anthocyanins can modulate cellular signaling, gene expression and protein activity. We have worked on chemicals and functions of anthocyanins from fruit and vegetables for near two decades. In this talk, I will summarize some key results in scientific research and some practices for developing anthocyanin foods as healthy foods. First, we found that a clear chemical-bioactivity relationship is presented in kinds of anthocyanins. Based on these information, we can clarify the quantity and quality of anthocyanins from a variety of fruits and vegetables. Second, we also found that anthocyanins having stronger antioxidant activity are easily oxidized. The factors including light, pH and metals affect anthocyanin color and functions. In food processing, how can we keep anthocyanin color and functions? Third, food coloring is one kind of food culture. In practice, how we can bring anthocyanin color with their functions to our healthy kitchen table? Based on these scientific knowledge on chemical properties and functions of anthocyanins, we have screened many kinds of fruits and vegetables, and developed “KUROYASAI” (Dark Vegetable) that contains higher quantity and quality of anthocyanins. Furthermore, we developed these “KUROYASAI” to health kitchen table, defined “KUROZEN” (Dark Healthy Meal). In my talk, I will present these scientific evidence of anthocyanin chemicals and functions as well as our R & D results from anthocyanin function, food processing to healthy kitchen table.

Preparation of O/W curcumin nanoemulsions stabilized with lysophosphatidylcholine and pharmacokinetics in BALB/c mice.

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Curcumin is the major bioactive component of *Curcuma longa L.* with documented properties of prevention and treatment in chronic degenerative and infectious diseases. However, its low solubility in aqueous media produces low bioavailability. The use of nanoemulsions provides an alternative to bioavailability problems. In this study, Curcumin O/W nanoemulsions were prepared in using lysophosphatidylcholine as emulsifier, which has proven emulsification abilities and beneficial physiological activities. In this study the objective was to test the bioavailability of curcumin nanoemulsions stabilized with Lysophosphatidylcholine in the plasma of BALB/c mice. Lysophosphatidylcholine was prepared by enzymatic removal of one of the fatty acid residues of pure Phosphatidylcholine. Nanoemulsions prepared had a mean droplet size of 124.7 ± 3.1 nm, a polydispersity index of 0.38 ± 0.04 and zeta potential of -18.59 ± 0.0 mV. *In vivo* release in Balb/c mice showed that curcumin nanoemulsions had the following bioavailability and pharmacokinetics parameters: *Cmax* of 610 ± 65.0 U μ g/mL and *Tmax* of 2 h. The study provides important data on the preparation and design of nano-encapsulated bioactive compounds using lysophosphatidylcholine as emulsifier.

Keywords: Curcumin; Bioavailability; Nanoemulsions; Phosphatidylcholine; Lysophosphatidylcholine.

Preparation of O/W Betulinic acid nanoemulsions stabilized with lysophosphatidylcholine and pharmacokinetics in BALB/c mice.

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In recent decades, the relationship between food and fitness has been studied. Functional foods are foodstuffs that in addition to the energy and nutritional value, provide bioactive compounds for the prevention or treatment of chronic degenerative diseases (diabetes mellitus, hypertension and cancer) and infectious diseases (HIV). Betulinic acid (BA) is a bioactive compound of pharmaceutical, food and cosmetic interest but it has limitations of low solubility in aqueous media and thus a reduced bioavailability. In this regard, efforts have been made to improve the development of formulations to allow greater absorption of this bioactive. Lipid-stabilized nanoemulsions as carriers for bioactive compounds provide benefits such as protection and controlled release of nanoencapsulated compounds. They have globule sizes between 100-500 nm and are stabilized with emulsifiers that provide more effectiveness in these systems. Because of their amphiphilic character phospholipids are used as effective emulsifiers. One of the most understudied phospholipid is lysophosphatidylcholine (LPC) which is a product of the partial hydrolysis of the phosphatidylcholine (PC) molecule, which unlike other phospholipids contains only one fatty acid in its structure. The aim of this study was to prepare O/W nanoemulsions with lysophosphatidylcholine as emulsifier to increase the bioavailability of the bioactive BA. To achieve this, the study was designed in three phases: the first was to prepare BA nanoemulsions; the second stage was the characterization and study of the stability over 12 weeks with measurements in the globule size, polydispersity index and zeta-potential and finally to perform a bioavailability study of BA in BALB/c mice. The results showed that the nanoemulsions had a mean globule size of 86.4 nm, a PDI value of 0.2 and Zeta potential of -6.92 mV. During storage, the globule size of BA NE increased by 10% in 12 weeks. The bioavailability study showed a C_{max} of 440 $\mu\text{g mL}^{-1}$ and T_{max} of 8 h. It is concluded that for BA, NE formulation provides a carrier system that ensures bioavailability in blood plasma in BALB/c mice.

Key words: Betulinic acid; Bioavailability; Nanoemulsions; Lysophosphatidylcholine.

Analysis and Evaluation of mucilage Nopal (*Opuntia ficus-indica*) in the Encapsulation of Active Compounds *Rhoeo discolor*

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Currently agribusiness nopal (*Opuntia ficus-indica*) in Mexico develops slowly because during processing releases a substance known as mucilage; a compound of hygroscopicity that due to their rheological properties can be easily used as a protective agent of active compounds in the food industry. Purple maguey (*Rhoeo discolor*) is a plant used in traditional medicine due to its high content of antioxidants, nopal mucilage being an innovative alternative to protect these compounds. Therefore, the aim of this research was to evaluate the encapsulant effect of mucilage of *Opuntia ficus-indica* in the active compounds of *Rhoeo discolor*. For that reason, were realized the encapsulated extracts of *Rhoeo discolor* with mucilage *Opuntia ficus-indica* where the stability was evaluated by the phenolic compounds and antioxidant activity. Besides quantified the content of catechin and epigallocatechin by HPLC chromatography and were obtained micrographs of microcapsules by SEM microscopy. In the encapsulated extracts, the behavior of polyphenols was stable for 90 days without statistically significant differences decreasing only 5%, were found 0.0829 and 5.8153 $\mu\text{g/mL}$ of catechin and epigallocatechin respectively. The micrographs allowed appreciating microcapsules well defined between 1 and 1.5 microns. The stability of phenolic compounds demonstrate that the mucilage of *Opuntia ficus-indica* protected the active compounds of *Rhoeo discolor*, also significant amounts of catechin and epigallocatechin found in encapsulated extracts provide a value added in the preparation of functional foods, promoting interest the by-product of nopal.

Keywords: Catechin, epigallocatechin, antioxidants, microencapsulation, functional food.

Anti-lipogenic effects of *Garcinia gummi-gutta* extract on different hypercaloric diets

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Garcinia gummi-gutta extract (GGG) is used for body-weight control. The (-)-hydroxycitric acid, contained in the fruit, modifies the lipid metabolism. The aim of this study was to evaluate the anti-lipogenic effect of GGG extract in rats fed with different hypercaloric diets. Thirty Wistar rats were induced for obesity (OB) (425.5±27.4g, >97 weight/age percentile) and 5 rats were control group (C) (p=0.01). Three experimental groups (n=5-OB), with their respective controls were integrated, and they were fed with hypercaloric diets (4.1 kcal / g): high-fat (fat ~45%), high-sugar (sugar ~50%) or both (O, fat ~45%, sugar ~30%) with (F, S, O) or without (FC, SC, OC) GGG extract (5.9%), during 11 weeks. Food intake (FI) and body weight (BW) were recorded daily. Total cholesterol (TC), HDL-cholesterol, triglycerides (TG) and glucose (GL) levels were determined in plasma and ketone bodies (KB) in urine, each two weeks. Total body (TBF), abdominal (TAF) and visceral (TVF) fat were quantified by DEXA and Soxhlet methods. Finally, a histological study in liver and testes was realized. Data were analyzed by ANOVA with multiples comparisons of Fisher, Student's t-test, Kruskal-Wallis and Mann-Whitney U tests. The results indicated decrease in BW in experimental groups compared with the control groups (p<0.01), particularly the F group (376.3±45.5g), which showed lower FI (12.0±1.2g, p<0.01) than FC group. A control effect over plasmatic TG and GL was observed in S (146.1±18.8mg/dL; p<0.01) and F groups (103.3.0±4.8mg/dL, p=0.04), respectively. The S and F groups had the lowest concentration of KB (3.5±1.8 and 2.1±0.7mg/dL, respectively, p=0.01) in comparison with SC and FC groups. The F and O groups showed lower TAF (31.4±10.0 and 38.6±0.8%, respectively, p<0.01), but only F group showed lower TBF (24.9±3.6, p=0.01) and TVF (62.9±7.3, p=0.02) than their control groups. Hepatic steatosis was lower in F group than FC group (p<0.01). No testicular damage was identified among groups. In conclusion, GGG extract had anti-lipogenic and hepatoprotective effects, decreased food intake and body-weight in rats fed with high-fat diet, and these effects vary depending on the type of diet consumed.

Keywords: *Garcinia gummi-gutta*, *Garcinia cambogia*, obesity, hidroxycitric acid, anti-lipogenic.

Evaluation of the Effect of Replacement of Wheat Flour by Soluble Fiber on Instrumental Texture and Sensorial Attributes of Cheese and Sesame Seeds Cookies

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It have been introduced certain types of fiber as partial wheat flour substitutes in bakery products recently, in order to enhance its nutritional benefits and its favorable effect on health, since fiber decrease the risk of chronic illness as diabetes. The aim of this work was to evaluate the effect of replacement of wheat flour by a soluble fiber compound on instrumental texture and sensorial attributes of cheese and sesame seeds cookies without fiber and with three substitution levels (5%, 10% and 15%). Cookie's hardness and fracturability values were determined using a texture analyzer by the fracture test, and the sensorial analysis was made by 82 not trained panelists, who evaluated the parameters of color, smell, taste and texture, in a hedonic five points scale. Results were analyzed using descriptive statistic and not parametric tests due to data nature. Regarding to instrumental texture, an increment on hardness values of cookies with substitution of flour by fiber was observed, and they differed significantly ($p < 0.05$) from control without fiber, while there was no significant ($p < 0.05$) difference between fracturability values of cookies with and without fiber. On the other hand, on scores of sensorial attributes of cookies with and without fiber, replacement of flour by fiber didn't yield significant ($p < 0.05$) differences, except for texture, whose scores decreased reaching the 10% substitution level and were significant ($p < 0.05$) different from those of control cookies. Because of its total fiber content, cookies with substitution levels of 10% and 15% are considered 'fiber good source', according to descriptors of nutritional properties stipulated at nutritional labeling Colombian norm. Thus, replacing up to 15% of flour by fiber in bakery products could be viewed as an effective strategy to increase the fiber input in a mass consumption foodstuff, while preserving some quality parameters of end product.

Keywords: Soluble fiber, substitution, bakery products

Evaluation of the Antioxidant Activity of Red Pitaya (*Stenocereus thurberi*) in Two Stages of Maturity

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Fruits and vegetables are the major source of dietary antioxidants, therefore, extensive research has been conducted to characterize their antioxidants properties, but limited information is available about the more exotic species. The aim in this study was to measure the antioxidant activity of pulp and peel pitaya (*Stenocereus thurberi*) to determine the potential of red pitaya to be used as a functional food to improve human health and reuse the subproduct. Red pitaya was analyzed in different ripeness by their antioxidant activity (methanolic 80%). Total phenolic content (TPC) was evaluate in Mature peel (MP), semi-mature peel (SMP), mature fruit (MF) and semi-mature fruit (SMF) by the colorimetric assay using Folin-Ciocalteu reagent; total flavonoid (TFC) using the aluminum chloride colorimetric method and the antioxidant activities were assayed by methods based on scavenging of DPPH, ABTS and Hemolysis was induced by the radical AAPH (2-2-azobis (2- methylpropionamide) dihydrochloride). The statistical design was completely randomized by triplicate with their respective replica. The analysis of the different treatments was assumed ($p < 0.05$). All data analyses were performed using the version 5.1 statistical package StatGraphics. In TPC the semi-mature peel (20.69 mg of GAE/g) showed a higher content of total phenols in comparison with semi-mature fruit analyzed (7.55 mg of GAE/g), followed by mature peel and fruit (10.67-6.93 mg of GAE/g) respectively. Flavonoids obtained were ranged in 10.21-17.28 mg catechin equivalents/g respectively. In antioxidant activity the values ranged from 6.24-11.49 $\mu\text{mol Trolox equivalent/gfw}$ for ABTS and 10.25-25.17 $\mu\text{mol Trolox equivalent/gfw}$ for DPPH. Finally, the highest percentage of inhibition of hemolysis corresponded to MP (88.04%), which was higher than even the SMP, MF & SMF extracts (84.80%), (85.84%) and (87.79%), respectively. Activity assays showed similar trends. The results obtained suggest that peel and pulp are potential sources to obtain bioactive phenolic compounds with high antioxidant properties which can be used in industries as antioxidant agents or for treatments in diseases.

Keywords: Pitaya, Antioxidants, Free radical scavenging assay

Design of antioxidant functional beverage with amaranth protein (*Amaranthus hypochondriacus*) and green tea extract (*Camellia sinensis*)

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Protein consumption is important to strengthen tissues, muscles and bones of human body. Daily diet must have 30% of protein, however not everyone are good quality proteins. A complete protein contains all the essential amino acids, which are useful to keep correct vital functions. Also, antioxidant consumption is helpful to diminish oxidative stress and damage to biomolecules such as proteins, lipids and nucleic acids. Amaranth (*Amaranthus hypochondriacus*) is considered a superfood because of its important protein content and quality. Amaranth protein is comparable with milk casein because of the presence of essential amino acids. Likewise, green tea (*Camellia sinensis*) is an important antioxidant source, it has a good taste and is easy to mix with other flavors. The aim of this research was to design a functional refreshing beverage with amaranth protein and green tea extract. Two different formulations with green tea (1 and 2 g per liter) and amaranth flour (10 g per liter) were prepared in water to obtain albumins and polar antioxidants. The solutions were centrifuged 10 min at 10,000 rpm after 24 h at 4°C light protected. The formulations were evaluated with five point hedonic scale by twenty judges. Bradford's method was used to evaluate proteins' content. Total polyphenol content was evaluated by Folin-Ciocalteu's method. The better taste formulation contents 12.24 mg of protein and 63 mg of total polyphenols in 100 mL. This beverage could be a refreshing alternative with an important high quality protein intake, without gluten and lactose intolerant problems.

Keywords: protein, functional, antioxidants

Design of Low Calorie Bakery Product with Natural Edulcorant

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The World Health Organization mentions that diabetes is increasing worldwide, particularly in developing countries. Causes are complex, but largely relate to the rapid increase of overweight, obesity and physical inactivity. On the other hand, the American Diabetes Association says that stevia is an excellent substitute for sugar, especially for diabetics. The sheet contains a compound called "steviol glucoside" which is not absorbed or digested by the human body, so it is expelled directly from the system. It is especially good for diabetics, as it stabilizes the level of blood glucose of a patient by increasing insulin resistance, this inhibits the absorption of glucose in the body and improves the health of pancreas. Consumption of desserts is common worldwide, however, diabetic patients are limited in the consumption of high glycemic index, which reduces their quality of life. Therefore, the objective of this work was to create a paste-based fondant stevia to encourage consumption among diabetics. The fondant is a paste used as very creative baking sheet, especially to create decorations pies, cakes and cupcakes. The base of the fondant is sugar and water, although other additional ingredients normally used to get the most striking and stable fondant. Fondant's formula is: powdered sugar, shortening, water, gelatin, glycerin, honey corn. For this research, the sugar glass was replaced with stevia and stevia, corn starch / starch ratio range is 50/50% and 70/30% w / w. A sensory analysis test was comparing the commercial and traditional fondant and the two formulations with stevia, which reveals that the second formulation (70% stevia, 30% starch), was the most accepted by the judges, remaining physical properties from the original fondant after stabilize it with xanthan gum.

Keywords: fondant, diabetes, stevia, starch.

Design of enriched meat-grasshopper hamburger (*Tettigoria viridissima*) as dietary alternative to children malnutrition

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According to ENSANUT (Nutrition and Health National Survey) from 1988 to 2012, malnutrition in 5 to 14 years old children is 7.25% at cities and 15% at rural areas. Malnutrition includes overweight and obesity. Mexico is the first place in child obesity. On the other hand, children under 15 years old eat fast food, this contribute to overweight because of the high content of carbohydrates and lipids. Mexican gastronomy is considered Humanity Immaterial Patrimony since 2010 by UNESCO. This means, that gastronomy is complete, vary, huge and internationally recognized. Nowadays, Mexico offers prehispanic foods like insects intake. Insects are an important source of protein. The aim of this research was to design hamburgers with pork, beef and soy meat and enriched them with grasshopper to increase protein intake and enhance Mexican gastronomy. Hamburger portion was 100 g, where 90% was protein and 10 % are condiments. The content of protein was 20.6 g, 10 g of lipids and 65 mg of cholesterol, meanwhile, the new formulations includes 60% of beef, pork or soy protein, 30% of grasshopper meat and 10% of condiments. The content of protein was 44 g, 10 g of lipids without cholesterol. The grasshopper formulations contents calcium, magnesium and complex B vitamin. The formulations preferred by 80% of children judges from elementary school was pork and grasshopper. This hamburger could be an important source of proteins to children, and at the same time enhance traditional Mexican ingredients.

Keywords: grasshopper, protein, hamburger, malnutrition

Use of Chia (*Salvia hispanica* L.) As Gelificant Agent to Make New Food Products

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Metabolic syndrome is suffering by 80% of Mexican population. Chia (*Salvia hispanica* L.) is a seed with high concentration of alfa-linolenic acid. Chia is flavorless and odorless and is possible to mix it with another foods, nevertheless is only consumed in water wrapped with mucilage. A spoonful of chia in water forms a solid gel, which is helpful to nutrient absorption regulation and electrolytic balance. The aim of this work was to made desserts using chia as gelificant agent to contribute in blood glucose and hypertension levels go down. Two desserts were made. To made mousse 40g of grenetin, milk and sugar are necessary to 500mL yield. The new product was made with 20g and 30g of chia and 20g and 10g of grenetin, respectively. To panna cotta, 45g of grenetin are necessary. Chia substitute 15g and 30g of grenetin. Sensory evaluation with 38 judges was made. Judges evaluate in hedonic scale, texture, color, flavor and sweetener. The result shows a higher preference of mousse with 50% of chia as gelificant agent, meanwhile, panna cotta was preferred with 66% of chia. Chia presents gelificant power, which is important to mix it with other foods to give it texture and contribute to chronic diseases control.

Keywords: chía; gelificant; mucilage, chronic diseases.

Esterification characterization of alginate, xanthan gum and soursop pulp.

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The esterification is a technique derived from molecular gastronomy consisting in a controlled gelation of a liquid, submerged in a vessel containing a solution of calcium chloride, liquid forms small spheres with food inside. In molecular gastronomy various ingredients are replaced in prepared foods trying to provide the same chemical response as the original ingredients but with new flavors, textures and functional properties that satisfies consumers. An advantage of this technique is to provide healthier and dietary foods. The aim of this research was to obtain and characterize a functional food with soursop by esterification with alginate and xanthan gum. The experimental design for physicochemical characterization was a completely randomized design with three replications and for sensory analysis evaluation, was a randomized complete block. For characterization of the new product AOAC methods were used and for sensory analysis a hedonic test was applied. The physicochemical variables analyzed were: total dry matter (77.75%), moisture (22.25%), total nitrogen (12.08%), fat (0.26%), ash (13.01%), fiber (9.4%), total sugars (71.31 mg/L), and calorific value (3.28,kcal/g). Product stability was estimated by visual analysis of moisture loss at 30, 60 and 90 minutes with an analytical balance. The soursop esterifications were microbiologically analyzed (aerobic mesophilic bacteria, fungi and yeasts) for 5 days. The first day in the counting of mesophilic aerobic bacteria microbial load of 4.5×10^4 CFU/g was obtained on the fifth day there was 7.5×10^4 CFU/g. To presence of fungi and yeasts there was a development of 2.0×10^3 CFU/g on the first day & the fifth day was 7.0×10^3 CFU/g. For sensory evaluation 16 trained judges participated and attributes evaluated were: overall appearance, odor, flavor, texture and overall acceptance. A hedonic test with a nine points scale was used. The results were analyzed using analysis of variance and if any significant difference Fisher test was performed to compare means at a significance level of 5%. The characteristics of significant differences ($P > 0.05$) were presented in overall appearance and texture. The soursop esterification product can be used as a new product due to its nutrition content and can be consumed by all kind of consumers.

Keywords: esterification, molecular gastronomy, soursop pulp, alginate, sensory evaluation

Fish Burger with Gluten Free Flours

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The aim of this study was to evaluate the effect of incorporation of different gluten-free flours on technological parameters of fish burgers. Eighteen burger batches were prepared from fish meat emulsified with 1.2% salt and 0.01% butylated hydroxyanisole. The additives were incorporated in the following concentrations: water (A) 0%, 15% and 30%, quinoa flour (HQ) and amaranth flour (HAo) at 0%, 5% and 10%, respectively. The burgers were molded in units of 100 ± 1 g, and weighed before and after cooking to determine the yield. The chewiness was determined with a Brookfield Texture Analyzer and the total color with an UV-VIS Spectrophotometer equipped with an integrating sphere. The data were obtained as the mean \pm standard deviation of 5 replicates and analyzed using the Statgraphics plus software. Analysis of variance (ANOVA) for a confidence level of $p < 0.05$ was made; means were discriminated with the Tukey test, evaluating also the combinations A-HQ and A-HAo. The parameters assessed were significantly affected by all ingredients added ($p < 0.05$). The highest yield ($93.41 \pm 0.34\%$) was observed in the formulation containing 10% HQ and 15% water. While that, when HAo was used, the best yield was obtained in burger with 10% HAo and 15% water, although the value reached was lower ($91.36 \pm 0.24\%$). Regarding chewiness, it decreased when the addition of water was increased reaching a minimum value of 5.13 ± 0.50 in the formulation with 10% HQ and 30% water; and a value of 11.91 ± 0.18 for 5% HAo and 30% water. The total color difference was higher in samples with 30% water ($\Delta E = 8.20 \pm 0.72$) due to the increase in the brightness of the samples, however the incorporation of HQ and HAo produced a variation in the total color of the samples but lower ($\Delta E = 4.24 \pm 0.10$ and $\Delta E = 4.17 \pm 0.28$, respectively). Hence, the addition of these flours improved the cooking yield of fish burgers, obtaining lower chewiness and changes in the total color in the burger processed with HQ.

Keywords: Cooking yield – Chewiness - Total color – Quinoa flour – Amaranth flour

Evaluation of Antimicrobial and Antioxidant activity of different extracts of edible insects

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Mexico is a country that has more than 300 species of insects, and many of these are consumed for their taste, nutritional and medicinal properties. Insects can be a very important source of antimicrobial and antioxidant compounds, however research in this area is focused only on the pharmacological application, finding some compounds capable of inhibiting Gram-negative bacteria. Studies so far are focused on living organisms, but not in insects ready for human consumption. The objective is to study the antioxidant and antimicrobial activity of different extracts of edible insects of Mexican origin. Insects used in this study were grasshoppers (*Sphenarium purpurascens*), maguey worms (*Comadia redtenbacheri*) and jumiles (*Euschistus taxcoensis*), which were purchased in the market for exotic meats "San Juan" located in downtown Mexico City. Extraction of bioactive compounds was performed in three different solutions with and without 0.6M NaCl (water, ethanol 50% and acetic acid 30%), and two fractions were obtained (supernatant and pellet). Antagonistic test against *Listeria innocua*-ATCC33090 and the antioxidant activity by the method of FRAP (ferric reducing/antioxidant power) was determined. Only the supernatant obtained of the extract of grasshoppers in water and the precipitated of maguey worm in ethanol and water, inhibited the growth of listeria. Moreover all extracts had antioxidant activity. Extracts maguey worms in water with NaCl showed the highest antioxidant activity ($0.847 \pm 0.140 \mu\text{g Trolox}/\mu\text{l extract}$). Jumiles and grasshoppers extracts showed the highest activity in acetic acid and ethanol ($1.033 \pm 0.093 \mu\text{g Trolox}/\mu\text{l extract}$ and $0.541 \pm 0.818 \mu\text{g Trolox}/\mu\text{l extract}$, respectively); however, a decrease in the antioxidant activity was observed with NaCl. Finally grasshoppers and maguey worms may be of interest to the food industry, since they have antioxidant and antimicrobial activity, but more studies are needed to broaden the spectrum of inhibition and other complementary methods to determine antioxidant capacity.

Keywords: antimicrobial, antioxidant, edible insects,

Foliar protein from Chaya crop (*Cnidoscolus chayamansa*): Isolation, characterization and its evaluation as potential ingredient for agroindustry.

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Besides of its nutritional value, proteins are much appreciated as food additives for developing products due to its functional properties. Last decades, animal proteins have been used as functional ingredients (ovalbumin, whey protein, gelatin, etc.), nevertheless, knowledge on vegetal protein behavior is still limited. One of the principal aspects of vegetal protein functionality is its low solubility, which determines its application. The aim of this study was to isolate and characterize foliar protein (Fraction I) from Chaya (*Cnidoscolus chayamansa*) crop biomass and evaluate the effect of drying method on the solubility. Protein isolates were obtained by lysis of the plant cell membranes, following by alkaline maceration, clarification, and acid precipitation. Precipitated protein was dried by three drying methods: a) vacuum drying b) freeze-drying c) spray drying. The presence of Fraction I protein known as RuBisCO (*Ribulose 1,5 bisphosphate Carboxilase-Oxygenase*) was confirmed by SDS electrophoresis, peptide fingerprinting showed characteristic bands mainly amide A, I and II on the infrared spectrum. The nativity of rubisco protein was verified by the presence of enthalpic peaks during calorimetric measurements. Fluorescence images demonstrated rough and irregular surfaces on protein isolate structure subjected to freeze and vacuum drying in comparison to isolates spray dried, which presented smooth, spherical and homogeneous surfaces. Isolate structural characteristics were related to processing drying conditions affecting directly protein solubility increasing its percentages when samples were spray dried even at neutral pH values. Viability of obtaining vegetal protein highly available and sustainable from foliar biomass dried by spray drying method, represented a potential ingredient to be evaluated as gelling, emulsifier and foaming agent among others, in order to get into the agroindustry.

Keywords: Chaya, foliar protein, structure, functionality, agroindustry

Cooking Quality and Sensory Analysis of Pasta Enriched with *Chlorella vulgaris* Biomass

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Microalgae can improve the nutritional and physical properties of conventional foods due the high nutritional content. Pasta is one of the best options for incorporating *Chlorella vulgaris* biomass, as it is popular with consumers due to its easy handling, storage and preparation. There is a great need for scientific knowledge on the implementation of this type of functional ingredients in industrial food. The aim of this work was to evaluate the addition of *Chlorella vulgaris* biomass on the cooking quality and sensory analysis of fettuccine pasta. Biomass production was carried out in a 30 L flat panel airlift photobioreactor. Fresh pasta was prepared using durum semolina flour, water and *C. vulgaris* biomass (1, 2 and 3 % w/w). Pasta made without *C. vulgaris* was used as the control. Pasta samples were dried at 40 °C for 3 h until final moisture of 10% (w/w) was reached. The effect of biomass addition on cooking quality (optimal cooking time, cooking loss, weight and length increase), color (L, a, b) and sensory characteristics on pasta were evaluated. Optimal cooking time was 5 min in boiling water and was considered as the time necessary to obtain complete starch gelatinization. Cooking loss was similar in all enriched pastas, being this value was below the technologically acceptable limit (<8%). Control samples showed higher cooking loss values (11 %). The weight and length of pasta increased in the range from 180 - 223 % and 23.3 - 37.7 %, respectively, indicating higher water absorption in enriched pasta. Pastas prepared with *C. vulgaris* were visually attractive, presenting green coloration. By increasing the microalgae concentration (1.0 – 3.0 %) color loss was less affected during pasta cooking process. Sensory evaluation indicated that pasta enriched with 1 and 2 % of *C. vulgaris* biomass showed the most overall acceptance. The results of this study indicated that the enriched pasta presented satisfactory technological attributes needed in the pasta industry.

Keywords: Cooking quality, sensory analysis, pasta, microalgae

Nutritional and Antioxidant Evaluation of Enriched Pasta with *Chlorella vulgaris* Biomass

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Pasta products are well accepted by consumers for their sensory attributes, low cost, easy preparation and transportation. Pasta is mainly used as an energy source due to its complex carbohydrate content making this food product a potential vehicle for nutraceuticals such as vitamins or polyunsaturated fatty acids. Microalgae are biological resources containing significant compounds, which are good for health and have nutraceutical and antioxidant value to be used as functional ingredients. The aim of this study was to evaluate the nutritional and functional properties of enriched pasta with *Chlorella vulgaris* biomass. Biomass production was carried out in a 30 L flat panel airlift photobioreactor and freeze-drying. Fresh pasta was made of durum semolina flour, water and microalgae biomass (1.0, 2.0 and 3.0 % w/w). The mixture was extruded as fettuccini (8 mm width and 80 mm length) using homemade pasta machine. Extruded pasta was dried at 40 °C for 3 h. Pasta without microalgae biomass (control) was also prepared. Pasta samples were cooking in boiling water for 5 min. Raw and cooking pasta samples were analyzed for crude protein, lipids, carbohydrates, total ash and moisture. Phenolic content and antioxidant activity as inhibition of DPPH radical was also evaluated. The ash content in enriched raw pasta was around 3 %, whereas in cooked pasta the ash content was reduced to 1.9 - 2.4%, however ash content was higher compared with control samples (1.6 %). Protein values ranged from 11.9 - 16.3 % and 10.5 - 15.1 % for raw and cooked pasta, respectively, showing an increment of 27 - 65 % in comparison with control pasta. Lipid content increased as microalgae biomass was increased. Total phenolics and antioxidant activity decreased after cooking process. The total phenolic content ranged from 20.6 - 25.4 mg GAE/g of pasta and the DPPH radical scavenging was between 39.2 - 51.7 % for enriched cooked pasta, being these values higher than control samples. According to the results, the addition of *Chlorella* biomass to pasta may be an appealing way to increase the daily intake of functional nutrients.

Keywords: Nutritional, antioxidant properties, pasta, microalgae

Evaluation of Cookies Added with Esterified Plantain Flour as a Functional Food

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Unripe plantain flour (UPF) is a gluten-free product with high content of indigestible carbohydrates such as resistant starch (RS) and dietary fiber (DF). However, when UPF is cooking, its high RS content (~80%) decrease to ~12%, reducing its nutraceutical effects. The RS, a type of DF, resists enzymatic hydrolysis and is fermented in colon by microbiota. Their beneficial effects include reduction in the caloric intake, glycemic response and levels of cholesterol and triglycerides. Esterification with citric acid (CA) (40% of starch dry weight), elevated temperature (>100°C) and long reaction time (>3 h) has been used to hydrolyze starches from different sources to increase RS and the results indicate that RS is thermally stable after heating. The aim of this research was to use esterified plantain flour (EPF) to produce cookies and evaluate their chemical characteristics and indigestible fraction level (IFL). Two cookies (control) were elaborated with commercial wheat flour (CWF) and raw UPF. The RS contents from EPF, after esterification with CA at 140 °C during 7 h, were 93.9% (uncooking) and 93.7% (cooking). Proximal composition, total starch (TS), total indigestible fraction (TIF), soluble (SIF) and insoluble (IIF) were evaluate, as well hydrolysis degree (HD) and glycemic index (GI). Cookies-CWF showed the lowest lipid content (8.7%), ash (0.4%) and the highest protein content (5.4%). Moisture content was lower in EPF (2.5%) than UPF (4.1%). Ash content was high in UPF (1.1%) but decreased in EPF (0.99%). Protein content was higher in UPF (2.2%) than in EPF (1.6%). CWF presented the highest (39.4% digestible fraction and EPF the lowest (14.7%). The highest IFL were for EPF 44.8% (TIF), 15.6% (SIF) and 29.2% (IIF). UPF showed IFL of 31.2% (TIF), 9.1% (SIF), and 22.2% (IIF); these levels were higher for CWF with 17.2% (TIF), 6.2% (SIF) and 10.9% (IIF). The hydrolysis degree was 96.7% (CWF), 74.37% (UPF) and 25.45% (EPF). The lowest GI (59.6) was for EPF and the highest (116.8) for CWF. Cookies elaborated with EPF with high IFL, low GI and gluten-free can be considered a functional food for people with specific or no specific nutritional requirements.

Keywords: plantain flour, esterification, cookies, resistant starch, glycemic index.

Viability of protein-microencapsulated *Lactobacillus plantarum* 299v in Tortilla and Fresh Cheese through storage.

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Several studies have shown that probiotic bacteria produce a beneficial effect on health. *Lactobacillus plantarum* 299v, has shown to be useful to reduce inflammation in chronic diseases. The microencapsulation technique can be helpful to maintain probiotic viability for longer periods without refrigeration and arrive thus in sufficient quantity to the colon where they can exert their beneficial action. Nevertheless the temperature used for drying can decrease bacterial viability and the use of thermo-protective ingredients as proteins are desired. The objective of this work was to determine the viability of *Lactobacillus plantarum* 299v (microencapsulated with protein from three different origin: soybean, whey or peanut) within two wide consumed foods (tortilla and fresh cheese) in order to assess the effect of proteins in *L. plantarum* performance after microencapsulation done by spray drying (ADL311S, Yamato, Tokyo, Japan, 130°C and 0.13MPa). The mixes were made with distilled water, alginate (1%w/w), inulin (5%w/w), maltodextrin (5%w/w), 2.5% of each tested proteins and *L. plantarum* 299v (1×10^9 CFU/ml). The tortillas were elaborated with nixtamalized corn flour and water and fresh cheese was elaborated with pasteurized milk, calcium chloride (0.03%w/w), rennet (1mL/20L milk) and salt (1.5 g/100 g of curd). Both products were inoculated during its manufacture with microencapsulated *L. plantarum* 299v (1×10^8 CFU/g product) and five groups were made: I) Control: without lactobacillus, II) Probiotics: lactobacillus without protein, III) microencapsulated with soybean protein, IV) with whey protein and V) Peanut protein. Bacteria's viability was evaluated each three days in both foods (10 g of product were diluted in phosphate-buffered saline –PBS- solution, inoculated on MRS agar plates and colonies were counted after incubation -48h, 37°C, anaerobic conditions). Results showed that after seven days of storage at 4°C, the fresh cheese with *L. plantarum* 299v and peanut protein did not have differences in viability reduction. When soybean and whey were used as microencapsulants a significant difference in viability after seven days of storage was observed. The same difference was observed in tortilla. This study suggests that the microencapsulation mix with 2.5% of peanut protein isolates has a positive effect in *L. plantarum* viability making this bacteria more resistant to the harsh conditions of food processing and store.

Keywords: Microencapsulation, Lactobacillus, proteins thermoprotective

Nutraceutical potential of different mango species (*Mangifera casturi*, *Mangifera lalijiwa* and *Mangifera indica*)

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There are many species of *Mangifera* genus in endangered and uncharacterized nutritionally, which are grown in countries with poverty and malnutrition problems. The main interest this work was to generate knowledge that reflects in the growing interest these species in the hometowns or countries with similar climates. The objective was to evaluate the effect of the maturity stage on nutritional, vitamin and phenolic content in pulp of three species mangoes (*Mangifera casturi*, *Mangifera lalijiwa*, and *Mangifera indica* cv. Tommy Kent). *Mangifera casturi* and *Mangifera lalijiwa* species were provided by Fairchild Tropical Botanic Garden (Florida, USA) and *Mangifera indica* cv. Tommy-Kent was harvested at an orchard located in the 'village' of 5 de Mayo, near Tepic, Nayarit, México in two maturity stage (physiologically maturity or immature and consumption ripeness). The analyses were: nutritional composition, total soluble polyphenols (TSP), B, C and E vitamins. Factorial design (3x2) was used. Data with ANOVA and LSD mean comparison with $\alpha=0.05$ (Statistica soft® version 10.0) were analyzed. Nutritional composition was dependently of maturity stage and specie ($p<0.05$). The higher values were in immature stage. It is important to mention that *Mangifera casturi* had the higher values of total dietary fiber. Also, vitamin C in immature *Mangifera casturi* was three times greater than *Mangifera indica* and *Mangifera lalijiwa*. The content of niacin, pyridoxine, riboflavin, thiamine and niacinamide was higher in consumption ripeness for all species ($p<0.05$), these results are interesting because vitamin B has been little reported in mango species. Changes in vitamin E were observed, *Mangifera indica* maintained values of 5.19 to 7.75 mg/100 g dw in immature and mature stages, respectively; while *Mangifera casturi* and *Mangifera lalijiwa* had 21.07 and 5.72 mg /100g in immature stage and decreased to 4.60 and 3.81 mg/100 g dw when fruits ripened. TSP were higher in *Mangifera casturi* followed by *Mangifera lalijiwa* in both maturity stages. In conclusion *Mangifera casturi* and *Mangifera lalijiwa* have a higher nutraceutical potential than *Mangifera indica* cv Tommy-Kent in immature stage therefore these fruits can be consumed or used for industry food in this maturity stage, although in consumption ripeness the fruits too conserved a good content of nutrients.

Keywords: mango species, nutrition and bioactive compounds

Bakery products enriched with dehydrated moringa (*Moringa oleífera*)

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Moringa oleífera crops thrive in many regions in Africa and Asia, as it feeds many people quickly and at a low cost. Its medicinal, culinary and nutritional virtues are still under study. In 2011, Chiapas reported a production of up to 500,000 plants, provided by the Instituto de Reconversión Productiva y Bioenergética. From a nutritional standpoint, Moringa is a plant with a high content of proteins, vitamins and minerals, and contains all essential amino acids. The objective of this research is to develop popular bakery products such as cookies and muffins with a 10% content of pulverized Moringa, and to study them via sensory testing. Disinfected Moringa leaves were dried out for approximately 3 h in solar driers at a temperature range between 50° and 60° C, until moisture content reached 11%. Thereafter, leaves were ground in a processor and put through a 40_μm sieve. The ingredients used for cookies and muffins were wheat flour, ground Moringa, butter, sugar, eggs, baking powder and vanilla. Ingredients were mixed together and shaped accordingly. Products were baked immediately thereafter at 180° C for 15 min. After cooling down, they were prepared for sensory testing and proximate analysis. Cookies were studied using hedonic testing using a “smiley” scale for 23 children in elementary schools between 8 and 9 years old. On the other hand, muffins were evaluated with a 9-point hedonic scale for 60 untrained panelists between 18 and 23 years of age. Cookies had a mean value of 18.34% ± 1.28 of raw protein, and a 70% approval rate among the children. Muffins had significant statistical differences (p<0.05) for attributes of color, smell and taste between samples containing 10% Moringa powder and control samples without it. Further studies are required to products, however, they could be considered in the Mexican diet.

Keywords: moringa, cookies, muffins.

Effect of nanoemulsions of Curcumin (*Curcuma longa*.) stabilized with modified Phosphatidylcholine on carcinogenesis in transgenic mice K14E6

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Cancer has is one of the leading causes of death by disease. Various alternative treatments have been developed to counter this condition, including less invasive alternatives with a higher degree of effectiveness. Such is the case of Curcumin, which is extracted from the rhizome of the *Curcuma longa* (diferuloylmethane) that shows multiple benefits. The antioxidant, anti-inflammatory and anticancer effects are highlighted; however, the use of Curcumin has a problem of low water solubility and absorption. This situation leads to the implementation of novel carrier systems such as nanoemulsions, which can have sizes between 20-200 nm. Based on the above, Curcumin nanoemulsions were formulated and employed to test their bioactivity on K14E6 mice. Nanoemulsions were prepared with lecithin, modified with medium-chain fatty acids (MCFA) as emulsifier. The preparations were used in a mouse model, to which skin melanoma was induced by the use of inductors: TPA (Phorbol 12-myristate 13-acetate) and DMBA (7, 12-dimethylbenzanthracene; as well as by the expression of genes associated with the process of carcinogenesis (Cne 2, Cdk4, caspase 8 and Cldn4.) Nanoemulsions with mean particle size 100 ± 5 nm were obtained and fed to mice that were divided into 4 groups, of which 2 were in the co-treatments of free and encapsulated Curcumin. Treatments lasted 32 weeks until their sacrifice; the number and size of tumors were counted and histological studies were carried out.

Keywords: Curcumin, Nanoemulsions.

Obtention of hidrolisates and bioactive peptides from ovalbumin, milk and soy using proteases from *Bromelia pinguin* and *Bromelia karatas*

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The fruits of *Bromelia pinguin* (*B. pinguin*) and *Bromelia karatas* (*B. karatas*) are rich in proteases; however they have been scarcely evaluated to obtaining of protein hydrolyses. The protein hydrolyses are a source of bioactive peptides, these compounds may exercise an important role in the regulation and metabolic modulation. The objective this work was to evaluate the use of vegetal proteases in the obtaining of hydrolyses and bioactive peptides with antioxidant activity from ovalbumin, milk and soy. Lyophilized proteases from fruits of *B. pinguin* and *B. karatas* were used to hydrolyze three substrates (ovalbumin, milk and soy) during 30, 60 and 120 min. Control enzyme was bromelain. The analysis were degree of hydrolysis (DH), total soluble peptides and antioxidant capacity. Subsequently total hydrolyses were subjected to a separation by membranes with pore size of 30, 10, 5 and 1 kDa, using ultrafiltration and antioxidant capacity of separated peptides was evaluated. The data were analyzed with ANOVA and means test (Tukey $\alpha=0.05$) using the software Statistica version 10. There was a 60 to 70% of DH with *B. pinguin* proteases, 40 to 60% with *B. karatas* proteases and 35 to 45% with bromelain, between 5 and 15 min for all substrates. In all treatments, the production of total soluble peptides increased with respect to time, but the higher content was found in soy with both vegetal proteases (470 and 722.7 $\mu\text{g/mL}$, *B. karatas* and *B. pinguin* respectively). The content of peptides in ovalbumin and milk hydrolyses were the lowest, being the least effective for these substrates, *B. karatas* proteases. All hydrolyses and bioactive peptides showed antioxidant capacity with ABTS and FRAP methods (5 to 20 mmol Trolox equivalent/g dw). In conclusion the studied vegetal proteases have good hydrolytic action on ovalbumin, milk and soy, as well as to generate hydrolyses and bioactive peptides with antioxidant activity.

Keywords: *Bromelia pinguin*, *B. karatas*, bioactive peptides, antioxidant activity

Evaluation of the bioactivity of betulinic acid nanoemulsions on carcinogenesis in transgenic mice K14E6

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Cancer is a multifactorial disease, and different treatments against it include: radiation therapy, chemotherapy, and surgery. However, their effectiveness is variable and tends to be limited. Innovative therapies have been evaluated that include consumption of bioactive compounds, among them betulinic acid (3 β -20-hydroxy-lup(29)-in-28-OIC). The application of this and similar compounds is limited by its low solubility and bioavailability. It is necessary to assess their bioactivity using carrier models such as nanoemulsions. Our thrust was to assess the absorption of nanoemulsions containing betulinic acid in transgenic mice K14E6. Lecithin modified with medium-chain fatty acids (MCFA), was used as emulsifier. Skin tumors were induced in K14E6 transgenic mice, with carcinogenic inductors TPA and DMBA; as well as the expression of genes associated with carcinogenesis in the skin. Nanoemulsions with betulinic acid had a globule size of 82 nm, with a yield of 86%. Groups of mice, developed tumors after 32 weeks of inductors application. The bioactive both as free as well as encapsulated was evaluated. The group of mice evaluated as co-treatment with the bioactive showed smaller and fewer tumors in compared to the control sick mice.

Keywords: betulinic acid, Nanoemulsion.

Changes of Color and Astaxanthin Content in Cephalothorax of Shrimp Treated with BHT and TBHQ during Sun Drying

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Shrimp is one of the most important aquaculture products in the world. Frozen headless shrimp is a popular presentation in the market. The cephalothorax derived from processing of this crustacean is little marketed and usually discarded. Solar drying of this product represents a viable alternative for better handling and subsequent use. However, important components like astaxanthin are degraded almost completely during sun drying. The aim of this work consisted in evaluate changes in the content of astaxanthin and color (L^* , a^* , b^* values) in cephalothorax of shrimps treated with the antioxidants BHT and TBHQ after cooking and during direct solar drying. Cephalothorax of shrimp (*Penaeus vannamei*) were subjected to boiling in brine (12.5% w/w) for 15 min at cephalothorax:brine ratio of 1:4. After the cooking, the antioxidants BHT (4.0 g/kg) and TBHQ (1.0 g/kg) were added to product-brine mixture. The heads were drained and dried under direct sunlight for 32 hours (4 days). During sun drying of the product, the weight loss, moisture content, astaxanthin content and values of L^* , a^* , b^* were estimated. The antioxidants BHT and TBHQ no affected the weight loss and moisture content in cephalotorax of shrimp after cooking and during sun drying. However, the L^* and a^* values, as well as the astaxanthin content were affected by the antioxidants incorporated. The a^* values observed in the products after cooking were: 26.5 ± 4.6 , 15.1 ± 3.8 and 10.7 ± 2.3 for the treatments with TBHQ, BHT and control respectively. This indicates a higher intensity of red color in the products treated with BHT and TBHQ than the control. The astaxanthin degradation in the product during the solar drying followed a first order kinetics. The kinetic parameters calculated were: C_0 ($\mu\text{g/g}$) of 78.3 ± 5.0 , 88.2 ± 7.7 y 53.4 ± 4.6 for TBHQ, BHT and control respectively. In the same order, the k values (h^{-1}) were: $4.1 \times 10^{-2} \pm 0.5$, $3.9 \times 10^{-2} \pm 0.7$ y $4.1 \times 10^{-2} \pm 0.6$. The above indicates that the incorporation of TBHQ and BHT to cephalothorax of shrimp favors the retention of astaxanthin after cooking and during solar drying.

Keywords: Astaxanthin; Cephalothorax; Shrimp; TBHQ, BHT

Polyphenol and polysaccharide content of corn silk extracts obtained from autochthonous Mexican corn races

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Corn silks have been used over the years to treat various ailments such as diabetes and urinary tract infections. Several studies have attributed these benefits to bioactive compounds contained in corn stigmas such as polyphenols and polysaccharides. In Mexico, there are about 65 native corn races. Nevertheless, there are no studies about the variation of polyphenols and polysaccharides on the silks from different autochthonous Mexican corn races. In this work, it is reported the content polysaccharides, polyphenols and the antioxidant activity of maydis stigmas obtained from five different corn races native from Mexico. The corn silks from the race Gordo (white kernels) has a significant amount of mono-di saccharides (365.9 μg EGLU / mg dry stigma). In contrast, the stigma from the race Cristalino de Chihuahua (yellow kernels) had a high amount of polysaccharides (containing a smaller amount of reducing sugars 41.4 μg EGLU / mg of solid). On the other hand, the highest content of polyphenols was found in corn stigmas from the races Cónico with red dark, red, and white-blue kernels (74.5, 72.6 and 73.7 μg GAE / mg of dry stigma). The highest content of anthocyanins and flavonoids were found in the race Cónico with red kernels (49.6 μg EQ/ mg) and dark red kernels (0.299 μg C3GE/ mg). The antioxidant capacity was determined using the DPPH free radical method. From the main results, it was found that corn silks from races with a high content of anthocyanins, had a higher antioxidant content. In summary, it can be concluded that the content of polyphenols and polysaccharides as well as its antioxidant activity differ depending on the corn race, and therefore its biological activity might also vary.

Keywords: Corn stigma, antioxidant, polyphenols, reducing sugars.

Evaluation of the Effect of Replacing Fat Pork by Peanut on Textural Properties of an Emulsified Meat Product.

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Sausages and ham occupy almost 90% of consumption of processed meat products in Mexico City. However, from the point of view of health, excessive consumption of meat products is not recommended due to the high fat content. Under this logic, the reformulation of traditional meat products can be carried out by modifying the content of lipids and fatty acids and / or adding a number of functional ingredients. Composition studies have shown that tree nuts have significant amounts of monounsaturated and polyunsaturated fatty acids (around 90%) including oleic and linoleic acids. Therefore, the replacement of pork fat by peanut (*Arachis hypogaea*) (0 to 10%) was assessed in this study and its influence on the modification of some characteristics of texture in a rabbit emulsified meat product. Peanut (*Arachis hypogaea*) and rabbit meat (*Oryctolagus cuniculus*) New Zealand breed were used. The texture tests conducted were compression, penetration and shear force. The significant differences between the mean values of the textural attributes were evaluated by ANOVA with 95% confidence (Minitab statistical versión 16, 2010, Pensilvania, EE.UU). Texture evaluation was carried out 24 hours after its preparation at 25 ° C. The results showed a significant decrease ($P \leq 0.05$) of texture values. Replacing pork fat by peanut in the sausages modify the textural characteristics obtaining softer products or with a less rigid structure. This may be because the tree nuts interfere with the formation of the structures of protein networks.

Keywords: sausage, peanut, textural properties.

Antioxidant and Angiotensin Converting Enzyme (ACE) Inhibitory Activities of Ultrafiltered Cocoa Protein Hydrolysates

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Although, abundant information on the chemical composition and biochemical characterization of the proteins of cocoa seed can be found in scientific literature, studies on their antioxidant and antihypertensive properties are scarce. Therefore, the aims of the present study were to assess the *in vitro* antioxidant and antihypertensive activities of the proteins from the cocoa seed and to analyze the changes on bioactivity due to enzymatic hydrolysis of proteins and subsequent separation of peptide fractions by ultrafiltration; likewise, molecular weight (M_w) and IC_{50} value of the peptides with the highest bioactivity were determined. Albumin (Alb), globulin (Glob) and glutelin (Glut) fractions were extracted from cocoa seeds (*Theobroma cacao* L.) in order to assess their antioxidant capacity (Aox-C) by means of DPPH, ABTS and ORAC assays and antihypertensive activity by the inhibition of angiotensin I-converting enzyme (ACE-I). Protein fractions were hydrolyzed with alcalase using an enzyme: substrate ratio of 1:10 (w/w) for 1 – 8 h, at pH 7.5 and 50°C. For peptide separation, hydrolysates were fractionated through an ultrafiltration (UF) membrane with a M_w cut-off (M_wCO) of 3000 Da. Aox-C and ACE-I of protein hydrolysates and ultrafiltered peptide fractions (UPF) were assessed under same conditions previously described. The UPF that showed the highest bioactivity was separated using FPLC. Finally, IC_{50} was calculated by linear regression. Alb, Glob and Glut showed significant differences ($p < 0.05$) in Aox-C and ACE-I. Among proteins, Glut and Alb showed the highest Aox-C and ACE-I, respectively. Both, hydrolysis and subsequent separation of peptide fractions through UF increased Aox-C and ACE-I, reaching values of 48.9, 41.2 % and 1.58 μM TE/mg protein in the DPPH, ABTS and ORAC assays, respectively. The highest ACE-I found was of 38 – 48%. The UPF that showed the highest bioactivity was separated in four peaks with M_w of 2959 – 535 Da and IC_{50} values of 237.5 – 296.3 $\mu g/mL$, 19.3 – 28.3 $\mu g/mL$ and 610 – 790 $\mu g/mL$ for DPPH, ABTS and ACE-I, respectively. These results show that enzymatic treatment and UF are attractive processes for the production of bioactive hydrolysates and peptides from cocoa proteins; they show a novel alternative use of cocoa seed.

Keywords: *Theobroma cacao* L., protein hydrolysates, ultrafiltration, peptide fractions, bioactivity.

Effect Of Adding Different Iron Compounds On Color Parameters In Wheat Flour Fortification.

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Anemia iron deficiency is still a public health problem in the country, which is evidenced in The Food and Nutrition Situation Survey, ENSIN 2010. As a strategy to control micronutrient deficiencies in Colombia, fortification of massive consumed foods constitutes a fundamental line of action. Thus, fortified wheat flour is their flagship product. The aim of this study was to evaluate the effects of adding different iron salts on color during wheat flour fortification. Experimental research. The characterization of 6 iron compounds commonly used in the fortification of wheat flour was made. Homogeneity and quantification of iron qualitative test was performed in conformity to international AACC 40-40 and AOAC 985.35 methods, respectively. The amount of iron added was based on the current concentration by Decree 1944 of 1996. The changes in Instrumental color analysis were determined by using CIELAB parameters and the whiteness index in each of the samples was based according to Hsu et al. Analytical data on qualitative homogeneity tests indicates differences with regards to ferric pyrophosphate and glycine stabilized ferrous gluconate. Such results are consistent with significant differences ($p < 0.05$) for both compounds in the quantitative determination of iron with respect to the other tested salts. Instrumental color analysis; significant differences for the parameters L^* , a^* and b^* were observed in all iron compounds except encapsulated iron salts and NaFeEDTA iron type. Whiteness index; this parameter was affected in larger proportion by NaFeEDTA and ferric pyrophosphate. The microencapsulated and protected compounds such as bisglycinate ferrous, ferrous fumarate and ferrous sulfate are alternative iron salts that exert no effect on the color of wheat flour and can be considered in the reformulation of fortification.

Keywords: Fortification, iron, iron deficiency, color, wheat flour

Enzymatic production of structured monoacylglycerides with an elevated content of medium chain fatty acids

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Much research has been focused on the modification or production of fats and oils for the preparation of functional and health-promoting lipids, also displaying technological properties that make their use in processing lines feasible. Recent studies have confirmed the potential of medium chain fatty acids (MCFAs) to reduce: body weight, particularly body fat; lipoprotein secretion and attenuate postprandial triglyceride response; fasting lipid levels in serum more quickly and efficiently than oils rich in mono- or polyunsaturated fatty acids; intestinal injury, and protect against alcohol-induced hepatotoxicity. Monoacylglycerides (MAG) are amphipathic molecules which are one of the most widely used emulsifiers in food, detergent, plasticizer, pharmaceutical and cosmetic industries. The present investigation examines the production of monoacylglycerides using *Candida antarctica* lipase by an enzymatic reaction between glycerol and MCFAs. The MCFAs were obtained by saponification of the MCT. Glycerolysis reactions were conducted in solvent-free systems. Substrates (Glycerol and free MCFAs) were placed in Erlenmeyer flasks and mixed in a heating plate with magnetic stirring at 300 rpm and 50 °C until complete dissolution. Five grams of substrates were placed in 25-mL Erlenmeyer flasks and mixed with 5% of immobilized enzyme. The reaction was carried out in an orbital shaker operating at 300 rpm for a period of 4 h. Samples were withdrawn periodically (0, 15, 30, 60, 120, 240 min) to determine the extent of incorporation of free MCFAs into glycerol. All experiments were performed in duplicate. The MG composition was determined as follows: 100 µg of reaction mixture was mixed with 1 mL of pyridine, 0.2 mL of HMDS and 0.1 mL of TCS and held at 40 °C for 15 min; then, evaporated with nitrogen and finally were extracted with 1 mL of hexane. 1 µL was injected into a HP GC Model 5890 gas chromatograph fitted with a flame ionization detector and a PE-5 (30 m 0.32 mm 0.1 µm) capillary column. The temperature program consisted of an initial temperature of 100 °C for 1 min, followed by heating to 300 °C at 10 °C/min. Then, this temperature was maintained for 30 min. Injector and FID temperatures were set at 300 and 315°C, respectively. Saponification of MCT yielded a mixture of free MCFAs composed of caproic acid-C6:0 (0.57 %), caprylic acid- C8:0 (71.62 %), C10:0-capric acid (27.63 %), and lauric acid-C12:0 (0.18 %). In this study, the maximum incorporation of free MCFAs into glycerol was obtained at a molar ratio of glycerol to free MCFAs of 1:6, an enzyme loading of 10%, and 50 °C. Under these conditions, incorporation at least of 90% of MCFAs to glycerol was achieved after 30 min of reaction. The chromatographic method showed the formation of the four types of MG (MAG-C6:0, MAG-C8:0, MAG-C10:0 and MAG-C12:0) and their isomers.

Keywords: Medium chain fatty acids, glycerolysis, monoacylglycerides, *Candida Antarctica* lipase.

Changing Digestibility of Pregelatinized Starch by Hydrothermal Treatment

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Gelatinized starch is rapidly hydrolyzed for digestive enzymes compare with unmodified (native) starch. Gelatinization is a process achieved when starchy products are cooking with water. The aim of this study was modified digestibility of pre-gelatinized starches by hydrothermal treatment (HT), stimulating formation of slowly digestible starch (SDS) and resistant starch (RS). High-amylose starches (HV and HVII) were pre-gelatinized, dried with two methods (oven and freeze-drying), moisture content was adjusted at 40% and were incubated in an oven at 100 °C for 3, 12 and 24 h. Oven drying decreased the rapidly digestible starch (RDS) from 51% to 20%, RS increased from 31% to 63%, whilst SDS did not show change compare with the fresh gelatinized starch (17%). Freeze-drying did not produce change in RDS, SDS and RS content. Pre-gelatinized HV and HVII with HT and drying in oven showed decrease in RDS (19% to 6% and 11% to 5%, respectively) and increase in RS (63% to 74% and 45% to 62%, respectively), depending of the incubation time. Freeze-drying starches showed an inverse pattern due to that HT of HV did not modify RDS and SDS content with the incubation time; RS increased from 45 to 62%. HVII presented an increase with the incubation time for SDS (16 to 28%) and RS (46 to 54%), but RDS did not show change. X-ray diffraction results showed that re-arrangement of starch structure after the HT was responsible of the digestibility changes. Pre-gelatinized starch with HT and drying in oven favoured the increase in RS content, whilst that freeze-drying favoured SDS and RS formation.

Keywords: Pregelatinized starch, hydrothermal treatment, digestibility

Improvement of Phenolic Content and Antioxidant Activity of Corn Tostadas with the Addition of Amaranth and Flaxseed Flours

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Dietary patterns of Mexican populations indicate that we consume corn and corn products as a significant portion of our diet. Among corn products we can find tostadas which can be baked or fried. Different studies reported that white corn and its products contained a low amount of total phenolic compounds and antioxidant activity; for this reason, the aim of the present work was to evaluate the effect of the substitution of corn flour for amaranth and flaxseed flours on the phenolic and antioxidant activity of corn tostadas. Two different formulations were used; one containing 25% of amaranth flour and 25% of flaxseed flour; and the other contained 37.5% of amaranth flour and 12.5% of flaxseed flour. A formulation that contained only corn flour was used as control, along with a commercial corn tostada. The proximate analysis and the caloric amount of the four samples was obtained. The phenolic content was determined with the Folin-Ciocalteu's technique and the antioxidant activity was measured with the DPPH⁺ and ABTS⁺ assays. All data were obtained from three replicates. Differences among samples were determined by one-way ANOVA test. The results showed that the substitution of corn flour for amaranth and flaxseed flour generated an increase in the fat and protein content and also in the caloric amount (14% of increase), however this increase improves the type of fatty acids compared with a fried tostada, and also improve the protein type that is being consumed. The phenolic content was improved in a 21% with the 25:25 substitutions. The antioxidant activity was increase in a 37% as compared with the non-substituted formulation. The results obtained suggests that the replacement of corn flour for 25% amaranth and 25% flaxseed flour improves the phenolic content and antioxidant activity of corn tostadas suggesting it's use as an alternative to increase the phytochemical consumption on the Mexican population.

Keywords: Tostada, amaranth, flaxseed, phenolic compounds, antioxidant activity

Peach Palm Fruit as a Source of Carotenoids for Nutritional and Health Improvement in Developing Countries

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According to the World Health Organization of the United Nations, deficiency of vitamin A is considered to be a moderate to severe public health problem in 122 countries around the world, with the highest prevalence in developing countries, and being infants, children, and pregnant women the most seriously affected. Vitamin A can be found in fish, eggs, and dairy products, which are expensive and often unavailable to poor populations. If the consumption of plant-derived provitamin A is also limited in these populations, a severe deficiency occurs. A promising approach for reducing Vitamin A deficiency in affected populations is promoting the consumption of locally grown provitamin A-rich plant foods. We propose the peach palm fruit (*Bactris gasipaes*) to be a source of provitamin A carotenoids among other benefits. To test this hypothesis, yellow- and orange-colored peach palm fruits, purchased in local markets in Costa Rica, were selected and their carotenoids were extracted and analyzed using HPLC equipped with photodiode array detection and APCI mass spectrometry. Analyses revealed the presence of a broad range of carotenes, with prevalence of (*all-E*)- β -carotene, two (*Z*)-isomers of γ -carotene and one (*Z*)-lycopene isomer. In addition, the physical deposition state of these carotenoids was investigated *in planta* by using light, transmission electron, and scanning electron microscopy. Globular amylo-chromoplasts were predominantly observed, mainly containing carotenoids in a lipid-dissolved form, which are usually highly available. A limited bioavailability test with two healthy non-smoking adults confirmed high absorption of these compounds to the human plasma. According to these results, peach palm fruit might be extremely useful for diminishing vitamin A deficiency in many subtropical and tropical countries, being the consumption of only 200 g of orange-fleshed peach palm fruits sufficient to meet the dietary recommendations of the U.S. Institute of Medicine.

Keywords: *Bactris gasipaes*; bioavailability; carotene; chromoplasts; lycopene

Rapid extraction and isolation of chlorogenic acid from coffee pulp.

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Coffee pulp (CP) is the main solid byproduct of wet processing of coffee cherries and it represents about 40-45% by weight of the fruit. CP is currently under-utilized and in some cases discarded without treatment, therefore it could represent a serious environmental problem. On the other hand, CP is a potential source of value added compounds such as chlorogenic acid (CGA). CGA has antioxidant, anti-carcinogenic and anti-inflammatory properties. It has potential applications in the chemical, pharmaceutical and food industries. In this study, we developed a method for the rapid extraction and isolation of CGA from CP based on Microwave Assisted Extraction (MAE) and column chromatography. CP was sun dried and milled at a particle size of 0.15-0.84 mm. Dry CP was subjected to a solvent extraction in a microwave oven MARS Express (CEM, USA). The effect of solvent, solvent concentration, temperature and extraction time on MAE was evaluated. Under the selected conditions (4 minutes at 60 °C with 50% ethanol) 8.79 g of crude extract containing 1.13% of CGA was obtained from 32 g of CP. Crude extract was fractionated first, on an Amberlite XAD-16 column and then on a semi-preparative C18 HPLC column. This procedure led to a 10.5-fold increase in the content of CGA with a recovery yield of 43.4%. Amberlite fractionation yielded 1.66 g of a sugar free with 5.9% (p/p) of CGA. Semi-preparative HPLC chromatography led to 70 mg of a CGA-rich fraction (61.7% purity). The developed methodology allowed the extraction and partial purification of CGA from CP through a fast, simple and reproducible process. The purity of the CGA-rich extract obtained is greater than that of some commercially available CGA products that are used as food supplements or additives.

Keywords: Chlorogenic acid, Coffee pulp, Microwave Assisted Extraction, Chromatography

Development of a Potential Functional Biscuit Using Cassava (*Manihot esculenta*) and Inulin

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Cassava (*Manihot esculenta*) is a cultivar which has been used previously for the development of baked products numerous times. Cassava tubers have been reported to contain 60 % water, 38 % carbohydrates and the 2 % left divided into ash, lipids, proteins and crude fiber. This cultivar also have the special characteristic of lacking gluten, allowing celiac patients to consume the different kinds of products developed from it. Inulin is a fructooligosaccharide considered a prebiotic and dietary fiber which enhances the development of probiotic bacteria in human's gut and promote healthy bowel's movement. For flour elaboration, cassava tuber's where obtained in a local Saltillo's supermarket, they were washed, cut and dried at 80 °C. After, they were milled and screened to a maximum particle size of 0.42 mm. Proximal analyzes of flour were made which consisted of determination of carbohydrate, protein, fat, crude fiber, ashes and humidity. Results showed a 73 % carbohydrate content and 0.22 % protein content which corresponds to literature findings. Biscuits were made by baking at 180 °C during 20 minutes in an convection oven, using a formula developed by the Laboratory of Food Technology of Universidad Autónoma de Coahuila. Physical tests, which consisted of firmness and color were made obtaining an average of 5 N, L= 73.91, a= 13.78 and b = 33.13 respectively. This values are found in similar products in scientific literature. Proximal analyzes for biscuits were made and an increase of fat was found from 0.45 % (in flour) to 8.6 % due to the product's formulation involves the use of cheese, carbohydrates diminished to 66 % by the same circumstance. Inulin was added in three different levels to the formulation and the same tests were ran, with similar results obtained and according to literature. Cassava and inulin can be used into the development of functional biscuits to enhance human health. However, sensorial analyzes and functionality tests must be done in order to assure an actual health enhancement to consumers and a good product acceptance.

Keywords: cassava biscuit, proximal analyzes, firmness, color

Biosynthesis of Phenolic Compounds in Salvilla (*Buddleja Scordioides*) and Stevia (*Stevia rebaudiana*) by Adding Chemical Elicitors

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The current interest in the study of secondary metabolism of plants has several nuances. Virtually all known secondary metabolites such as phenolic compounds have some biological activities. They have shown antioxidant, anti-inflammatory activities among others. However, since these compounds are produced by plants under stress conditions (abiotic and biotic), it is difficult to obtain standardized raw material, so the use of greenhouses and administration of chemical elicitors is an alternative. The aim of this research was to perform the metabolomic analysis of salvilla and stevia plants, elicited with salicylic, jasmonic and abscisic acids (at 0.5, 1 and 2mM). Plants of both species were propagated under controlled conditions, elicited every 15 days for 45 days, analyzed by liquid chromatography coupled with mass spectrometry (LC-MS/MS) and subjected to a network analysis using the software MetaboAnalyst 3.0. The relative abundance of tested compounds was reported as the area under the curves. The best content of phenolic acids in salvilla plants, was shown by the salicylic acid (1mM) treatment, being caftaric acid its major component, while flavonoids quercetin, linarin, quercetin-O-glucuronide and luteolin-O-glucuronide were also detected. For stevia, the best treatment was abscisic acid (0.5mM) and the major compounds observed were 4-O-caffeoylquinic acid, 3,4-di-O-caffeoylquinic acid, and the flavonoids rutin, quercetin-3-O-rhamnoside, luteolin rhamnoside and luteolin-O-glucuronide. Finally, the network analysis confirmed the preference towards the synthesis of flavonols and hydroxycinnamic acids.

Keywords: Salvilla, stevia, salicylic acid, jasmonic acid, abscisic acid.

Physicochemical Characteristics and Sensorial Evaluation of Sausage with Peanuts

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Children need additional proteins for a healthier growth but if they don't receive the correct quantity of food for the correct function of their metabolisms, the proteins are use like the last resource of energy in their commune life styles and not for their grown. This has caused the increase rates of childhood overweight and not necessarily by eating high-calorie foods. The purpose of this work focuses on the development of a sausage added with peanut paste to increase its protein level. The peanut paste was produce and stored at 4°C, the manufacturing process was focused on replacing unwanted ingredients (animal fat and carbohydrates) and to promote the presence of bioactive compounds by replacing the fatty acid profile and total protein using the peanut past. Six formulations Vienna sausage type including the witness were produce, replacing the dorsal fat and potato starch for the peanut (F1 3.94%, F2 3.96%, F3 4.02%, F4 4.27%, F5 4%) respectively. Color, pH, protein and lipids content were evaluated. A test for measuring the degree of satisfaction of the product was conducted using a hedonic scale graph 5 points, to children between 5 and 6 years. The sausage level of protein and fat were F1 22.5%, 45.75%, F2 13.7%, 50.67%, F3 14.6%, 53.26% %, F4 15.3%, 53.31% and F5 10.6%, 50.65%, fat and protein respectively. pH values obtained do not reflect significant difference between formulations (W 6.5, F1-F4 6.8, F5 6.9, Pp 7). The color study shows that the formulations tend to red, but F2 has a pale color because it has a greater variation to blue and green compared to the rest, unlike F3 in which all are reduce tending to a darker color of sausage. The formulations that were more accepted are F4 (43%), F2 (57%) and F2 (28.6%). Food development aimed at improving the nutrition of the population is a smart way to combat and prevent health problems like childhood overweight.

Keywords: Sausage, peanut, functional food sensorial evaluation.

Stability of emulsions (W/O) made with organogels as carriers of bioactive compounds

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Research on functional foods and nutraceuticals has gained great interest recently because of the importance of diet on human health. The beneficial properties of a large number of bioactive compounds present in foods have been widely studied; however, the bioavailability exhibited by most of them is not the desired one due to their hydrophobic properties. Organic solvents (e.g. vegetable oils) allow dilution and diffusion of lipophilic compounds; therefore, they are convenient vehicles for bioactive compounds of apolar nature. However, when consumed, the aggressive conditions in the digestive tract alter the balance of forces that keep dispersions and dilutions. This can be avoided with a previous stabilization of emulsions, partially immobilizing the system within a high viscosity medium (organogels). When altering the process of preparing the organogels, is possible to modify and improve the stability thereof. Hence, the objective of this work was to evaluate and select the best stability conditions from organogels emulsified at different manufacturing conditions, using two oils (canola and coconut), different concentrations of water and two emulsification techniques (homogenizer and homogenizer plus ultrasound) to obtain stable emulsions from organogels loaded with bioactive compounds (e.g. quercetin, curcumin, lupeol). Organogels stability and emulsion properties were determined by centrifugation tests, rheological studies (oscillatory shear, creep and recovery), ζ potential, and particle size analysis and droplet size distribution. It was found an almost zero degree of emulsification for coconut oil, observed through micrographs, so it was discarded. From the droplet size distribution of emulsions, better samples were observed at low water concentrations (5 and 10%), showing a normal distribution with a similar average drop size in both cases ($\sim 36\mu\text{m}$) and with no clusters formation, which was unlikely at higher concentrations (12.5%). Furthermore, it was found a negative ratio of water concentration and the residual viscosity associated to the emulsion stability. Results were compared using one-way analysis of variance (ANOVA) in a univariate experimental design, nested to a full factorial of two factors at two levels.

Keywords: Nutraceuticals, vegetable oils, bioaccessibility

Development of dressings with flour of amaranth, pea and quinoa.

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The use of dressings is very wide because they bring flavor to our meals, within the ingredients used in its manufacture is egg yolk. The downside is that it has a lot of cholesterol, one egg contains about 200 mg cholesterol, which almost reach the dietary intake limit set by the American Heart Association of < 300mg/ day. The aim of this work was to develop dressings using quinoa flour, pea and amaranth as emulsifiers replacing egg yolk. The ingredients used were: salt, vinegar, sugar and water; as emulsifiers: egg yolk (control, 4%), amaranth flour (3%), flour of pea (3%) and flour of quinoa (3%). For the elaboration of dressings, first mixed emulsifiers in the propeller 500 rpm with water for better incorporation, and subsequently added: sugar, salt and vinegar, in constant flow oil was added later. The mixture was homogenized in the IKA T50 Digital for 3 minutes at 3000 rpm and 2 minutes at 5000 rpm. In order to study the influence that the different flours exerts on the rheology and stability of salad dressing emulsions, both flow curves and droplet size distribution test were performed. After that became a sensory evaluation, a preference test was performed with 59 panelists. Age range was from 19 to 24 years old, both sexes. The data were subjected to a one-way analysis of variance using SPSS software with a confidence level of 95% ($P < 0.05$), and after that Tukey test. The results of the flow behavior index (n) were: egg yolk dressing (control) (0.283) < pea dressing (0.313) < quinoa dressing (0.325) < amaranth dressing (0.328) < Trademark (0.350), all were pseudoplastic. And for the coalescence rate were egg yolk dressing (control) (1.33×10^{-7}) < amaranth dressing (1.93×10^{-7}) < pea dressing (6×10^{-8}) < quinoa dressing (6.66×10^{-8}). Our results showed that amaranth dressing has a rheological behavior similar to the trademark and was the preferred sensory and dressings made with it are physically stable, so we can consider it as a new food option.

Keywords: Reduced cholesterol dressings, Rheology, sensory evaluation

Encapsulation of Microalgae and Cyanobacteria to Fortify a Novel Functional Yogurt

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An unhealthy diet is one of the main factors for a wide range of chronic diseases such as diabetes, obesity, cancer, cardiovascular diseases, among others. According with the National Survey of Health and Nutrition (ENSANUT), in 2012, 26 million of Mexican adults had overweight and 22 million of adults had obesity, likewise 16 million children had overweight and obesity. In contrast, more than 300 thousand children suffered of malnutrition. Nowadays, there is a current need to provide innovative healthy products to people in order to decrease the number of people with unhealthy diet. This study focuses on the production of a functional yogurt product with encapsulated microalgae and cyanobacteria strains: *Haematococcus pluvialis* and *Arthrospira platensis*. *A. platensis* has been used widely as food supplements in a form of powder and pills due to its high content in proteins and fatty acids. *H. pluvialis* has been recognized for its ability to produce high-added value products under stressful conditions such as antioxidants (astaxanthin). Despite the benefits that those microalgae have, few efforts have been done to use them in food products. The main objective of this work is to evaluate the nutritional properties such as protein content, lipid fraction, carbohydrates, antioxidants, carotenoids, and total phenolic compounds that these microalgae strains provide to the food product. Additionally, physicochemical, microbiological, and sensory evaluation were assessed to evaluate the quality of the product. The results will be considered for the feasibility of a new commercial product. This novel product may have the potential to enhance the nutritional intake, strengthen the health of consumers, and reduce the risk of chronic diseases.

Keywords: Functional food, microalgae, encapsulation, fatty acids, protein content

Comparison of the Effect of Fat Substitution by a Soluble Fiber Compound on Instrumental and Sensorial Texture Parameters in Bakery Products

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As fat possess the highest energy value between macronutrients, a promising and healthy alternative for food industry is to replace it by fiber, in mass consumption foodstuff like bakery products. The aim of this work was to compare the effect on instrumental and sensorial texture, of fat substitution by a dextrane type soluble fiber compound, at different levels (0%, 15%, 25% and 35%), in bakery products (muffins and cake). For this was carried out a texture profile analysis using a texturometer, and a hedonic type organoleptic test, in which 80 not trained panelists participated, who evaluated sensorial texture perception. Statistic analysis was made by parametric or not parametric tests, depending on obtained data nature. As regards to instrumental texture, fat replacement by fiber yielded a reduction on primary and secondary mechanical features; reduction of cohesiveness and resilience was significant ($p < 0.05$) in the cake, with respect to control without fiber, without significant ($p < 0.05$) differences between substitution levels; there weren't significant ($p < 0.05$) differences on gumminess and chewiness values in muffins without fiber and with fat substitution by fiber until 25%. Moreover, there weren't significant ($p < 0.05$) differences on sensorial texture scores of muffins with and without fiber, while acceptability degree and purchase intent exceeded 60% for both products, independently of level of fat replacement by fiber. Based on nutritional properties descriptors erected on nutritional labeling Colombian norm, muffins with 35% of substitution, as well as cake with 25% and 35% of replacement, can be considered as 'fat reduced', and the higher substitution level of both products can be denominated 'fiber good source'. In conclusion, replacement until 35% of fat by fiber in bakery products, besides reducing fat content and incrementing its fiber input, enhances its texture mechanical attributes, and keeps its organoleptic features.

Keywords: Soluble fiber, fat substitution, bakery products

Development of Organogel-based Nanoemulsions as a Novel Vehicle to Improve Bioaccessibility of Lipophilic Nutraceuticals

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Nanotechnology has become a fundamental tool for developing systems that increase the effectiveness of nutraceuticals through ensuring their bioavailability. The use of nutraceuticals increases every day, some of them such as polyphenols and triterpenes possess important biological potential. Curcumin, quercetin and lupeol have shown biological effects against many clinical conditions and are promising to act as therapeutic agents. However, their limited aqueous solubility compromises their oral bioavailability. Therefore, the formulation of organogel-based nanoemulsions containing nutraceuticals represents an encouraging prospect, as products that can contribute to prophylaxis on some medical conditions, increasing biological activity by improving their oral bioavailability. Two oils (coconut and canola) and a gelator (Myverol) were used for organogels preparation. Three emulsion concentrations (5, 7.5 and 10%) and two surfactants (Tween20 and Tween80) were used for organogels formulations; while ultrasound was chosen as the homogenization method. Particle size (PS), polydispersity (PdI) and zeta potential (ZP) at 0-28 days were evaluated. Both PS and PdI showed no significant differences ($\alpha=0.05$) between the organogel-based nanoemulsions. ZP values were relatively unchanged over time, indicating stability of the emulsions evaluated. The ZP was the most significant parameter ($\alpha=0.05$) for choosing the most stable condition. The more stable organogels were observed with 5% coconut oil, 10% Tween80 and 85% de-ionized H₂O. Emulsions loaded with bioactives were obtained at these conditions and showed significant differences in PS, PdI and ZP in comparison with unloaded samples. Simple shear tests showed that the uncharged emulsions had not important differences in viscosity, yield stress and activation energy. Among loaded organogel-based nanoemulsions, lupeol presented the more similar rheological behavior respect to unloaded conditions. However, simulated digestion and subsequent UPLC/MS-MS analysis showed that only the curcumin loaded emulsion increased its bioaccessibility by 44.83%, while the other two emulsions suffered significant reductions (lupeol 62.87% and quercetin 12.57%), compared with their correspondent free compound formulations. These results suggest that organogel-based nanoemulsions are not suitable for increasing bioaccessibility of naturally lipophilic compounds.

Keywords: Nutraceutical, nanoemulsion, organogel, bioaccessibility

Antioxidant and Apoptotic Activity on HT-29 Cells from Extracts of *Flourensia microphylla*.

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In Mexico, colon cancer has the third place on incidence in man and women. Apoptosis is one of the programmed cell death type most studied, and play an important role in cancer treatment since one of the cell death purpose is eliminate damaged cells as carcinogenic, from the organism. Recently it has been an incremented interest in the research of natural products, this is because of his phytochemical compounds that have been linked in the treatment of different diseases as cancer. Mexico has an extensive variety of semi desert plants that has been studied because of their high content of polyphenols. *Flourensia microphylla* has been studied by its antifungal activity. Though, there are no reports about its antioxidant activity nor anticancer. The aims of this research were to explore the antioxidant and apoptotic effects from two extracts of *F. microphylla*: ethanol and acetone 70% on colon cancer HT-29 cells. It was determinate the total phenols content in the extracts of *F. microphylla* by Folin-Ciocalteu method, obtaining as results 1276.08 ± 1.17 and 856.16 ± 0.96 mg/100 mg sample for the ethanol and acetone 70% extracts, respectively. The antioxidant activity throws different results for the 3 methods; in DPPH it was inhibited 58.97% for ethanol and 68.57% for acetone 70%. For the ORAC assay were obtained concentrations of 138.19 ± 1.80 and 117.19 ± 1.74 mEq Trolox/100 mg sample; and for NO assay were obtained IC50 of 0.007 ± 0.0012 and 0.015 ± 0.0061 in acetone 70% and ethanol extracts, respectively. For the biological assays it were used HT-29 cells at 90% confluence. Cell viability was evaluated and treatments were carried out to obtain protein and later, apoptosis assay was carried in human cells apoptosis microarrays. As result, it was obtained that ethanol extract activated the necessary pathways to reach apoptosis, though, acetone 70% extract began a cell death but did not complete the apoptosis process. According these results, it can suggest that ethanol extract acts as a natural anticancer agent.

Keywords: *Flourensia microphylla*, antioxidant activity, apoptosis, HT-29 cells

Modeling the effect of solvents on Total Phenolic Compounds extraction and Antioxidant Capacity from Avocado seed

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The aim of the research was to evaluate the effect of solvents on the extraction of phenolic compounds and antioxidant capacity (DPPH and iron reduce method) from avocado seed applying a mixture model design. Avocado seed was ground, dried at 50°C until constant weight and stored in dark bottle at room temperature until use in order to evaluate the effect of solvent extraction using a special cubic model of mixture design. It was observed that predicted and experimental data show a good determination coefficient with 0.97 and 0.87 for phenolic compounds and antioxidant capacity (both methods), respectively, and indicate that phenolic compounds show a good correlation with the antioxidant capacity of avocado seed. Moreover, the use of different solvents alone or in combination in the amount extraction of phenolic compounds and antioxidant capacity in avocado seed varied from 15.6-168 mg GAE/100 g dw, 15.4-132.1 mg Trolox/100 g dw (FRAP method), and 33.3-363.2 mg Trolox/100 g dw (DPPH method). However, the optimization process show that the mixture of water:ethanol:acetone (41:18:41%) presents the higher values of phenolic compounds and antioxidant capacity, this results was corroborated experimentally. The uses of mixture design model can be a good tool to evaluate the effect of different solvents on the extraction of bioactive compounds and antioxidant capacity of fruits, vegetables and by-products.

Infant formula based on whey.

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The North west Region of the from Durango state is characterized by the production of cheese, so that large amounts of whey, which may represent a serious environmental problem, otherwise the whey contains proteins, minerals and vitamins, which can be generated he exploited in the manufacture of beverages, because of this we decided to develop a children's drink to use the whey, it was provided by the company SISTEMAS LÁCTEOS AUTOMATIZADOS S.A DE C.V. the whey was characterized with: pH, acidity, density, alcohol 70 and 85% determination. It work was developmented with nine formulations which were prepared by varying quantities of cornmeal and sugar were proposed, it was determined to be the response variables acceptability of drink, so a sensory evaluation was conducted with 120 primary school children who were aged among 6 and 12 years prior to the screening assessment of taste, odor identification and ordering of colors were applied. To determine the acceptance of the beverage acceptance test was applied with a hedonic scale of 1 to 5, where 1 means I dislike and 5 means I like. With the results we proceeded to a variance analysis in the SSPS program by determine acceptance of the drink.

Keywords: child drink, sensory evaluation, whey.

Use of mango peel to increase bioactive compounds and antioxidant capacity of edible films of starch and chitosan

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Mango (*Mangifera indica* L.) is an important fruit in Mexico. Mexico it is the main exporter at worldwide (23.5% of the total worldwide production). The aim of this work was to evaluate the concentration of mango peel on the bioactive compounds and antioxidant capacity of starch and chitosan edible films. Mango peel was obtained from Manila variety and dried at 40°C until weight constant, edible coating was formulated with 0, 2, and 4% of dried mango peel. Color, total flavonoids, phenolic compounds and antioxidant capacity was evaluated in edible films. Results indicated that the color of the films was significant affected by the mango peel, especially the *b* (yellow) color parameter. In the other hand, the incorporation of mango peel significantly increases the total flavonoids (10-50% with starch and 86-93% with chitosan), phenolic compounds (145-191% with starch and 63-325% with chitosan) and antioxidant capacity (371-442% with starch and 640-985% with chitosan as increases the mango peel concentration, being higher in all films formulated with chitosan. The use of mango peel in edible coating is an alternative to added-value to waste of mango industry.

Development of Dairy Beverage by the Addition of Fructans and β -glucans

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The current trend in the food products demands the consumers; it is finding foods that nourish and that also provide health benefits. This due to health problems afflicting the most of the population, that suffer, chronic degenerative diseases (diabetes, hypertension and obesity), associated with high intake sugars, salt, saturated fatty acids, and low intake in soluble fiber and vitamins. This led to the development of a variety of functional foods distributed in markets with great acceptance by consumers. Thus, high-demand products (tortillas, milk, drinks etc.) are being reformulated in order to provide healthy and accessible alternatives to the consumer. The aim of this study was to development a dairy beverage, added with fructans and β -glucans as sweeteners and fat substitute, respectively and that at the same time act as prebiotics. A base mixture (skimmed milk powder, whey powder and vitamins) was obtained and added with different concentrations of β -glucans and fructans. Each formulated mixture was mixed with water and homogenized during 60 s. After that were heated at 70° C by 60 s, cooled, packed and stored at 4° C. Soluble solids, pH, density, viscosity and phase separation were determined and analyzed using response surface methodology ($p < 0.05$). Soluble solid and viscosity were significant affected by both β -glucans and fructans addition. Also the concentration of β -glucan significantly affects the color of beverages. The best formulations was chosen considering the minor changes in their chemical and physical properties compared to the control (mixture base) maintaining 3 g of fiber per serving to ensure the bifidogenic nature of the dairy beverage.

Keywords: Prebiotic beverages, functional food, nutrition.

Physical Chemical and Sensory Evaluation of Nuggets Chicken With Peanut (*Arachis hipogea*) to Increase Its Protein Content

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Numerous studies have described positive health impacts associated with the incorporation of nuts, including peanuts, into the diet. Frequent peanut consumption improves indices of cardiovascular health, glucose metabolism, weight management and overall diet quality. Regular consumption is likely necessary to realize health benefits, and this requires a sustained behavioral change. Obesity is the most common nutritional disorder in the developed world and it is considered to be a risk factor associated with the development of the major human diseases, including cardiovascular disease, diabetes, and cancer. The objective of this work was formulate a protein nugget and his acceptance by consumer. Chicken nuggets were processed by substitution of fat by peanut at 0, 15, 20, 25 and 35% (NC, N15, N20, N25 and N35), protein and lipids content were evaluate, with these results and using a statistical model of randomized mixtures, the amount of peanut and chicken was determined to use to get the highest percentage protein nugget (NOp), using the statistical program Statgraphics Plus 5.1; fatty acid profile were evaluated by HPLC. A test for measuring the degree of satisfaction of the product was performed using a 5-point hedonic scale. All nuggets with peanuts had higher protein content than the control ($p < 0.05$), 44% for N15 and 43% N20, 37.84 and 39% for N30 and N25 respectively and NO with 33%. The lipid content increased in direct relation to the increase in peanut (from 15% for N0 to 32% for N32). Nuggets with peanuts had higher percentage of oleic and linoleic acid. The NOp had less unsaturated acids and greater amount of linoleic acid (31.7%). Protein content was 45.76 % for NOp being significantly different whit other groups ($p < 0.05$). The addition of peanut affects the sensory quality, only N25 and N30 nuggets were not well accepted. NOp was well accepted. In conclusion replacement for peanut flour used in making nuggets raises the protein content of the product. It is possible to cover the protein requirements of a child from 7 to 10 years with the intake of two to four nuggets

Keywords: nuggets, peanut, functional food.

Effect of Heat Treatment on the Contents of Proanthocyanidins of Bayo Victoria Beans and their Degree of Polymerization in a *In vitro* Simulated Digestion

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Beans are one of the most produced and consumed worldwide legumes. Various studies have linked the habitual consumption of beans with a decrease in the risk of suffer chronic-degenerative diseases thanks to its phenolic composition, highlighting its content of proanthocyanidins (PA). PA are polymeric units of flavan-3-ol linked by interflavanic bonds (C4-C8), which to be molecules of high molecular weight and high degree of polymerization (DP) are metabolized in the colon by intestinal microbiota enzymatic action. Bean size Bayo Victoria was determined, and was classified as a grain of large size (40.1081 ± 0.5341 g/100 bean seeds). A gain size to cook in open pot (OP) of 31% and pressure cooker (PC) of 33% was observed. This feature is related to its high water absorption capacity (WAC: 68.3083 ± 0.0519 %). The WAC together with the grain properties such as hardness cotyledon and the phenomenon "hard to cook", are the responsables of the prolongedated times to cooking in OP (321.5 ± 26.16 min) determined by the Mattson method, and in PC (68.89min). In the proximate analysis no significant statistical difference was observed in protein composition, effect of thermal processing (R: 22.505 ± 0.6010^a , OP: 22.8411 ± 1.4571^a , PC: 25.1275 ± 1.3293^a); plus, thermal process beans showed an decrease in the fat content (R: 4.5493 ± 0.0560^b , OP: 3.9838 ± 0.4823^a & PC: 3.7908 ± 0.4573^a), which relates to starch-lipid complexation and fat oxidation during heat treatment; it was also observed an increase in crude fiber content, associated with the presence of amylaceous substances in the grain; and a decrease in ash content associated with the diffusion of some minerals to the cooking water. Three successive extractions with aqueous acetone (70:30) from bean flour 1:10(w/v) were performed. Proanthocyanidins content by LC-ESI-MS/MS, and the DP following the floroglucinolisis technique was determined. Group B proanthocyanidins were found in all prosecutions, keeping a higher concentration in raw (0.01087 ± 0.00050 μg/mg dry sample), and a considerable decrease being observed effect of processing (OP: 0.00052 ± 0.00021 ; PC: 0.00198 ± 0.00075 μg/mg dry sample), the same effect was observed in the DP. The *in vitro* digestion of PA of beans, allows to know the metabolic changes in each phase of digestion, besides knowing the bioaccessible fraction. The statistical análisis was calculated by Tukey $p < 0.05$.

Keywords: Beans; Degree of polimerization; Heat treatment; Proanthocyanidins

Elaboration of Extruded High-fiber Breakfast Cereals Added with Citrus By-products Rich in Bioactive Compounds

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Nowadays, people have less time to prepare foods due to current time-demanding jobs. Therefore, there is a high consumption of so-called fast food, including high-fiber breakfast cereals (HFBC). To improve its nutritional/nutraceutical content, it has been suggested the addition of materials rich in nutrients and bioactive compounds, including some by-products from citrus, such as naranjita fruit, which are important sources of carotenoids, dietary fiber, and phenolic compounds, whose consumption has been associated with potential health benefits. The aim of this work was to study the effect of the extrusion temperature (ET: 88.79-131.21°C) and content of dehydrated naranjita fruit bagasse (DNFB, 0.64-13.36%) in a mixture of wheat-bran:oat-bran:yellow corn grits (55:36:9, %) on physical, nutritional and sensory properties of HFBC. It was used a single screw extruder, and the response surface methodology for data analysis. The lowest expansion index values (< 1.12) were obtained at high ET in all the range of DNB. Whereas, the lowest water solubility index values (< 14%) were presented at low levels of DNFB throughout all the range of ET. In addition, the highest content of insoluble dietary fiber (> 11%) and soluble dietary fiber (> 2.8%) was presented by combining high ET and intermediate levels of DNFB. Also, the highest content of total carotenoids (> 7.5 µg/g db) was obtained at DNFB (> 10.5%) and ET (>110 °C), whereas, the highest sensory acceptability values ("like slightly", LAM scale) were presented at ET (> 126°C) and DNFB (3.5-10.5%). It is possible to elaborate HFBC with appropriate physical, nutritional and sensory properties, whose consumption can have potential human health benefits due to the important levels of bioactive compounds provided by the raw materials used for their elaboration.

Keywords: high-fiber breakfast cereals, naranjita, extrusion, bioactive compounds.

***In vitro* propagation of oak (*Quercus sideroxyla*) with nutraceutical properties**

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Oak trees have been used mainly for timber, cellulose, firewood and charcoal production. However, the ITD research group on functional foods and nutraceuticals has pursued the non-timber use of this species. They have reported that the leaf infusion of *Q. sideroxyla*, has anti-carcinogenic properties attributed to bioactive compounds that are synthesized in different pathways at different times of the year as a response to stress conditions. This endangered species presents limited availability of standardized raw material. Besides, conventional methods for propagation of *Quercus* species are not efficient because the seeds are recalcitrant and their fruiting is irregular. Thus, the plant tissue culture could be a convenient option to provide plant availability. Therefore the aim of this study was to propagate *Q. sideroxyla* plants from acorns. X-ray analysis was performed on collected seeds; and healthy acorns underwent mechanical scarification to induce their germination. A 2² x 4 blocked design using activated carbon (AC), silver nanoparticles (AgNp) and four Quoirin Lepoivre medium concentrations (10, 20, 30, 40%) was used. Best results were observed in the 30% medium with 70% of sprouted explants, not presenting statistical differences (Tukey p=0.05) compared to the 40% medium. The principal component analysis was revealed in terms of the presence of main and secondary roots, number of secondary roots, length of radicle/root; also the number and size of shoots were interrelated positively with germination. Otherwise, in the case of total oxidation, a negative relationship was shown. AC promotes the germination and growth as adsorbent of toxic substances. For induction of multiple shoots a 2x3 incomplete factorial design was used with and without CA in the media and three hormone concentrations (6-Benzylaminopurine (BAP): α -Naphthaleneacetic acid (NAA), 1:0.1, 1.5:0.15, 2:0.2 mg/L). Data on size and number of sprouts were taken. Wilcoxon Matched analysis revealed that there were significant differences between hormone treatments. In the rooting phase the same design was used reverting regulators rates (NAA:BAP 1:0.1, 1.5:0.15, 2:0.2 mg/L). Percentage data of explants with roots were taken.

Keywords: *Quercus sideroxyla*, *in vitro*, 6-Benzylaminopurine, α -Naphthaleneacetic acid, activated charcoal.

Potential Use of *Pleurotus ostreatus* Mycelium to Develop a Novel Functional Food Product

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Nutraceutical nature of different mushroom species due to their nutritional and medicinal characteristics has turned them into an important field of study. *P. ostreatus* is a mushroom used for direct diet intake. Nevertheless, functional properties and its applications in foods have been totally unexplored principally the selection of the carrier food which can represent a potential alternative to take advantage of native Colombian strains. The aim of this work was to evaluate the impact of *P. ostreatus* mycelia on sensory attributes of a low calorie mango juice. Mycelium was obtained by liquid stated fermentation (100 rpm) in yellow cornmeal based media, in which it could get a good nutraceutical profile, its composition was 12,76% protein, 0,8% sterols (bioactive compounds) in which were identified (GC-MS) like ergosterol, stigmasterol and γ -sitosterol with high potential for reducing cholesterol, 14,43% total polysaccharides with 10,29% of β -glucans and 95% moisture. A standard formulation of mango juice (30% of mango pulp) was prepared and pasteurized. Afterwards, the wet product was added at 45 °C to avoid compounds damage. Mycelia concentration ranged from 0% (control) to 4,5%. The sensory acceptance of mango juice was evaluated through and affective test with 30 consumer panellists. The parameters evaluated were visual appearance, taste, flavour and consistency. The samples were rated on a five-point hedonic scale (with Intensity and acceptability increasing with numerical values). Samples showed no significant differences ($P>0.05$) for odour, flavour and consistency. However, 3.5% and 4,5% mycelia content had lower acceptance for colour and taste. This might be related to aromatic and alcohols like compounds founded and probably terpenoids, which confer spicy and mentholated notes. With the appropriated use of colorants and flavours, the use of mycelia in fruit juices is a promising alternative to develop nutraceutical foods, considering that the sterols content is according to save levels.

Keywords: *Pleurotus ostreatus*, fermentation, functional food

Employment of Non-Traditional Carbon Source and Increase of Nutritional Character in Fungal Biomass

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Within the context of functional food investigation, the searching of the best kind of nutraceutical must be a priority. Many works about mushrooms with healthy effects have showed their great potential and the possibilities for improving their bioactive contents by the usage of untraditional carbon sources (CS). The aim of the present work was to compare the content and variety of sterols in the mycelia of a native Colombian strain of *Pleurotus ostreatus* along a fermentation process daily, it was focused to obtain by liquid-state fermentation (LSF) the major quantity of biomass with the best functional character, all developed in yellow cornmeal (YC) with 30 g/L formulation. The LSF was done for eleventh days, 100 rpm. Mycelium samples were taken every day, then dry biomass and sterols content were quantified. The two days with the best proportion between biomass/sterols content (% of sterols in biomass) were analysed by CG-MS to determine triterpenoidal compounds. The results showed that the best proportion was for day ninth with 0,89% then followed by day eleventh with 0,84% sterols content in biomass. However, the identification of compounds showed that YC substrate stimulates the biosynthesis of more variety of bioactive compounds on eleventh day. In the particular case of sterols, the fact of carry the bioprocess until the 11th day results in a mycelium with some kind of sterols with ergosta and stigmasta nucleus clinically recognized as potent hypocholesterolemic agents. The union of the biological action of these metabolites into the biotechnological biomass product improves and position it as an excellent candidate for using such as an ingredient in functional foods

Keywords: *Pleurotus ostreatus*, mycelium, sterols, liquid-state fermentation, functional.

Evaluation of Phenolic Compounds and Antioxidant Capacity in Fruit and Husk of Green Tomato during Storage

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Green tomato (*Physalis ixocarpa* Brot) is also known as tomatillo or husk tomato, belongs to the Solanaceae family and is an important part of the traditional Mexican diet. In this work the antioxidant capacity and phenolic compounds of the fruit and the husk of the “Rendidora” variety was evaluated during storage at 4 and 25°C. Samples were taken at the start of storage (t_0) and six points for 12 and 18 days (from 25°C and 4°C, respectively). The hydrophilic part was assessed, working with two aqueous extracts: acetone (Ac80%) and methanol (Me80%). The total polyphenol content (PFT), flavonoids and antioxidant capacity (DPPH, FRAP, ORAC) was evaluated in a lyophilized sample. Husk samples showed a decrease in the values over time and significantly exceed (Tukey $p=0.05$) to the results of the fruit for all analyzes. The PFT in husk at t_0 was 1508.4 ± 15.16 and 1448.4 ± 88.9 mgGAE/100g; in pulp 284 ± 16.7 and 274.3 ± 3.84 mgGAE/100g in Ac80% and Me80% extract, decreasing towards the end of storage: husk at 25°C (1008.6 ± 30.69 and 1122.1 ± 14.26 mgGAE/100g) and 4°C (1023 ± 14.84 and 1137.6 ± 15.98 mgGAE/100g); pulp at 25°C (328.3 ± 1.76 and 324 ± 20.4 mgGAE/100g) and at 4°C (332.1 ± 18.4 and 354 ± 17.1 mgGAE/100g) in the respective extracts. The same behavior was observed for flavonoids. Antioxidant activity by DPPH for the Ac80% and Me80% extracts of the husk presented the values of: 87.9 ± 0.55 and $90.1 \pm 0.34\%$ (initial) 41.2 ± 3.35 and $58.2 \pm 3.83\%$ and (final to 25°C) and 48.19 ± 3.7 and $61.1 \pm 1.13\%$ (final to 4°C); in FRAP 1110.7 ± 44.1 and 1295.7 ± 61.7 μ MTrolox/100g (initial) and 642.2 ± 35.8 and 993.3 ± 29.4 μ MTrolox/100g (final to 25°C) and 759 ± 11.04 and 1074 ± 87.61 μ MTrolox/100g (final to 4°C). In the ORAC assay, the response of husk extracts followed a downward trend over time, taking up in Me80% from the initial t_0 of 1126.4 ± 42.2 μ MTrolox; the pulp showed a different behavior, having a maximum in Me80% at 4°C after 15 days of 1261.4 ± 76.3 μ MTrolox. A positive correlation ($p \leq 0.05$) between the content of phenolic compounds and responses to antioxidant capacity tests was observed. These results demonstrate the presence of bioactive compounds with antioxidant capacity in both the fruit and the husk of green tomato while cold storage decreases the loss of them.

Keywords: husk tomato, antioxidant capacity, phenolic compounds)

Prebiotic effect of Miel de Maguey and its addition to yogurt as functional food.

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Prebiotics such as inulin and its derivatives (oligofructose and fructooligosaccharides) are made up of lineal fructose chains that have diverse applications in aliments, including sugar substitute, fat substitute, and increase in palatability, creaminess and texture. It is also known to be a good substrate for probiotic bacteria. The Miel de Maguey (agave syrup) is a sweet substance obtained from hydrolysis of the fructan stored in the maguey plant. The objective of this project was to evaluate the prebiotic effect of the agave syrup and the relationship between the degree of polymerization grade of inulin present, and its capacity to function as prebiotic. Prebiotic activity was determined for tree agave syrup samples with five different lactic acid bacteria (*L. acidophilus*, *L. casei*, *L. plantarum*, *L. paracasei* y *L. lactis*) and one entire enteric strain (*E. coli*), growth (CFU/mL) was measured at 0, 24 y 48 h. Simple carbohydrates were characterized by HPLC-RID with the purpose of identify the mono and disacarid presence. For the characterization of agave syrup and inulin, it was necessary to calculate free residual sugars, and proceed to an acid hydrolysis to calculate the average of degree of polymerization. Average degree of polymerization grades the tree agave syrup was lower than 10 GP, while inulin presented a GP of 25.86. The use of the agave syrup and inulin as prebiotic for lactic acid bacteria growth, demonstrated that prebiotics with a <10 GP promote the growth of the probiotic bacteria (*L. acidophilus*, *L. casei*, *L. plantarum*, *L. paracasei* y *L. lactis*), meanwhile the inulin does not present prebiotic activity. The prebiotic that got a stronger growth with the different carbon source was the *L. casei*. Agave syrup was used to prepare a functional aliment, a yoghurt sweetened with the agave syrup and prepared with *Streptococcus thermophilus* and *Lactobacilos delbruekii* subsp. *bulgaricus*. For sensorial evaluation of the functional foods, 50 consumers were invited as untrained panelist group; of that analysis, 56% of the panelist accept the product. Agave syrup showed prebiotic activity and it is directly related to the degree of polymerization. This products can be used to prepare functional foods, as added prebiotics.

Keywords: inulin, LAB, probiotics, miel de maguey

Correlation between consumption of red wine Lambrusco and increase of antioxidant activity of blood plasma

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The antioxidant capacity of red wine is directly related to its polyphenol content. Several studies have linked regular, moderate consumption of red wine, with a decreased incidence of cardiovascular disease, especially in Mediterranean countries. Del mismo modo, la capacidad antioxidante de vino neutraliza los radicales libres en el cuerpo, que ayuda a reducir las especies reactivas de oxígeno (ROS). The aim of this study was to evaluate the antioxidant capacity in blood plasma, after moderate intake of red wine Lambrusco, by the method of capturing the radical 2,2-diphenyl-1-picryl hydrazyl (DPPH). This study was conducted in university students ($n = 17$) of both sexes from the Faculty of Chemistry Sciences from Orizaba (Veracruz University) under the following inclusion criteria: Healthy students with indistinct age who did not consume drugs or alcohol, in the last two weeks, which are divided into two groups (control and problem). Samples were obtained in the control group at 8 and 10 hours of fasting, the problem group at 8 hours of fasting and two hours after moderate intake of red wine; subsequently determining the antioxidant activity of human plasma and red wine was performed by the method of DPPH, the measurement is made in a spectrophotometer at a wavelength of 515 nm. From the absorbances obtained the percent inhibition of DPPH was calculated, the results showed that the problem group (with moderate intake of red wine) has increased the antioxidant capacity of blood plasma (mean=22.38 %) compared to the control group (mean = 14.52%). with this result can be considered red wine Lambrusco, as a food capable of improving plasma antioxidant capacity in just 2 hours after consuming.

Fortification of yoghurt with complex phenolics-ovalbumin

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Nowadays yoghurt has gained a positive perception by consumers as a functional dairy product with health promoting ingredients. Yogourth is a fermented dairy product obtained by lactic acid fermentation through the action of *Lactobacillus delbrueckii* ssp. *Bulgarius* and *Streptococcus thermophilus*. The resulting lactic acid reacts with milk protein, promoting the characteristic texture and sensorial properties of this product. Green tea is the most popular beverage in the world, it is a plant rich in polyphenols, flavonoids such as flavanols, flavonols and phenolic acids. The industry is looking for the new substances, that could be applied in food, however the antioxidants in green tea can be degraded by various factors such as light, pH, oxygen and metal ions; one technique to increase its stability is encapsulation, there are various proposals as chemical processes, including ionic gelation, which is the formation of a complex between protein and polyphenol is. The structure of yoghurt is disintegrated by shearing processes before packing, facilitates the incorporation of new ingredients (fruits, fibers, minerals, antioxidants) and the pH is close to 4, which makes it appropriate to incorporate matrices that respond to pH changes. The aim for this work was developed complex phenolics from green tea (*Camellia sinensis*)-ovalbumin by ionic gelation method to include in the yoghurt. Was analyzed for antioxidant potential using DPPH method, total phenolic content (TPC) and total flavonoids quercetin equivalent (TPQ). Complex were performed at different pH values where a higher percentage of encapsulation was obtained at pH 4, likewise for different concentrations of said complex were employed ovalbumin obtaining greater efficiency with 0.5% w/w of said protein compared to 1% and 3% concentration of ovalbumin, showing a 66% TPQ containing 5 ppm (w / w) of polyphenol extract of green tea, percentage of trapping free radicals (DPPH) of 93.58% and 1.75 Eq galic acid (mg/mL).The results showed significantly higher antioxidant potential and TPC of yoghurt with complex than control. The complex formation is a novel technique to incorporate antioxidants to different foods.

Keywords: antioxidants, phenolic compounds, yogurt, complex

Glucose Syrup as Obtained of Amaranth (*Amaranthus hyponcondriacus* L) Starch Grain

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Starch is the main component of amaranth grain. The starch is composed of 80% amylopectin which is readily hydrolyzed into glucose by amylolytic enzymes. This characteristic can be used to manufacture glucose syrup containing maltodextrins and cyclomaltodextrins². This glucose could be used to obtain ethanol by fermentation. Different starches are generally used for the production of glucose syrups, including corn starch. The α -amylase and amyloglucosidase are the enzyme involved and the degree of hydrolysis which is evaluated as Dextrose equivalent (DE). In this study amaranth starch was used to obtain glucose syrup using α -amylase and amyloglucosidase. Different amaranth starch concentrations (50, 100 and 150 g / L) was employed, α -amylase and amyloglucosidase for enzymatic hydrolysis at 90°C and 60°C, respectively were used. A 100 g starch/ L produced a syrup DE=59.38, while 50 and 150 g starch / L produced DE=18.83 and 30.90, respectively; decreasing DE when used 150g / L starch may be due to enzyme inhibition by the high concentration of substrate employed. The minimum recommended DE for glucose syrup as reported in 1980 is >20. In case corn starch hydrolysis is reported DE values of 50-70 in sugar syrups. The results in this study show that amaranth starch syrup is high DE which is compared to corn starch. Therefore amaranth starch is a good alternative to manufacture glucose syrup similarly to other cereal starches.

Keywords: amaranth, amylopectin, dextrose equivalent, enzymatic hydrolysis

Assessment of Antioxidant Activity and Tyrosinase Inhibition of Protein Hydrolysates of *Amaranthus hypochondriacus* Grain

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Amaranth grain proteins were evaluated to assess the antioxidant and tyrosinase inhibitory activities in order to determine the capacity of these proteins to lighten human skin so that a cosmetic product might be designed. Amaranth proteins were hydrolyzed with trypsin so as to obtain peptides of various sizes. These hydrolyzates were obtained using E=13.816 U / mg, T= 37 ° C and pH= 6.5, at the following times 3, 21, 30, 36 and 48 h. The degree of hydrolysis (DH) was measured by using 5% TNBS. DH for albumin 1 and globulin was 22% and 17%, respectively. The antioxidant activity was performed through the copper chelating activity of albumin 1 and globulin (81% and 78%, respectively) as well as through the ABTS^{•+} radical-cation *discoloration method* (69% and 42%, respectively). Albumin 1 and globuline hydrolysates could inhibit 138 U tyrosinase/mg at pH 6.8, roughly 52% and 30% for each one. Albumin 1 and globuline hydrolysates were characterized by size exclusion chromatography in order to assess the DH, antioxidant activity and tyrosinase inhibition. It was observed that the smaller the peptide, the better the aforementioned activities. These amaranth protein hydrolysates might be used because of their biological activity and thus could also be useful in the design of nutricosmetical products to preserve the health of human skin.

Keywords: amaranth, bioactive peptides, antioxidant activity, tyrosinase.

Changes in Bioactive Compounds in Millet Seed (*Pennisetum glaucum*) Associated to Three Different Processing Techniques

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Millet seed (*Pennisetum glaucum*), commonly utilized as an animal feed, is rich source of protein, essential amino acids and bioactive compounds such as phenols and flavonoids. However, this seed has low digestibility due to the presence of antinutritional compounds like tannins and phytates, reasons by which millet has been little exploited for the food industry. Therefore, in this study three different treatments at two intensity levels (immersion in distilled water by 2 and 20 h; boiling in distilled water by 5 and 15 min; and sprouting during 4 and 7 days) were proposed in millet seeds in order to evaluate the impact of these treatments on their content of bioactive compounds (total phenolic compounds, total flavonoids and total chlorophyll content). Experiments were repeated at least twice, and values detected by standard spectrophotometric methods were statistical analyzed in a NCSS software at $p \leq 0.05$ by the ANOVA and the Tukey multiple comparison method. High contents of total phenolic compounds and total flavonoids ($p \leq 0.05$) were found in seeds under the proposed treatments, the trend was inversely proportional to the intensity of the treatments. The detected values of bioactive compounds significantly exceed levels detected in millet seeds without treatment (control treatment). Moreover, bioactive compounds were detected into immersion and boiling water, then these biocompounds will leak by lixiviation. The results indicate the feasibility that this seed has to be employed as an ingredient in the development and / or formulation of functional foods rich in bioactive compounds.

Keywords: bioactive compounds, flavonoids and phenols, pearl millet

Sanitary Quality of Cooked Pork Ham Formulated with Potassium Lactate

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In Mexico increased consumption meat products mainly cooked ham, one of the most popular. These products contain salt (<3%), pH values around 6.0 and higher to 0.95 a_w , factors are not enough able to inhibit microorganisms related to post-process contamination. The increasing demand for ready to eat meat products, leads to the search the combined use of barriers to the growth of spoilage microorganisms or pathogens, which has promoted the development of different conservation techniques, to ensure the safety of these meat products, without affecting their physicochemical and sensory properties. In this paper was used potassium lactate as a biopreservative added to the formulation in the processing of cooked pork ham. To evaluate its effect on the microbiological stability (Account of total aerobic bacteria) and physicochemical properties (pH and CRA) post-processing. The effect of potassium lactate in three batches of 520 g, with three different treatments were evaluated: 1) Without potassium lactate, 2) 2% potassium lactate and 3) 4% potassium lactate, after processing slices of ham were obtained (2mm) for each treatment and stored in ziplock bags under refrigeration at 4 ° C. These samples were analyzed for total aerobic mesophilic bacteria, pH and water holding capacity (WHC) on days 0, 3 and 5. The results were analyzed using Minitab 16 statistical software, by analysis of variance (ANOVA), with a significance level of 5%. The addition of potassium lactate in the formulation showed optimal results, treatment with 4% of lactate and refrigeration (4° C), developed conditions that kept the sanitary quality of ham slices of pork in compliance with the standard (NOM-213-SSA1-2002). Also, this formulation did not significantly changes in WHC and pH of the slices. In the same way, the addition of 2% potassium lactate showed microbiological results similar to treatment with 4% with no significant changes in pH and WHC.

Keywords: Cooked ham, potassium lactate, aerobic mesophilic bacteria

***In vitro* antioxidant properties of *Prosopis alba* exudate gum from northeast region of Argentina**

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The search of new hydrocolloids has been addressed to currently undervalued natural resources. In this context, vegetable gums arise as an interesting alternative, especially when they are obtained from non-exploited autochthonous sources. *Prosopis alba*, is one of the most widely spread trees in the northeast region of Argentina. Under environmental stress conditions, this tree excretes an exudate gum whose protective activity against microorganisms and insects was attributed to phenolic compounds. These bioactive substances could impart useful functional properties, if the exudate gum is employ as food component. Therefore, the objective of this work was to evaluate the *in vitro* antioxidant activity of *P. alba* exudate gum (PAG) in comparison with commercial *Acacia senegal* (arabic gum, AG), used as reference due to its botanical similarity. For this purpose different *in vitro* essays were performed to evaluate the PAG behavior in terms of different antioxidant mechanisms. Both, PAG and AG presented a similar scavenging activity of ABTS⁺• synthetic radical, that depended linearly on gum concentration. However, PAG showed a higher scavenging activity against OH radicals (50.61 ± 0.48 % inhibition/mg gum db.) and a higher reducing power (2.19 ± 0.05 mg ascorbic acid eq./g gum db.) respect to AG (46.08 ± 0.24 % inhibition/mg gum db. and 1.06 ± 0.01 mg ascorbic acid eq./g gum db., respectively). These results were related to the higher content of polyphenols ($9.55 \pm 0,06$ mg galic acid eq./g gum db.), especially flavonoids (2.53 ± 0.04 mg quercetin eq./g gum db.) in PAG. PAG also presented better chelating activity than GA, which was attributed to its high tannin content (5.78 ± 0.04 mg eq. tannic acid eq./g gum db.). Antioxidant properties of PAG, could be interesting not only for its use as protectant of easily oxidized food components, but also for its potential health benefits. The antioxidant activity expands the functionality of the suited gum for its use as a novel functional ingredient, with the imminent benefits of employing an actually unknown source.

Keywords: *Prosopis alba*, exudate gum, antioxidant activity, food additive, functional property

Preparation of a Pasta with Functional Properties Add with Flour of *Moringa oleifera*

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The *Moringa oleifera* tree has nutraceutical properties derived from its content of nutrients and bioactive compounds. From its leaves, it is able to obtained flour to be used in the elaboration of value-added products such as bread, crackers and pasta, among others. Pasta made from semolina constitute a massive consuming food, however, it has low biological value of protein due to deficiency in lysine. To solve this deficiency, some of the pasta components can be replaced by flour from different fuller sources. The mixture of semolina and moringa flour is an alternative that allows the development of a pasta with better nutritional characteristics, as moringa leaves contain all the essential amino acids and a high content of minerals, vitamins and phenolic compounds with antioxidant properties, thus promoting consumption of healthier foods. The aim of this study was to develop lasagna pasta type with moringa flour added indifferent levels of semolina and wheat flour substitution and to evaluate the chemical and physical properties of the products developed. The pasta was prepared by maintaining a 70/30 proportion of semolina / hard wheat flour adding moringa flour in different ratios (1, 3, 4, 7%). The dough was fed to an extruder and the product was dewatered on a dryer tray at 40 ° C with air velocity of 1 m / s. Moisture, protein, fat and ash (AOAC) were determined and the content of total phenols (Folin-Ciocalteu), antiradical activity (DPPH), water activity, color and cooking quality was evaluated. With the addition of moringa flour in formulating, an increased in protein content was aimed (5.391-9.629% for uncooked pasta and 2.533-7.188% for cooked pasta), total phenols presented significant values (0.118-0.293 mg ET/g b.s was achieved for uncooked pasta and y 0.046-0.190 mg ET/g b.s for cooked pasta) and antiradical activity (1.594-11.152 for uncooked pasta and 1.079-10.507 for pasta cooked pasta) accompanied by lipid lowering. The moisture content of the pasta was within the reference values reported and the cooking quality of the enriched pasta remained within acceptable ranges for its preparation. Replacing semolina / wheat flour by moringa flour yielded a paste of better nutritional quality and characteristics of a functional food.

Keywords: Functional Foods, Pasta, *Moringa oleifera*

Phytosterol oxidation in O/W nanoemulsions formulated with enzymatically modified emulsifier

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Phospholipids are common and natural emulsifiers, which can be enzymatically modified to improve their functionality and nutritional value. Phosphatidylcholine (PC), one of the most widely used phospholipids in food emulsions, exerts its antioxidant activity by inhibiting lipid hydroperoxides and chelating prooxidant metals in oil-in-water (O/W) emulsions. Phytosterols are also employed in functional foods because of their hypocholesterolemic effect, but they are known to be susceptible to oxidation. The aim of this study was to evaluate the effectiveness of lysophosphatidylcholine (LPC) as enzymatically-modified phospholipid to prevent oxidation of O/W functional nanoemulsions containing free phytosterols. Functional O/W emulsions were formulated with 10:1 ratio of emulsifier: free phytosterols, 4% medium chain triglycerides (MCT), 30% glycerol and 55% water. The physico-chemical stability of functional O/W emulsions was evaluated at 37°C during 14 days, by determining particle size, Z-potential, peroxide value (PV), phytosterol content and phytosterol oxidation products (POPs), and was compared with a control O/W functional emulsion (containing PC and free phytosterols). Two experimental replicates were ran. The initial functional O/W emulsions formulated with LPC showed the higher particle size and the lower Z-potential with respect to PC (160.88 ± 51.31 nm vs. 76.25 ± 1.99 nm ; -33.28 ± 10.64 mV vs. -16.93 ± 1.89 mV). After 14-day storage at 37°C, both emulsions displayed a 70% increase in particle size with respect to the initial one, while Z-potential remained constant. Along storage, PV was stable in functional O/W emulsions formulated with LPC compared to the PC one, in which PV showed an increasing trend during the first 7 days followed by a decrease. This evidenced that the functional O/W emulsion formulated with PC was more susceptible to the oxidation. Regarding POPs, only β -sitosterol oxides were detected. Initial sterol oxidation was mainly characterized by 7β - and 7α -hydroxysitosterols; after 7 days, 5,6-epoxides, triol and 7-ketositosterol started appearing, and steadily increased thereafter. It is remarkable that nanoemulsions prepared with LPC did not show any epoxy derivatives. In general, functional LPC O/W emulsions showed a better physico-chemical stability than PC ones.

Keywords: Free phytosterols, O/W nanoemulsions, phytosterol oxidation products, enzymatically modified emulsifiers, phospholipids

Influence of the degree of roasting coffee in the incorporation of phenolic compounds and melanoidins antioxidant activity

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Coffee is the most consumed beverage in the world because of its flavor and particular aromas result from chemicals originated from the beans during the roasting process. Coffee is rich in phenolic compounds such as chlorogenic acid (CGA), caffeic and melanoidins (HMWF), which give it antioxidant effects that are beneficial to health; these compounds are sensitive to temperature increase. The objective was to determine the influence of the roasting degree of *Coffea arabica* beans in the incorporation of phenolic compounds in HMWF and antioxidant activity. The green *Coffea arabica* beans were subjected to different toasted at 220 ° C for 5, 6, 7 and 8 min, total phenols was determined by the method of Follin-Ciocalteau; the clarified beverages were analyzed for their antioxidant activity (DPPH assay) and its relationship to its content of HMWF by spectrophotometry. The results show that the longer toasting process (5 and 6 min.) produces the greatest concentration of total phenolics 135 and 125 mg of CGA respectively, suggesting that during roasting there is decreased CGA, major component of the hydroxycinnamic acids, which are more abundant in green grain that had 156 mg of CGA. A higher concentration of HMWF 2.74 mg and antioxidant activity 1.48 mmol Trolox / g were obtained for 8 min. roasting, compared with the green grain (1.47 mg / g of HMWF and 1.98 mmol of Trolox / g). In conclusion, the longer toasted of *Coffea arabica* beans, HMWF formation is favored due to the inclusion of CGA and 8 min. could be the right time to get the benefits of HMWF and therefore its beneficial health characteristics for their antioxidant activity.

Keywords: antioxidant activity, melanoidins, *Coffea arabica*

Development of a Pork Pattie Added with Sesame (*Sesamum indicum*) as Functional Ingredient

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Food is considered as functional when it has benefic effects, beyond his nutritive value, on human health affecting positively the organic functions in order to improve health or prevent any illness on consumer. Sesame, when is regularly consumed has functional properties like cholesterol regulation and hypertension prevention. Moreover, it contains antioxidants as sesamine and sesamoline which protect against free radicals and exert anti carcinogenic effects. The objective of the present work was to develop pork patties added with sesame like functional ingredient. One hundred and twenty patties were made, 30 were made according a traditional formula without sesame addition (Control), 30 were made according traditional formula plus 5% of sesame addition (P5), 30 were made according traditional formula with 10% of sesame addition (P10), and the last 30 were made according traditional formula with 15% of sesame addition (P15). Dry matter (DM), Moisture (Mo), Organic Matter (OM), Ashes (As), Crude Protein (CP) and Crude Fat (CF) content were evaluated, Physicochemical characteristics; pH, Cooking Losses (CL) and color (L^* , a^* , b^*) were evaluated. A sensory preference test was made to evaluate the satisfaction of product. Data were evaluated considering a complete random model with GLM procedure of SAS®. no differences ($P>0.05$) were showed in DM, As, and CP among treatments while OM and CF had differences ($P<0.05$) being T15 and T10 higher in fat content (10.6 and 12.9 % respectively). Color showed differences in a^* value being control the reddest pattie (15.08 ± 2.08), while treatments with sesame addition P5, P10, and P15 were less red (7.75, 6.14, 6.22 respectively). The preference test indicated that T10 had the high preference ($P<0.05$; 7.88 preference level) followed by T5 with 7.32 of preference level, and T15 with 6.67 of preference level. Control treatment showed the lowest ($P>0.05$) preference level (6.43). Addition of 10% of sesame is recommended since it showed the best preference and did not present drastic changes in physicochemical characteristics. The color of the hamburger was not determinant to affect satisfaction when cooking.

Keywords: Pork patties, Functional food, Food quality, Functional ingredients

Functional Effect Desired Depends of the Use of Correct Ingredient

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The functional food industry expansion has emerged as a result of advances in innovation in science and technology, and on the other hand because of the demand of new strategies to avoid health concerns or to improve health. In the Laboratorio de Digestión *ex vivo* from CIATEJ (Centro de Investigación y Asistencia en Tecnología y Diseño del Estado de Jalisco), we consider it is important to select the correct ingredient to get the desired effect in a product. Studies performed in our laboratory had demonstrated that ingredients with similar characteristics such as insoluble fibers have different effects on food formulation and more important, they have different effect on biological functions. There were tested agave fructans (*Agave tequilana* Weber var Azul) with different degree of polymerization (DP) *in vitro* and in an *ex vivo*. *In vitro* evaluation was made to determine acceptance degree for each ingredient by pathogens and probiotics growth. *Ex vivo* evaluation was performed in the Automatic and Robotic Intestinal System (ARIS), which simulates human digestive tract conditions (sections of the digestive tract, temperature, enzymes, motion, pH, time of residence, native microbiota from an objective population, diet, and swallows). ARIS evaluation consisted on simulated human digestion when was used a standard diet added with a DP<10 agave fructan. Pathogens and probiotics growth, were monitored in ARIS, additionally nutrient bioavailability (carbohydrates, sugars, lipids, short fatty acids, protein and aminoacids that are able to be absorbed, and fiber) were quantified. *In vitro* evaluation demonstrated that all microorganisms presented affinity for a specific agave fructan, it could be related with chemical structure and type of linkage. Evaluation in ARIS demonstrated this agave fructan with a DP<10 was bifidogenic but also promotes *Clostridial* groups growth. Nutrient bioavailability showed a significate decreased on sugars and total carbohydrates with the fructan administration, and an increased on total protein, glutamine, leucine and valine after the fructan administration.

Keywords: Functional, Biological effect, ARIS.

Fermentation of Radish (*Raphanus sativus*) Juice by Two Lactic Acid Bacteria

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Research has shown that the addition of probiotics to food provides several health benefits including improved gastrointestinal function, enhanced immune system and lower risk of colon cancer. Currently, probiotic products are usually marketed in the form of fermented milk and yogurt. However, lactose intolerance and the cholesterol content are two drawbacks related to their consumption, particularly in Asia. It has been suggested that fruit juice could serve as a good medium for cultivating probiotics. Fruit and vegetables are healthy food, because they are rich in antioxidants, vitamins, dietary fibre and minerals. Furthermore, fruit and vegetables do not contain any dairy allergens that might prevent usage by certain segments of the population. The aim of this work was evaluated the effect of incorporating three levels of sacarose solution (45°Brix): 5, 10 and 15% V/V on radish juice over viable cells count (CFU) and pH, using two probiotics strains (*Lactobacillus plantarum* and *Lactobacillus johnsonii*). So, three a 250 mL Erlenmeyer flask containing 100 mL of substrate solution of radish juice were pushed into the fermentation equip at 37+2°C, 120 rpm and 48 h of fermentation time. Viable cell count was obtained with spread plate method employing the MRS agar. There are not significant statistical difference ($p>0.05$) on the three levels of sacarose solution incorporated studied; sufficient viable counts were obtained to exert beneficial effects probiotics: lactic acid bacteria (LAB) population was between 108 and 1010 CFU/mL and the pH between 3.6 and 4.9. So, the fermented drink made of radish can be prepared with any level of incorporation of simple syrup

Keywords: radish, LAB, CFU/mL

Changes in Phenolic Compounds and Antioxidant Activity of *Moringa oleifera* Flour under Different Agroindustrial Processes

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Plant materials are very important source of bioactive compounds having high importance for pharmacology and food industries due to wide biological activities. Phenolic compounds are considerate bioactive compounds since they have demonstrated several benefits on human health decreasing chronic-degenerative diseases risks. In addition, they are well known as potent antioxidants compounds. *Moringa oleifera* (moringa) represents a good source extraction of phenolic compounds with a wide range of applications on food formulation of functional foods. However, food processing could be cause alteration on bioactive compounds for drying, freezing, baking, boiling and frying on food products and therefore change nutritional and functional composition of these products. This study was carried out in order to evaluate moringa flour under different agroindustrial processes and recorder functional characteristics. Moringa flour was submitted at 5 different processes usually applied on food industry phenolic compounds and antioxidant activity were evaluated by Folin-Ciocalteu for total phenolic determination and DPPH, ABTS free radicals scavenging and ferric reducing antioxidant power were evaluated as indicatives for antioxidant activity. In addition, UPLC-QToF was applied to identify changes on phenolic compounds on samples. Results shown an increment on phenolic compounds after drying, baking and frying with 57.27, 69.75 and 61.25 mGAE ml⁻¹ respectively; while samples after boiling recorded less phenolic than control did; in samples summited to dry-freezing, changes were no observed. Antioxidant activity increased after baking and frying; however boiling process affected that property. UPLC-QToF assay suggests several benefic changes on phenolics in all samples. In this sense, moringa flour can be used in food products formulation to obtain new functional foods.

Keywords: Phenolic compounds, Antioxidants, Moringa.

Fermentation of Lemon Leaves, Mint Leaves and Lemon Grass By Three Lactic Acid Bacteria

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Research has shown that the addition of probiotics to food provides several health benefits including improved gastrointestinal function, enhanced immune system and lower risk of colon cancer. Currently, probiotic products are usually marketed in the form of fermented milk and yogurt. However, lactose intolerance and the cholesterol content are two drawbacks related to their consumption. It has been suggested that fruit juice could serve as a good medium for cultivating probiotics. Fruit and vegetables are healthy food, because they are rich in antioxidants, vitamins, dietary fibre and minerals. Furthermore, fruit and vegetables do not contain any dairy allergens that might prevent usage by certain segments of the population. The aim of this work was evaluated the effect of incorporating three levels of saccharose solution (45°Brix): 5, 10 and 15% V/V on Lemon Leaves, Mint Leaves and Lemon Grass juice over viable cells count (CFU) and pH, using three probiotics strains (*Lactobacillus plantarum*, *Lactobacillus casei* Shirota and *Lactobacillus johnsonii*). So, three a 250 mL Erlenmeyer flask containing 100 mL of substrate solution of each vegetable were pushed into the fermentation equipment at 37±2°C, 120 rpm and 48 h of fermentation time. Viable cell count was obtained with spread plate method employing the MRS agar. There are significant statistical difference ($p < 0.05$) on the three levels of saccharose solution incorporated studied; sufficient viable counts were obtained to exert beneficial effects probiotics: lactic acid bacteria (LAB) population was between 10^5 and 10^7 CFU/mL and the pH between 3.6 and 4.9. So, the fermented drink made of each vegetable can be prepared with any level of incorporation of simple syrup.

Keywords: lemon leaves, mint leaves, zacate lemon, LAB, CFU/mL

Stability of Phenolic Compounds and Antioxidant Activity of a Cookie Formulated with Moringa Flour

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Study and formulation of functional foods is increasing at food industry, due to the demand of consumers on the production of food enhance with bioactive compounds, which have benefits on human health. *Moringa oleifera* (moringa) represents a good source of bioactive compounds such as phenolic compounds with application on food industry. In addition, intake of moringa leaves provides protection against liver damage and are recognized for providing high antioxidant activity extracts. In this sense, moringa leaves were incorporated into a cookie formulation in order to evaluate changes on phenolic compounds and antioxidant activity. Cookie was formulated according to **NOM-051-SCFI/SSA1-2010** and baking at 130 °C for 20 min. Ultrasound was used as extraction method and extracts were evaluated by Folin-Ciocalteu for total phenolic content and DPPH, ABTS free radicals scavenging and ferric reducing antioxidant power were evaluated as indicatives for antioxidant activity. UPLC-QToF was applied to identify changes on phenolic compounds on samples. Total phenolic compounds increased after baking in 30% and antioxidant activity twice or three times depending on the used method. UPLC-QToF assay suggests several benefic changes on phenolics in all samples, which make this product an alternative for customers.

Keywords: Phenolic compounds, Antioxidants, Moringa.

Effect of Pulsed Electric Fields on the Physical-Chemical Properties, Microbial Inactivation and Polyphenols Stability of Kombucha Analogues from Oak Leaves Infusions

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Kombucha is a traditional fermented beverage obtained usually from black tea, although several vegetal sources have also been used as a substrate. To obtain kombucha from oak leaves, several authors have claimed that kombucha consortium has to be stored at ~20°C, so its typical biofilm and microorganisms in it can continue growing normally. Thermal processing was useful in preventing biofilm growth, color, and taste changes. Unfortunately, relatively low temperatures and processing short times decrease total phenolic content and antioxidant activities. As an alternate process, pulsed electric fields (PEF) were used and their effect on the quality parameters, microbial reduction and phytochemical composition evaluated. Kombucha from infusions of oak leaves were processed with PEF (continuous mode, pulse width 30, 200Hz, 46.4 KV/cm, flow 102.85 L/h) and stored (4°C, 30 days; 25°C, 20 days; and 35°C, 15 days). The pH, °Brix, % acidity, total microbial count (acid-acetic bacteria, yeast), total phenolic content, and radical scavenging activity were analyzed; also flavonols and flavan-3-ols were determined (UPLC-ESI-MS/MS) at each stored condition. Anova and Tukey tests were used for results analysis. A strong reduction on bacteria and yeast with a hard recovery of yeast at higher temperature and times were observed. The best condition of storage was at 4°C. Kombucha treated by PEF did not show significant changes on physical-chemical parameters with respect to time at any temperature. Similar behavior was observed for total phenolic content and radical scavenging activity. Flavonols increased with time and temperature in untreated samples, while minor changes were observed in PEF samples. Flavan-3-ols diminished in the untreated samples, and were unaffected by PEF treatment along the storage. In conclusion, use of PEF is useful to process kombucha analogues with minor changes in their polyphenolic compounds.

Keywords: Kombucha; Polyphenols, Pulsed Electric Fields

Polyphenolic Stability of Fermented Guava (*Psidium guajava* L.) Leaves Infusion by Kombucha Consortium

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Psidium guajava L. (guava) leaves have been used for a long time as traditional medicine in form of decoction, milled and used as comprises. Dried guava leaf is found in many commercially available botanical supplements. Several biological activity studies showed that guava leaves have important beneficial health effect as anti-inflammatory, hypoglycemic, antibacterial, antidiarrheal and antioxidant effects. There are reports about phytochemicals and flavonoids, in particular, quercetin from guava leaves. In contrast guava leaves fermentation process showed a lack on the knowledge. However, it has been reported the fermentation with *Phellinus linteus* mycelium grown using guava leaf as a substrate, and subsequently fermented with *Lactobacillus plantarum* and *Saccharomyces cerevisiae*. Reports on fermented guava leaf extracts that can potentially suppress the expression of inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2). Kombucha is a traditional fermented beverage obtained usually from black tea, although several vegetal sources have been also used as a substrate. No reports have been published on the use of Kombucha consortium in guava leaves infusions. The starting kombucha consortium was maintained in sweetened (sucrose 10 % w/v) black tea at 25°C. Freshly cultured kombucha was used for further subcultures of fresher fermentation batches. Fermentation conditions were time (11 days), sucrose 10 % (w/v), inoculum (2.5% w/v, Kombucha consortium) and incubation temperature (22°C). Total volume of fermented guava leaves was 0.5 L. Guava leaves infusions were prepared with milled dry guava leaves (2% w/v) poured into water at 80°C by 10 min. Kombucha made with black tea was used as control. pH and acidity were measured. Hydroxycinnamic acids, flavan-3-ols, carbohydrates (glucose, sucrose, and fructose) and succinic acid were evaluated by use of UPLC-ESI-MS/MS along the fermentation process. Obtained results were analyzed with ANOVA and Tukey tests. pH and acidity indicated that fermentation process was under control and that guava leaves infusion was fermented by Kombucha. Sucrose consumption was more efficient in Kombucha control, but at the end of fermentation no differences were observed. Higher concentration of succinic acid was observed in Kombucha controls (620 vs 520 mg/L). Flavan-3-ol present in Kombucha controls showed at drastic drop at day 1. Guava leaf fermented infusion showed a speeding increase at day 1 product of the inoculum, but the drop was not observed at the same rate that in Kombucha control. Hydroxycinnamic acids in kombucha control showed an increase in function of the time, however in guava leaves fermented infusion no changes were observed along the fermentation. The use of guava leaves as substrate for Kombucha analogues is possible.

Keywords: Fermentation; Guava; Kombucha

Design of Cookies Added with Earthworm (*Eisenia foetida*) And Amaranth Flour to Fight Children Malnutrition

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Dietary changes and sedentary life are the main causes of metabolic and nutritional diseases. Children are the most susceptible population group suffering overweight, obesity and undernourishment in Mexico. Parents must to choose a balanced diet to the children, but it is a difficult work, because of the short time to prepare it. The most easy and quickly way to feed children is giving fast food to them. Nowadays, there is an increase in insect intake because of the high quality protein content. Earthworms (*Eisenia foetida*) are of nutritional interest since they are a rich source of protein (>60% w/w). Besides, it is known earthworm's flour contents essential amino acids, such as phenylalanine, leucine, lysine, isoleucine, methionine and valine. On the other hand, amaranth is a pseudo cereal with high quality protein content, useful to bakery products. The aim of this work was to make cookies with amaranth and earthworm flour to contribute as a new food alternative to children. Cookies with wheat, amaranth and earthworm flour were made using different concentrations. The flour concentrations were 50/40/10 wheat/worm/amaranth, the second formulation includes 60/20/20 and the last one 40/30/30, respectively. After bakery tests, the first formulation presents the best physical quality. A sensory evaluation of the formula was made with five point hedonic scale with 50 judges between 6 and 15 years old randomly choose. 96% of the judges accepted the cookie with 45% carbohydrates, 31% protein and 1% lipids. This product could be an attractive functional food because of the good taste have a relationship with enriched nutrition.

Keywords: cookie, malnutrition, earthworm, protein.

Design of Functional Food to Women at Climacteric Stage

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Climacteric is a period in women life. This period is characterized by significant low of estrogen production. The process occurs before and after menopause (last menstruation). This stage happens in mature women and is considered an involution period. The symptoms are physical and emotional as vaginitis, osteoporosis, arteriosclerosis, nervousism, headache, depression and low libido, but is dependent of each women. All these symptoms are related with hormonal deficiency. 95% of women suffer different climacteric symptoms, but there are a lot of products in the market promising to diminish the suffering, but all of these products have secondary effects. The aim of this research was to create a food product with soy, cereals, honey and dry fruits to help to mature women to counteract climacteric effects. Soy has an important content of isoflavones, natural phytohormones which substitute estrogens women are losing. Besides, dry fruits provides antioxidants and fiber. The cereal bars were formulated with tofu at different concentrations. To favor the product acceptance, a survey to 40 mature women (45 years old or more) was realized. 52% of judges does not know soy benefits, but 80% could consume it. The best formula was 50% tofu with 29.4 mg of isoflavones and 20% dry fruits, 20% cereals and 10% honey. The cereal-tofu bar nutritional composition is 38-40% protein, 18% vegetal lipids, 15% carbohydrates, 15% fiber and 14% moisture. The pleasant flavor and texture (according to judges) of the bar, could be an alternative to help climacteric women to have a better quality life during this hard stage, according to gynecologist.

Keyword: climacteric, soy, isoflavones, antioxidants.

Development of a graham crackers from bagasse vanilla (*Vanilla planifolia*)

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In food processing a large amount of waste that are dumped as municipal waste, which are considered as pollutants that affect the environment occurs, as in the case of Vanilla pods that are treated with an ethanol solution for extraction aromatic compound of Vanilla, at the end of this process remain as residues (bagasse). Bagasse vanilla pods was conditioned, subjected to dehydration in an oven until a humidity of 5% to grinding. A proximal chemical analysis and total dietary fiber (TDF) vanilla bagasse was conducted, the result was 31.8%, of which, 15. 2% corresponds to the insoluble fiber and 16.5% to soluble fiber. Later cookies were made with four formulas, in which a mixture of wheat flour and vanilla Bagasse (% HT / BV) was used in the following proportions: 60/40, 70/30, 80/20, 90/10; a blank sample (wheat flour in its entirety) was also performed. To these samples were performed sensory analysis where the best formulation was 60/40 and the highest scores in the three characteristics measured for comparative analysis, it should be noted that this formulation is that it contains more fiber all processed products and those that exist in the market. A sensory analysis was performed, the best formulation is 60/40 and got the highest scores in the three characteristics measured for comparative analysis, it should be noted that this formulation is more fibers containing all processed products. The product made with bagasse Vanilla had an average hardness of 65.8 g/N, which is less than the product with more fiber trademark All Bran® with an average hardness of 108.6 g/N.

Keywords: bagasse vanilla, total dietary fiber (TDF), insoluble fiber, soluble fiber.

Improvement of Quality Parameters of a Dietary Fiber-Enriched Pound Cake with the Incorporation of Extruded Orange Peel

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The food processing industry is responsible of the production of a large amount of vegetable by-products, resulting into a severe environmental problem. The above has led to the use of these by-products not only for the consumption of nutraceutical compounds associated to these materials, but also for their functional properties on the elaboration of food products. Dietary fiber (DF) is a compound well-known for its physiological and technological functionality. In order to extend its applicability, extrusion processing has been used to modify DF content, composition and functionality. The use of fruit DF concentrates for bread making could give better nutritional quality than those found in cereals because of its higher soluble dietary fiber (SDF): insoluble dietary fiber (IDF) ratio (SDF:IDF) and the DF associated nutraceutical compounds. The aim of this study was to evaluate the use of orange peel DF concentrate (OPC) with different SDF:IDF ratio (modified by extrusion) on physical properties of pound cake. Pound cakes were formulated with 6% (d.b.) of DF from OPC with three different SDF:IDF ratio (0.15:1, 0.42:1, 0.99:1; M1, M2, M3 respectively). Dough and cake density, moisture, color (L , a , b), texture profile analysis (TPA), and bread crumbs were compared to a control sample (pound cake with no added DF; CS). Analysis of variance and Tukey test were performed to verify the differences of the studied variables (p -value < 0.05). Even that a decrease in dough density values was observed when compared CS (1.074 g/cm³) with M1 (0.851 g/cm³) and M2 (0.944 g/cm³), no differences were perceived in cake density values. Similar results in moisture content were noticed for CS; however, with an increased SDF:IDF ratio, moisture values raised up to 7% (p/p). The addition of OPC didn't modify L and a color parameters but a $\approx 20\%$ increase in b (yellowness) was found. A reduction of hardness was detected with an augmented SDF:IDF. No significant differences were observed on the other TPA values. As SDF:IDF ratio was increasing, the crumb showed bigger size continuous air channels than the CS. Thus, the results demonstrate that extruded OPC improve some parameters related to bread quality.

Keywords: pound cake, orange peel, dietary fiber, extrusion

Effect of Blanching and Osmotic Dehydration on the Antioxidant Properties of *Byrsonima bucidaefolia* Fruits

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The fruit of *Byrsonima bucidaefolia*, traditionally in the Yucatan peninsula they are consumed in fresh and pickle, the fruits are immersed in hot water and preserved with salt. These fruits have a potential as a source of natural antioxidants. Thus, the objective of this research was evaluate the combined effect of blanching (50 °C and 100 °C for 5 minutes) and osmotic dehydration (solution 5 and 10 % NaCl) on the antioxidant properties of *Byrsonima bucidaefolia*. Seven treatments were evaluated: a control by dipping samples for 5 minutes in distilled water (C); blanching to 50 °C (E50); blanching to 100 °C (E100); blanching to 50 °C with application osmotic dehydration 5% (E50-5); blanching to 50 °C with application osmotic dehydration 10 % (E50-10); blanching to 100 °C with application osmotic dehydration 5% (E100-5); and blanching to 100 °C with application osmotic dehydration 10% (E100-10). For determine the antioxidant properties were used two methods: the antioxidant capacity was evaluated through the DPPH method and the total phenolic content was determined according to the Folin-Ciocalteu assay. The significant differences between treatments was performed with ANOVA followed by Tukey test was applied to determine the difference between the means. The level of significance was set at $p = 0.05$ for all analysis. In the antioxidant capacity, the higher percentages of inhibition free radical were found in the treatments E50 (95%) and E50-5 (94%). The total polyphenols content was decreased with blanching, showed small lost E100 (120 mg A.G/g extract), while osmotic dehydration E100-5 showed higher polyphenols content with 172 mg A.G/g extract. In the capacity antioxidant were obtained significant differences during blanching and osmotic dehydration ($p \leq 0.05$), noting an increase in the percentage of inhibition applying such treatments. Regarding the content of polyphenols was decrease with blanching ($p \leq 0.05$). For osmotic dehydration the content of polyphenols was increased ($p \leq 0.05$). It is concluded that the fruit blanching at 50 °C with osmotic dehydration 5% showed an increase in antioxidant activity, for polyphenol total, the scalding temperature to 100 °C and osmotic dehydration with 5% salt showed greater polyphenol content.

Keywords: *B. bucidaefolia*, antioxidant capacity, polyphenols, blanching, osmotic dehydration.

Development of Quinoa (*Chenopodium quinoa*) and dried fruit based snack bars with soluble dietary fiber addition

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The nutritional value of dietary fibre has been widely studied. High dietary fibre intake has been associated with health benefits such as better control of blood glucose and cholesterol levels, protection against cardiovascular diseases, regulation of intestinal function, promotion of intestinal health and protection against colon cancer. Dietary fibre has been included in many foods because the average intake is lower than the recommended amounts according to international organizations. Because of the growing consumer demand for healthy, natural and convenient foods, attempts are being made to improve the nutritional value of snack foods. In this category, the energetic and cereal bars have gained acceptance in the consumer by using dried fruit and whole grains. However, due to the high content of sugar and vegetable fat in the binder, in some cases, nutritional values cannot be considered healthy. The aim of this study was to develop snack bars with components of superior nutritional value like quinoa and with high dietary fibre content (10% of daily requirement per serving). In the production process, density, selection of cereals and relation solids-binder were analyzed. Snack bar was formulated without (control bar) or with fibre (fructooligosaccharides, polydextrose and soluble corn fiber). The fibers partially replaced the sugars in the binder aiming to cut sugar by 60% and the selected formulations aimed at reduction of 10 – 20% caloric value. Moisture content, water activity, binder viscosity and final fiber content were evaluated for each formulation. The optimized formulations, fructooligosaccharides with 40% less sugar and soluble corn fiber with 60% less sugar, were evaluated by sensory analysis with consumers.

Keywords: polydextrose, fructooligosaccharides, soluble corn fiber, functional food.

Bioactive compounds and cellular antioxidant activity of selenized *P. ostreatus* fruiting bodies

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Pleurotus species have been recognizing as a good source of selenium, due to its ability to absorb and accumulate minerals from the substrate. This mineral is highly important to promote the human health balance and to reduce the incidence of chronic degenerative diseases due to its potent antioxidant and immunostimulant effects. *Pleurotus* mushrooms cultivated on substrates enriched in selenium increase the content of phenolic acids and flavonoids. However, the identification of flavonoids in *Pleurotus* is doubtfully because it has been demonstrated that mushrooms can not synthesize and absorb them and also they have been only determinate by spectrophometric methods and not confirmed by mass spectrometric, furthermore the cellular antioxidant activity (Caco-2) and their relation with compounds identifications of *P. ostreatus* has not been reported. The aim of this study was to analyze the effect of selenization on the yield, profile of phenolic compounds (free and bound), amino acids, and the absorption of selenium and cellular antioxidant activity of *P. ostreatus* fruiting bodies from different flushes. The yield of *P. ostreatus* fruiting bodies were increased by selenization effect (20%). The highest selenium content were found in mushrooms harvested from selenized substrates in flush 1 and 2 (15.1 and 15.2 µg/g, respectively). Selenium and flush effects increased the ergothioneine content and modified the amino acid profile. The mass of flavonoids had not founded in free and bound phenolic extracts. The cellular antioxidant activity was significantly different between selenized and non-selenized treatments. Selenium enrichment increased the biological efficiency, the content of bioactive compounds (ergothioneine), amino acids, total selenium and increases cellular antioxidant activity of *P. ostreatus* fruiting bodies.

Keywords: *Pleurotus*, selenium, ergothioneine, cellular-antioxidant-activity.

Nutrimental and antioxidant properties of a bread product additioned with unconventional ingredients

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The flours used to make bread are poor in nutrients and have a low extraction rate, which makes them nutritionally deficient. The agro-industry produces a great amount of wastes or by-products, which can be used as a source of nutrients. The objective of this study was to elaborate a bread product using wheat flour (WF) and different flours obtained from unconventional ingredients (UI), made out of apple (AF) and carrot bagasse (CF), mushroom (MF) and lentil (LF). The making process of UI flours included oven drying at 60°C, grounding and sieving. The new bread (SB) was formulated by partially substituting WF for UI flours. Control bread (CB) was made with 100% WF. The bread was elaborated by a standard procedure. The proximal composition was determined in the final product using AOAC procedures. Microbiological analysis in aerobic mesophilic bacteria, total coliforms and fungus and yeasts was realized by direct methods. Phytochemical analysis such as total phenolic compounds (Folin), flavonoids (Al₂Cl₃), and antioxidant capacity (FRAP, DPPH and ABTS) was determined in the UI flours and breads. In the final formulation, the WF was substituted in 14% by UI flours. Microbiological quality of SB was guaranteed according to official regulations. Proximate analyses showed that SB was higher in protein (7.6±0.39%) (p=0.01), total fat (1.3±0.04%) (p<0.01), ash (1.8±0.05%) (p<0.01) and crude fiber (1.1±0.01%) (p<0.01) than CB. Phytochemical composition of flours indicated that MF has a higher phenolic content (8.4±0.33 EAG/g), and antioxidant capacity (FRAP-40.9.4±0.73 ET/g, ABTS-69.9±2.8 ET/g, and DPPH-17.5±0.39 ET/g) than the other UI flours (p<0.01). The CF had higher flavonoid content (9.5±0.17 EC/g, p=0.021) than all UI flours. Partial substitution of WF by UI flours in SB caused increased total phenolic compounds in 400% (p<0.01), flavonoid content in 290% (p=0.01), antioxidant capacity in 624% by FRAP (p=0.01), 218% by ABTS (p<0.01) and 810% by DPPH (p<0.01) in comparison with CB. The use of UI flours in the bread making process had an impact in the composition and antioxidant properties of the product, which benefits the health of the consumer and demonstrates that agro-industrial by-products can be used to improve nutritionally deficient foods.

Keywords: Bread, nutritional, antioxidant capacity, functional, agro-industrial residues.

Physical Modification in Dietary Fibers Using Microwave and Ultrasound and Their Evaluation in an Animal Model.

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Although the beneficial effects of dietary human health fiber are widely recognized, and poor consumption is associated with numerous conditions called "diseases of civilization" (diabetes, obesity, diverticulosis and cardiovascular disease), it has also been observed that increased dietary fiber consumption demonstrated adverse effects on digestion, absorption and utilization of some nutrients from food. Therefore, the purpose of this investigation is to evaluate different physical treatments (Microwave and Ultrasound) to help enhance the efficiency fortification of bakery products with fiber, allowing the beneficial effects of this in the body, but without compromising the nutritional quality of the final product. Commercial fibers that were analyzed were (rice bran, corn fiber, oat fiber and wheat fiber), these were subjected to physical treatments Ultrasound and Microwave once made these treatments, the samples are evaluated in a bioassay, where rats are kept in individual stainless steel cages under controlled environmental conditions for 30 days and food is provided *ad libitum* (administered diets are composed of both unmodified and modified fibers, as well as the corresponding controls), blood samples are taken and evaluated the parameters glucose, cholesterol and triglycerides using a commercial kit. The results are analyzed by ANOVA, with a significance level (α) 0.05, and the fiber obtained better results in the three blood parameters was oat fiber modify by Ultrasonic treatment if obtained a significant difference against the control treatment, while wheat fiber modify by Ultrasound treatment achieving lower levels of glucose, cholesterol and triglycerides compared with the same fiber without modification and modified by microwave, finally the two other fibers evaluated (maize and rice) were not significantly different between treatments (microwave and ultrasound) compared to unmodified fiber, or compared to control treatments. These results give us a better idea about whether we modifications help improve the fortification of some baked goods at the same time as a continuation of the same line of research are carrying out enzymatic modifications for later comparison with the treatments mentioned in this work.

Keywords: dietary fiber, microwave, ultrasound

Screening of Organic Compounds as Acetylcholinesterase Inhibitors for Functional Food Development

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Functional foods have a potentially positive effect on health beyond basic nutrition, promote an ideal health and help to decrease the risk of disease. Actually there are no foods that contain compounds that can help to control Alzheimer's disease (AD). Nowadays, there is no cure for Alzheimer's disease. Once a person starts showing signs - memory loss and problems with learning, judgment, communication and daily life-, there are no treatments that can stop or reverse them. Some drugs curb the breakdown of a chemical in the brain, called acetylcholine, that's important for memory and learning. They may slow down how fast symptoms get worse for about half of people who take them. The hydrolysis of acetylcholine (Ach) is realized by means of enzyme acetylcholinesterase (AchE). The compounds that inhibit Ach hydrolysis are inhibitors of AchE. Thus, the functional food to control AD may contain AchE inhibitors. The goal of the present study was performed screening of thirty-five organic substances to select inhibitors of AchE, evaluate their toxicity in *Artemia salina* model and define kinetic model of inhibition process. Spectrophotometric technique (Ellman's method) was applied to evaluate AchE activity in the presence and absence of assayed substances. Only 4 compounds were selected based on inhibition effect and no toxicity observed on *A. salina*. Two compounds inhibit AchE by means of competitive mechanism; one of them is uncompetitive inhibitor, and other present mixed inhibition mechanism. Obtained results could application to development of functional food to control Alzheimer's disease, considering that selected compounds are new inhibitors of AchE.

Keywords: screening, acetylcholinesterase inhibitors, Alzheimer's disease control, functional food.

Antioxidant and Antityrosinase Activities of Peptides from White Sorghum Grain on Human Skin Cultures

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At the present, the food industry has developed nutricosmetics (orally ingested products), which provide benefits to health and skin and which may be a potential new market on bioactive molecules. Thus, the aims of the present study were to assess the antioxidant and antityrosinase activities of the peptides from white sorghum (*Sorghum bicolor* L. Moench) grain on human skin cultures exposed to UVB-radiation. Sorghum kafirins (prolamin fraction) were extracted with *t*-butanol and were hydrolyzed with alcalase by using an enzyme/substrate ratio of 1.6 U/g protein for 9 h, at pH 7.5 and 50°C (Degree of hydrolysis = 18 %). For peptide separation, hydrolysates were fractionated through an ultrafiltration (UF) system with a M_w cut-off (M_wCO) of 3000 Da. Peptide concentration was determined by TNBS method. Antioxidant activity was measured by enzymatic activity of superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) by the use of antioxidant assay kits. Tyrosinase activity was determined by a spectrophotometric method. Skin samples (n=6) were obtained from healthy adults (25 – 35 years of age) and tissue cultures were prepared according to previously reported protocols. Four groups were assessed for each sample: non-UVB-exposed skin (negative control); UVB-exposed skin (positive control); non-UVB-exposed skin plus peptides (treatment 1) and UVB-exposed skin plus peptides (treatment 2). Sorghum grain contained $8.38 \pm 0.22\%$ (dry basis) of crude protein. Prolamin extraction showed the presence of the three main Kafirins (α -, β - and γ -Kaf). UF achieved the separation of peptide fractions (PF; $M_w < 3000Da$), with $37.71 \pm 3.69\%$ of permeate with a peptide concentration of 818.56 ± 112.63 mg/mL eq L-Leucine. UVB exposed controls resulted in a reduction of 10 – 30% SOD, CAT and GPx activity in comparison to negative controls. PF showed protective effect on the activity of antioxidant enzymes in the presence of oxidative stress induced by UVB- radiation, only. Other studies had shown that sorghum PF have the capacity to inhibit tyrosinase. Our results show that sorghum peptides could be considered as candidates for the design of nutricosmetics due to their antioxidant and anti-tyrosinase properties.

Keywords: sorghum peptides, health skin, antioxidant, tyrosinase, ultrafiltration

Lipase-Catalysed Enrichment of γ -Linolenic Acid for the Production of Structured Triglycerides

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Given the health benefits of functional foods we conducted the preparation of structured triglycerides (sTAG) containing γ -Linolenic acid (GLA). First, the enrichment GLA was optimised in a solvent-free system by lipase-catalysed esterification of free fatty acids from evening primrose oil (EPO-FA) and 1-butanol (BtOH). The lipase employed to carry out this step was a free preparation of *Candida rugosa*. Variables evaluated were: molecular sieves (MS) loading (2.5, 5, 10 and 15%, based on the total weight of substrates) and MS addition time (3, 9, 12 and 15 h). Secondly, the physical separation of the reaction phases was carried out by thin-layer chromatography (TLC) in order to recover the maximum amount of GLA. Finally, GLA was allowed to react in the presence of glycerol and fraction B of *Candida antarctica* (CALB). Variables assayed were enzyme loadings (5, 10, 15 and 20%, based on the total weight of substrates), temperatures (30, 40, 50 and 60°C) and substrates molar ratios (1:1, 2:1, 3:1 and 4:1, glycerol:GLA). According to our results, *C. rugosa* showed very low selectivity for GLA. Combined with the addition of MS, GLA was highly enriched in the non-esterified fatty acid fraction achieving ca. 90 wt.% with the addition of 5% molecular sieves at 9 h of reaction. Then, GLA-enrich fraction was used to prepare sTAG where high temperature favoured the correct interaction for enzyme and its substrate, avoiding mass transfer limitations. We were capable of producing a highly structured triglyceride (60%) containing 49 wt.% of GLA for a 15% of CALB loading at 60°C and 3:1 (glycerol:GLA) substrates molar ratio. The present work was carried out in solvent- and surfactant-free system.

Keywords: GLA, enrichment, lipases, structured TAG

Lipases and Phospholipases for Structured Lipids Preparation

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The acylglycerol structure exemplifies the major lipid building block and therefore is an interesting structure to modify. Such modification is driven by: (1) consumers who have become more concerned about the relationship between diet and wellness, and (2) new and novel functional compounds can be prepared when the original structure of a lipid is modified. This trend has led to the design of functional foods or nutraceuticals, namely, fortified, enriched, modified and enhanced foods. Advances in the biochemistry and engineering of enzymatic reactions and reactors have improved the knowledge and understanding of such reaction systems and thus, make available a generation of structured lipids. The present contribution deals with the different reaction systems employed for structured lipids preparation. First, we produced structured phosphatidylcholine with an elevated CLA content, catalysed by phospholipase A₁. Secondly, we performed the lysophosphatidylcholine formation employing free and immobilized lipases in the presence of ethanol and water. Finally, the synthesis of structured glycerides was carried out using both lipases and phospholipases to incorporate omega-3 and omega-6 fatty acids. According to the enzymatic kinetics generated, we observed that reaction environments as well as operational parameters, namely substrates molar ratio, temperature and enzyme loading, clearly affect the extent of the reactions. Combined with selectivity of the enzyme used, high contents of polyunsaturated fatty acids were incorporated into different lipids.

Keywords: *enzymes, lipids, modification*

Comparison of the effect of sodium reduction in low fat spun paste type cheese during storage on the texture profile analysis and sensory evaluation.

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A high sodium intake affects consumer's health, being salt the principal food source. Globally it has been established that through the high intake of salt derived from food, population overtake salt recommendation (2g/day), thereby reducing the sodium content in foods is part of the WHO/PAHO's salt reduction intake strategy. Cheese, provides significant amounts of sodium and fat, thus, the aim of this study was to evaluate and compare the effect of reduced sodium and fat content in a spun paste cheese, on the texture profile analysis (TPA) and sensory analysis, during storage at 30 days. Cheese was manufactured from milk standardized to 1.5% w/v of fat, to get a semi-fat spun paste cheese, with two salt reduction levels (33% and 67%) and a control 0%. A stepped experimental design was followed for testing on days 1, 15 and 30 of storage. At each time a TPA was conducted using a texturometer, then an ANOVA was performed ($p \leq 0.05$). Sensory analysis included: a consumer acceptance that was evaluated by 60 consumer's panel (with chronic kidney disease) on a 5-point hedonic scale; and a descriptive test scores with trained panelists who qualified: color, flavor and texture; then a correspondence analysis was run. There was a trend: TPA parameters decreased with storage time, however, no significant differences were found, suggesting that these changes probably not due to salt's reduction levels tested. In the sensory evaluation with trained panelists, texture was identified as a critical descriptor, probably these results may be affected by the reduction in fat on cheese. In conclusion, the results indicate that sodium reduction was not critical in TPA or taste perception, which will allow work with 67% of salt reduction and obtain a semi-fat paste spun cheese.

Keywords: Texture, texture profile analysis, low fat cheese, TPA, sodium reduction, sensory analysis

Effect of Extraction Solvent on Antioxidant Activity Assays of *Passiflora biflora* Lam and *Stevia rebaudiana*

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The use of different solvents and combination with water shows a highest extraction of phenolic compounds in different plant and fruit extracts with antioxidant potential. This study was conducted to investigate the antioxidant activity in *Passiflora biflora* fruit and *Stevia rebaudiana* leaves in ethanol, methanol, water, acetone, ethanol-water (70:30), methanol-water (50:50) and acetone-water (70:30) extracts. The assays used for determining the antioxidant activity were free radical inhibition (DPPH) and cation decolorization (ABTS). An analysis of variance (ANOVA) and Tukey multiple comparisons ($p \leq 0.05$) was performed. The results showed significant difference ($p \leq 0.05$) in antioxidant activity among the solvents used in *Passiflora biflora* extracts, aqueous extract showed DPPH antioxidant activity of $10,568 \pm 13.17 \mu\text{M trolox/g}$ and ABTS $14,721 \pm 215.44 \mu\text{M trolox/g}$. The combination solvent-water 50:50 (methanol-water) and 70:30 (ethanol-water) got better the antioxidant compounds extraction. *Stevia rebaudiana* leaves extracts showed antioxidant activity (DPPH) of $111.2 \pm 0.10 \text{ mM trolox/g}$ and (ABTS) $315.7 \pm 6.1 \text{ mM trolox/g}$ for ethanol-water (70:30) extracts which showed the highest efficiency and antioxidant activity. The acetone extracts showed the lowest antioxidant activity (DPPH) with $46.3 \pm 0.21 \text{ mM trolox/g}$ and (ABTS) $58.6 \pm 2.0 \text{ mM trolox/g}$. The results showed that *Stevia rebaudiana* leaves and *Passiflora biflora* fruit has a high antioxidant potential, which has been attributed to free radical, and suggests a potential to be used in food and pharmaceutical industry as a natural antioxidant and can help in the development of value-added food products formulated with non-traditional agricultural products.

Keywords: antioxidant activity, DPPH, ABTS

Antioxidant Activity in Drink Probiotic Whey

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The liquid whey used to manufacture a variety of products due to their composition and properties beneficial in humans. The aim of this study was to develop and to evaluate six fermented whey-based beverage with tropical fruit juice of star (*Averrhoa carambola* L.) and passion fruits (*Passiflora edulis* Sims f. *Flavicarpa* Degener), sweetened with stevia (*Stevia rebaudiana* B.). This may be an alternative use for by product from artisanal makers' jarocho cheese in the center región of Veracruz. The MIXED procedure of SAS® was used with a correlation structure of compound Symmetry, the F degrees and comparison of means were adjusted by Kenward-Roger procedure. The results of antioxidant activity in *Averrhoa carambola* L. was 20.68% (DPPH), 35.18% (ABTS) and content of phenolic compounds of 0.87 mg AG/g. *Passiflora edulis* Sims f. *Flavicarpa* Degener showed antioxidant activity DPPH (17.7%), ABTS (28.61%) and total phenols (0.54 mg AG/g) and *Stevia rebaudiana* B. which showed highest antioxidant activity 71.03% DPPH, 96.82% ABTS and 49.61 mg AG/g of total phenolic compounds. The beverage sowed antioxidant capacity by DPPH was 3483.67 and 2612.07 μ M Trolox/g, ABTS 3988.63 and 3931.67 μ M Trolox/g, phenolic compounds 38.14 and 35.29 mg gallic acid/L, respective. These healthy probiotic beverages are a potential option of added value to whey.

Keywords: fermented beverage, *S. rebaudiana*, *P. edulis*, *A. carambola*.

Effect of Traditional Cooking Methods on Phenolic Compounds and Antioxidant Activity of Ayocote (*Phaseolus coccineus* L.)

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The effect of soaking (12 h in water), boiling (atmospheric pressures, 96°C, 150 min) and cooking at high pressure (15 lb, 120 °C, 30 min) on the total phenolic content and antioxidant properties such as scavenging activity *in vitro* on free radical scavenging activity (DPPH[•]) and oxygen radical absorbing capacity (ORAC) values of seeds of two varieties, negro and morado, of ayocote bean (*Phaseolus coccineus* L.) were investigated. Although all the treatments in comparison to the original raw ayocote ($p < 0.05$) were shown to lower the level of bioactive compounds due to leaching into the soaking and water cooking (ca. 7.2% and 13.5), pressure cooking was a better method in retaining active compounds in ayocote beans than boiled (21.16% and 27.4%; 10.2 % and 15.2% for black and morado varieties respectively). Cooking treatments reduced total phenolic compounds content significantly in the varieties but no differences existed between the cooking treatments ($p < 0.05$). Raw ayocote and its processing products showed inhibition of DPPH[•] and ORAC which are affected by cooking treatments. The level of retention of inhibition of DPPH[•] and ORAC for soaking, cooking water, boiled and pressure cooking ranged from 7.2-8.7%, 33.7-49.33, 57.37-66.44, 74-94% (for DPPH[•]) and 6-12%, 9.2-39.26%, 17.37-43.37%, 18.3-76% (for ORAC), respectively. The antioxidant activity is decreased by the cooking treatment; however, the sum of products processing (grain processed and cooking water) is greater than the raw ayocote beans, regardless of the variety. The present findings encouraged consumption of ayocote beans together with cooking water for the maximum potential health benefit.

Keywords: Antioxidant activity ayocote beans, cooking methods, total phenolic content

Application of Chemical Elicitors on Nutraceutical and Antinutritional Compounds of Common Bean Sprouts and their Effect on Dyslipidemia Control

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Cardiovascular disease (CVD) is the leading cause of death in the world. The multifactorial process of CVD, includes dyslipidemia, characterized by abnormal lipoprotein serum levels. It has demonstrated that common bean (*Phaseolus vulgaris* L.) produces benefits effect on lipids metabolism. In addition, seed germination process generates changes that increases their nutritional value, reduces antinutritional components and could increase bioactive compounds. Additionally, the application of chemical elicitors to seeds, can improve its agronomic characteristics and phyto-chemical composition. Therefore germination and elicitation of the common bean could produce a foodstuff with greater benefit in dyslipidemia. Therefore, the objective was to increase the nutritional and nutraceutical quality of bean sprouts by applying chitosan (0.7, 3.3 and 7 μ M), salicylic acid (0.1, 1 and 2 mM) and hydrogen peroxide (10, 20 and 30 mM) as chemical elicitors and to evaluate their effect on dyslipidemia. Optimal conditions for germination of Flor de Junio Dalia (FJ Dalia) bean were 25 °C and 78% RH, at fourth day. It was evaluated the effect of chemical elicitors on germination parameters, antinutritional components and bioactive compounds of FJ Dalia, and the results showed that highest concentrations of each elicitor (AS 2 mM, Q 7 μ M and H₂O₂ 30 mM) improved germination percentage and radicle length of the sprouts, likewise, reduced antinutritional compounds like lectins, trypsin inhibitors and phytic acid and increased phenolic compounds. Afterward, using UPLC-ESI-MS/MS coumaric, salicylic, gallic and caffeic acids, as well as, gallate, rutin and quercetin flavonoids were identified as the major components in AS treatments. Q 7 μ M, 30 mM H₂O₂, and AS, 2 and 1 mM were the best treatments and these were evaluate in rats fed with high fat and high fructose diet and supplemented with 10% sprouts. Results showed that the treatments of Q 7 μ M, and, AS, 2 and 1 mM, had similar gain weight than healthy group. However consumption of sprout control and treated with 30 mM H₂O₂, have lowest weight gain, even than the healthy group. Sprouts significantly decreased triglyceride, and LDL levels, and maintains high HDL cholesterol levels. However, these effects were not improved as a result of chemical elicitation.

Keywords: Elicitation, common bean, dyslipidemia,

Infusions of elicited peppermint (*Mentha piperita*) ameliorate obesity and their complications

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Obesity is related to the elevated consumption of hypercaloric drinks. Therefore, one alternative for the control obesity is low-caloric beverages, such as herbal infusions, which provide bioactive compounds. *Mentha Piperita* (peppermint) infusion is an herbal preparation with health benefits. These effects have been associated to its phytochemical content, mainly phenolic acids and flavonoids, which can be enhanced by elicitation during growth. Therefore, the aim of this study was to evaluate the effect of elicited peppermint infusions on obesity and their complications. Plants of *Mentha piperita* were grown in a greenhouse at 25 °C and 80% RH in pots. Foliar application of chitosan (2 µM) and salicylic acid (1 mM) was made 45 days after planting. At 14 days of elicitor application, the growth response was determined by measuring the length of the leaf from the base to the apex (longitudinal growth) and at the broadest part (transverse growth). Sixty days after planting, midlife leaves were collected from each experimental unit and dried at 45 °C for 24 h, and milled (0.7– 1.0 mm). Infusions were prepared by adding 1 g of ground to 100 mL of boiled water, standing for 10 min, and then infusions were filtered. Phenolic compounds, flavonoids, alkaloids and phytosterols were identified using a Waters UPLC-ESI-MS/MS system, as well as, antioxidant capacity was determined in the infusions. Additionally, the consumption of the infusions was evaluated in prevention of obesity using rats fed with a high fat and high fructose diet. The chitosan and salicylic applications did no produce significant changes in growth parameters as compared to control plants. However, both elicitors increased clorogenic acid, hesperidin and rosmarinic acids, β-campesterol and Δ-7 stigmasterol, as well as, vinblastine, trigonelline and nicotinic acid. Both elicitors improved antioxidant capacities (ABTS and DPPH assays). The consumption of the peppermint infusions decreased significantly the body weight gain, adipocytes size, serum triglycerides and glucose concentration and steatosis, being the most important effect for peppermint with chitosan treatment. Therefore, the application of chitosan during peppermint cultivation could be used for the improvement of antiobesogenic properties of peppermint infusions.

Keywords: Peppermint, elicitor, salicylic acid, chitosan, and obesity.

Substitution of pectin by puree of apple or chia for the preparation of Ate

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Ate is a sweet prepared from guava. It is the result of the concentration of the pulp of the fruit with sugar. Consistency, texture, viscosity and characteristic to achieve a very high percentage of sugar flavor is achieved pectin to gel mainly used. México is the main manufacturing center. However, exist another components like Chia seeds (*Salvia hispanica* L.) that contain 5-6% of mucilage that can be used as soluble dietary fiber, increasing the viscosity of the chyme, slowing the stomach emptying and increasing the feeling of satiety. For this reason, it was proposed to develop a product that is achieved replace the pectin and add another type of fiber but without losing the same properties of the product. In order to maintain product properties pH was determined according to the NOM-130-SSA1-1995. The rheological properties were determined using a TA.XPLUS Texture Analyzer in the compression mode (pre-test speed 5 mm/s; test speed 1 mm/s; post-test speed 5 mm/s; distance 10 mm and trigger force 0.04903 N). L*, a*, b*, Hue (H) and Croma (C) was evaluated with a colorimeter, the yield of product was evaluated with a general balance of matter and finally, a sensorial evaluation was made using 20 untrained judges. All analyzes were performed in triplicate. a completely randomized design with three replications and a comparison of means by Tukey ($p < 0.05$). There are no significant differences in pH (3.43, 3.49 and 3.46), H (68.325, 72.05 and 68.97), compression (168.77, 169.81 and 166.38 N) and yield -35.59, 42.37 and 37.16 of evaporated water- (general balance of matter) to control, puree and chia, respectively. Only in adhesion and puncture were found significant differences, but in sensory evaluation, judges prefer the product with Chia. The use of Chia is a viable alternative to the manufacture of Ate. It lies within the normative, provide additional fiber and improve the acceptance of the product.

Keywords: Chia, Rheology, NOM, puree of apple, Ate.

Evaluation of digestibility of gluten-free bars making with cereal and unripe plantain flours

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In Mexico sociocultural aspects and eating fast food have led to overweight and obesity. It is a public health problema. The demand for healthy products has increased, including gluten free products. In this work a gluten free cereal bars was developed with unripe plantain, amaranth and corn flours. The ingredients were mixed and the dough was laminated and cut into rectangles, which was subsequently baked at 170 ° C for 25 min, the product was cooled and stored. The bar moisture, protein, lipids and ash content were determined according to the official methods of the AACC. The dietary fiber was determined by official method (985.29 AOAC). The total starch and resistant starch content were analyzed. Available starch was calculated as the difference between the total starch and resistant starch. Texture analysis was performed. Sensory evaluation was performed using a hedonic scale. The results of the analysis were compared with commercial bars of wheat, oats, barley, rye, sunflower and linseed. Protein content, ash, dietary fiber and resistant starch on the gluten free bar were higher than comercial bars; on the other hand, the lipid content was lower. The total starch content was similar in both bars; however, resistant starch content was significant difference. In the sensory evaluation the two products were accepted by the judges. The dietary fiber, protein and resistant starch content in gluten free bars, it can be recommended as a funtional food, might be replacing those high energy bars and it can be an option for gluten free products.

Keywords: cereal bars; gluten free; dietary fiber.

Antioxidant and anti-inflammatory activities of amaranth protein-pullulan (90:10) nanofibers loaded with EGCG in LPS-stimulated macrophages

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Bioactive plant compounds such as epigallocatechin gallate (EGCG), the major polyphenol in green tea, have been evaluated for various beneficial effects, including anti-inflammatory and antioxidant properties. However, due to its low bioavailability ($\approx 0.1\%$), EGCG was previously encapsulated in amaranth protein and pullulan (90:10) nanofibers (NF) by electrospinning. Therefore, the aim of this study was to demonstrate if the anti-inflammatory and antioxidant activities of EGCG loaded onto amaranth-pullulan nanofibers (NF-EGCG) were enhanced in mouse RAW 264.7 macrophages. First, the results demonstrate that NF-EGCG and free NF inhibited the growth of RAW264.7 cells in a dose-dependent manner, showing a cytotoxic effect at doses from 25 to 50 μM and 10-50 μM , respectively, compared to the dose of EGCG (50 μM). On the other hand, both EGCG and free NF significantly inhibited nitric oxide (NO) production (as measured by nitrite levels) up to 31 and 43.2%, respectively, in LPS-stimulated macrophages; however, the anti-inflammatory activity of NF-EGCG was only slightly improved (up to 38.5%); moreover, neither NF-EGCG or free nanofiber (NF) significantly induced nitric oxide (NO) levels in nonstimulated macrophages. We also observed that EGCG at doses of 10 and 25 μM reduced LPS-induced reactive oxygen species (ROS) generation in macrophages. Similar effects were observed with NF-EGCG at the same concentrations, whereas free NF failed to reduce ROS generation at any concentration. Furthermore, the amaranth-pullulan NF nearly maintained the antioxidant activity of EGCG, assessed by the induction of the intracellular levels of glutathione (GSH), in both no- and LPS-stimulated macrophages, measuring lower levels of GSH in LPS-stimulated macrophages probably attributed to its utilization in the neutralization of the oxidative/nitrosative stress induced by LPS treatment. On the other hand, the activity of the NADP(H):quinone oxidoreductase (NQO1) enzyme was only induced in LPS-stimulated macrophages treated with 25 μM EGCG, whereas no induction of NQO1 activity was observed with NF-EGCG at the same concentration. Neither NQO1 activity nor GSH levels were induced with free NF. In summary, the results indicated that the amaranth protein-pullulan (90:10) nanofibers only maintained, but not enhanced, some of the anti-inflammatory and antioxidant activities of EGCG in immunostimulated RAW 264.7 macrophages.

Keywords: epigallocatechin gallate, nanofibers, amaranth protein, nitric oxide, reactive oxygen species, glutathione, quinone oxidoreductase

Correlation between moderate consumption of Lambrusco red wine and the increment in antioxidant activity in blood plasma

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Antioxidant capacity of red wine is directly related with its polyphenol content. Diverse epidemiological studies relates the regular and moderate consumption of red wine with lower incidence of morbidity and mortality due to cardiovascular diseases in Mediterranean countries. Also, red wine has a demonstrated to neutralize free radicals in the organism, by means of liberation of electrons in the bloodstream, acting on the oxidative reactions of degradation. The aim of this study was to evaluate the antioxidant capacity in the blood plasma, after a moderate ingestion of Lambrusco red wine, using the DPPH method. This study was done in 17 students (male and female) of the School of Chemical Sciences, Region Orizaba-Córdoba, with the following inclusion criteria: healthy students with no consumption of prescription medicine or alcohol ingestion for at least two weeks, and were divided in two groups (control and study group). Blood samples from the control group were taken after a fast of 8 and 10 hours, and for the study group, samples were taken after an 8 hours fast and two hours after a moderate ingestion of red wine. The determination of the antioxidant capacity in plasma was done by the DPPH method, and the percentage of inhibition was calculated from the absorbance lectures at λ of 515 nm. Results showed that the study group (with a moderate consumption of red wine) had an increase in the antioxidant capacity of blood plasma (mean=22.38%) as compared with the control group (mean=14.52%); with this result it can be considered red wine as a food with high antioxidant capacity, and that its inclusion in the everyday diet could help to fulfill the dairy requirements of antioxidants needed by our organism.

Keywords: Lambrusco, DPPH, antioxidant

Microencapsulation and characterization of bioactive compounds of *Cnidoscolus chayamansa*

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In recent years the interest of medicinal plants has taken more importance. *Cnidoscolus chayamansa* coming from the Peninsula of Yucatan and Guatemala have special nutritional value and is considered of great potential for its easy cultivation and productive potential. In the Huasteca Potosina it is mainly used in infusions to treat constipation, circulation problems and as a diuretic, among others medicinal uses, related with presence the polyphenols and its antioxidant capacity. However, these compounds are readily degraded by factors such as light or air, which is why the technique of microencapsulation is an alternative for their preservation, helping to extend the useful life of these compounds. The objective of this research was the characterization of bioactive compounds of *C. chayamansa* and their microencapsulation. An infusion was prepared with 5% of leaves from *C. chayamansa* in water and held at 90 ° C for 5 minutes, subsequently microencapsulation with a spray dryer were conducted a two different conditions, the first one with a mixture of maltodextrin 5% and the second one with senegal arabic gum at 5%; physico-chemical determinations (% of humidity, water activity, color) and antioxidant activity (% inhibition, total phenols, ABTS, ORP) were carried out. The treatment with maltodextrin at 5% was the one that showed the greatest amount of total phenols 3225.3 MEAG / L, while infusing with senegal arabic gum presented 2925.3 MEAG / L, the inhibition percentage of free radicals measured as antioxidant activity was higher for infusion treatment with maltodextrin 5% (72%) compared to senegal arabic gum (65%). The fresh extract *Cnidoscolus chayamansa*, presented an inhibition to the DPPH radical of 54% and total phenol content of 1694.6 MEAG / L. Eventhough the mixture of infusion with maltodextrin showed higher antioxidant activity and better total phenol content, it will be necessary to monitor both mixtures to verify the stability of them and determine the best encapsulant for *C. chayamansa* bioactive compounds.

Keywords: *Cnidoscolus chayamansa*, microencapsulación, fenoles totales.

Microencapsulation of Active Compounds of the shell *Cucumis sativus*

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Cucumis sativus is a vegetable that is grown almost everywhere in the world. Mexico ranks eighth in the world production with 640,051.00 tons for year. This crop is an important source of antioxidants for their content of vitamin C, beta carotene and flavonoids, mainly present in your peel, containing most of the nutritional value. The objective of this work was to recover bioactive compounds of cucumber peels to conserve your functionality by microencapsulation (Spray drying) and evaluating their possible food application. To do this, infusion *C. sativus* peel in purified water was used. Subsequently four runs were carried out in a spray dryer. Seyal encapsulating material as arabic and acacia senegal gum at 5% was used and 10 % each. To determine the stability of the microcapsules obtained once, the physicochemical tests were performed (% Humidity, water activity, color) and antioxidants (% inhibition, total phenols, ABTS, ORP). The results for the fresh samples were a 90.63 % moisture, pH 6.7, and 0.959 Aw, the total phenol content was 28.69 EAG mg/L, and presented a % inhibition of free radicals 30%. As to microencapsulated samples obtained from the infusion with 10% of senegal gum arabic obtained 9.2% moisture , water activity of 0.253 and total phenol content was 177.92 EAG mg/L; seyal microencapsulated gum arabic samples showed a higher moisture % (9.5%) containing 0.293 Aw. The higher total polyphenol content was presented by the microcapsules obtained from the infusion with 5% gum arabic seyal with 390 EAG mg/L. Microcapsules shell *Cucumis sativus* with significant amounts of polyphenols and antioxidants, which help reduce oxidative stress in humans, so that a food based microcapsule shell *Cucumis sativus* could be considered as a potential source bioactive compounds of therapeutic applications.

Keywords: *Cucumis sativus*, spray dryer, encapsulant material, stability, additive

Protective Effect Anthocyanins blue Corn tortilla Mixteco Race on Stability Genomics.

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The aim of the study was to evaluate protective effect of anthocyanins tortilla (as food and extract) blue corn Mixtec race (MzAM) on genomic instability by erythrocyte micronucleus test in peripheral blood of mice. This breed of corn contains higher content of polyphenols and anthocyanins than other breeds of corn and therefore higher antioxidant activity. Six groups of Balb / C mice were formed adults; Group1 / negative control (saline); Group 2 / Positive Control (cyclophosphamide [CF] 5 mg / kg body weight); Group 3 / Experimental 1 (CF 5 mg / kg) + 20 ul of extract tortilla MzAM); Group 4 / negative control group 5 / Experimental 2 (0.06g of MzAM) Group 6 / Experimental 3 (0.6g MzAM). Groups 1-3 were administered orally by oropharyngeal cannula in groups 4 to 6 was ad libitum. Of the tip of the mouse tail samples peripheral before blood was collected and after treatment for 6 to 9 days every 24 h, smears were performed, were fixed and stained with acridine orange (specific staining for nucleic acids) and EN10, 000 total erythrocytes the frequencies of micronucleated erythrocytes (MNE) was analyzed; micronucleated polychromatic erythrocytes (EPCMN) and the ratio of polychromatic erythrocyte (EPC) by fluorescence microscopy. Analysis of Variance and Kruskal Wallis test was performed whit significance value 0.05. In the negative controls (1 and 4) group similarities in the frequency of MND, and EPC EPCMN along the sampling found. Group 2 had higher frequency of MND (micronucleogénic damage) and decreased EPCMN (cytotoxicity); while groups 3, 5 and 6 showed a significant decrease of MND ($P < 0.05$). These results suggest that the extract MzAM tortilla is protective of genomic instability as it decreased the frequency of MNEs in animals treated with CF and tortilla as food, also decreases the frequency of MND.

Keywords: Anthocyanins, blue Corn tortilla-Mixteco, Genomics.

Content analysis of functional compounds 20 Brazilian fruits presents in México.

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Curiosity for the exotic has enabled the world to learn more about the existence of very private tropical fruits, not only for its pleasant taste but because it has been identified as an important food source functional compounds. In México, we have the possibility to grow some tropical fruits in our territory. It is important the introduction of tropical fruits from other countries because it gives us the opportunity to analyze them to know all or certain characteristics of them and thus know the advantages that we can offer. Fruits that are to be subject to analysis are listed below: Camu-Camu, Manga Tommy, Puça-Preto, Acerola, Bacuri, Cajá, Caju, Jambolao, Goiaba Paluma, Mangaba, Umbu, Jaboticaba, Murita, Noni Polpa, Puça-Coroa-de-Frade, Uvaia, Açaí, Carnauba, Jucara, and Pupunha Acre. The objective was to analyze the content of functional compounds Brazilian tropical fruits present in México. Quantification of total polyphenols by the method of Folin-Ciocalteu and vitamin C, method TEAC, method ORAC, method DPPH and method FRAP. The results were submitted to analysis of variance and mean comparison by LSD method ($p < 0.05$). Hence other phytochemicals, mainly polyphenols, would be responsible of the remaining antioxidant activity. Total polyphenols ranged from 6430 to 7510 mg/kg of pulp, explaining the antioxidant activity. Antioxidant activity of the different phenolic families can be estimated by the percentage of contribution of vitamin C and the sum of phenolic fractions to the total antioxidant activity. The fruits present high in vitro antioxidant activity, demonstrated with ABTS, DPPH and ORAC methods. Attempts were made to correlate the single concentrations of the major phenolic compounds identified in the samples with the antioxidant activities observed, but poor correlations were found. The contribution of ascorbic acid to the hydrophilic antioxidant activity ranges between 40% and 83%, the remaining due to polyphenols, mainly phenolic acids. These results therefore indicate that fruits are potent antioxidant foods and might have potential value as functional food ingredients. The results showed an increase antioxidant capacity being ripe fruits which had the highest antioxidant capacity.

Key words: antioxidant capacity, Brazilian fruits, TEAC, ORAC, DPPH, FRAP

Determination of Phenolic Compounds Obtained from the Fermentation of the Juice of Aloe Vera and Lactic Acid Bacteria.

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Aloe vera (AV) has broad applications in the food pharmaceutical and cosmetics industries, due to its therapeutic, functional and antioxidant properties; that is considered the biological activity responsible for the preventive effect on some cardiac and immune diseases, it has 75 potential active ingredients which include phenolic compounds: They are classified into two groups: Chromones as the aloesina and anthraquinones as the barbaloin. The objective of this study was to determine the total phenols from the fermented juice of the AV by lactic acid bacteria. Juice fermentation was conducted by inoculating 1×10^6 UFC of lactic acid bacteria in 50 mL AV for 120 h at 37° C in anaerobic conditions, subsequently centrifuge to separate biomass from the supernatant. We evaluated the presence of total phenolic compounds using the colorimetric technique of Folin-Ciocalteu adapted to microplate, to fermented juice, juice not fermented and the fractions by TLC. Phenolic compounds of the fractions were determined. The content of total phenolic compounds (PT) for JF, JFBD, JFBD2 was; 11.47 mg GAE / g, 18.92 mg GAE / g, JFBD2 103.89 mg GAE / g, respectively. It look there is statistically significant difference between treatments and that the content of these compounds increases after fermentation. Of the 7 fractions obtained by TLC, the JFD2 fraction showed higher amount of PT. AV has great antioxidant phenolic compounds; in the form of anthraquinones and Chromones which are bioactive compounds that are used as antibiotics and antiinflamatorios. AV is an alternative for use in various pathologies, since it contains phenolic compounds with high antioxidant value, acts to repairing the skin for a better conduction of active principles phenolic compounds extracted from the fermented AV can be used in drinks to aportarian health benefits.

Keywords: phenolics compounds, *Aloe vera*, lactic acid bacteria

Quantification and characterization of compounds phenolics, during digestion *in vitro* of a sweet made with mango (*Mangifera Indica L.*) bagasse

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The pulping mango (*Mangifera indica L.*) process generates 55% (w/w) in waste (seed, husk and bagasse). Mango bagasse (MB) has a high content of dietary fiber and phenolic compounds (PC), which could be used as an important source of antioxidants. The aim of this study was to evaluate the bioavailability of PC, during *in vitro* digestion (DNI), using as a model system a sweet made with mango bagasse (SMB). It was measured and characterized the PC content (total phenols (TP), tannins (TA) and flavonoids (FLA)) and antioxidant capacity (AC) by DPPH and ABTS methods, before and during DNI of MB and SMB. Results showed that MB has a higher content of TF and a higher antioxidant capacity compared with SMB with majority of Gallic Acid. FLA content and TA was higher for the SMB compared with MB where mangiferin it was found as majority. During the DIN, half of the FT were absorbed 15 min and 60 min after undergoing a DIN for MB and SMB; 17% of the FLA was quantificated in the digestible fraction after 15 min of MB digestion. Apparent permeability coefficient for FT was 50% higher in SMB than MB. So it can be concluded that the SMB is a good choice as a nutraceutical food.

Keywords: Mango, phenolic compound, antioxidant capacity.

Antihypertensive Activity *in vivo* of Phenolic Compounds Extracted from a Healthy Expanded Extruded Snack Elaborated with Quality Protein Maize and Black Common Bean

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Hypertension is defined as a sustained elevation of arterial blood pressure, which is associated with an increased risk of cardiovascular disease. It is one of the most frequent chronic conditions in developed countries, and its incidence is only increasing. An estimated 20% of the adult population suffers hypertension. Some reports claim that inclusion of whole grains in the daily diet has many beneficial physiological effects in the control and prevention of chronic-degenerative diseases, like hypertension. Therefore, the objective of this study was to determine the antihypertensive activity *in vivo* of phenolic compounds extracted (PCE) from a healthy expanded extruded snack with high nutritional and nutraceutical value from a mixture 70% of quality protein maize + 30% black common bean, this snack was made by extrusion technology at an extrusion temperature of 137 °C and a screw speed of 233 rpm in a single screw extruder (optimized conditions). The effect of PCE (Free and Bound) on blood pressure was investigated in spontaneously hypertensive rats (SHR). Because a preliminary oral treatment with PCE (50, 150, 250 and 500 mg/kg) the dose used was 250 mg/kg. The male SHR were kept at 23 °C with a 12-h light–dark cycle and had free access to a standard mouse/rat chow and water, SHR were randomly divided into six groups: control (1.5 mL distilled water, unprocessed sample (Free and Bound PCE), processed sample (Free and Bound PCE) and Captopril (10 mg/kg of SHR). Measurements of the systolic blood pressure (SBP) were recorded before and after the treatment of test samples at 0, 1.5, 3, 4.5 and 6 h by a tail-cuff blood pressure system. In this work, it was found that, free and bound extracts from the unprocessed sample showed a significant (Student's test, $p \leq 0.05$) decrease in SBP on SHR (-20.25 mmHg and -32.14 mmHg, respectively) at 6 h after administration. On the other hand, free and bound extracts from the processed sample showed a significant (Student's test, $p \leq 0.05$) decrease in SBP on SHR (-17.47 mmHg and -26.35 mmHg, respectively) at 6 h and 4.5 h after administration respectively.

Keywords: Antihypertensive Activity, Phenolic Compounds, Extruded Snack, Quality Protein Maize, Black Common Bean

Development and Evaluation of a Xoconostle (*Opuntia Matudae*) Pulp Frozen Yogurt with Potential Functionality

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Xoconostle is an underused endemic fruit in Mexico which is characterized by its high nutraceutical value due to the concentration of soluble fiber in its composition where dominates mucilage. The fruits diversification is very limited and mainly includes products that use thermal processes for preservation as in sauces and jams, because of this, the soluble fiber that provides the functional character to food gets degraded. The aim is to develop and evaluate a frozen yogurt and xoconostle pulp to make use of complex carbohydrates and natural pigments of the fruit to increase the diversification of consumption of this product. The ice cream was prepared with non-fat yogurt, xoconostle pulp, a mixture of sucrose as sweeteners and stevioside and xanthan gum as a stabilizer. The mixture was subjected to aeration process and frozen at -0.4° F. The result was submitted to a proximal analysis in which the moisture content, fat, protein and pH were determined, based on the current Mexican regulations, plus a sensory evaluation to 50 untrained panelists, which consisted of two analysis where the sensory profile of the ice cream was characterized and in turn was measured the product approval by a hedonic scale of 5 points where 1 is “dislike” and 5 being “Love it”. As a result the ice cream got an approval of 3.77 90% points where the texture was the most pleasing attribute among the panelists with a result of 4.02 points. Physico-chemical analysis showed a content of 5.74% protein, lipid content of 0.65%, sugars 12.9% moisture 76.46% and a pH of 4.4. Freezing as a conservation method allows us to preserve the xoconostle nutraceuticals and diversify their consumption as food pleasure, promoting health and pleasure among their consumers.

Keywords: Frozen yogurt, xoconostle, functional food.

Development and Evaluation of a Frozen Requeson Cheese Dessert with Potential Functionality

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The requesón cheese, is a common Mexican cheese, obtained by the acid coagulation whey; it is very rich in milk albumins, 100% digestible protein, provides essential aminoacids such as L-cysteine, L-glutamate and glycine, which promote glutathione synthesis. Cinnamon is a very delicious and popular spice, modern science has now confirmed its medicinal properties. Honey has been used as both a food and a medicine. It is considered that ice cream and dairy desserts are foods provide a lot of calories in relation to the quality of nutrients that provide. Freezing is an excellent process to conserve nutrients, so a frozen dessert is a very good alternative to preserve highly digestible protein. Thus the objective of this work was to develop and evaluate a frozen dessert cheese with a good intake protein whit high digestibility. Two formulations were developed (F1 and F2) using different quantities of ingredients (requeson cheese, cinnamon and honey). The physicochemical analyzes performed were: moisture, fat, protein, and protein digestibility. The sensorial analysis evaluated consumer acceptance, using a 5 points hedonic scale (1= dislike extremely and 5=like extremely), it carried out with 100 untrained judges. Results were analyzed statistically by using comparison of means ($p < 0.05$). The following physicochemical analysis showed difference in the moisture, proteín and fat content between formulations (Moisture: F1: 51.06% and F2: 57.43%; Protein F1: 9.36% and F2: 9.05%; Fat F1: 7.75 % and F2: 13.5), highly digestible proteintein (99.9%) showed both formulations, (no significant difference). Color was the best evaluated attribute in both formulations F1 and F2 (acceptance of a 4=like and 3=indifferent, respectively). Acceptance of F1 is distributed: 48% in the range like-like extremly (values 4 and 5), 32% indifferent (value of 3) and 20% in dislike-disllike extremly (values between 2 and 1); on the other hand, acceptance of F2 is distributed: 21% in the range like-like extremly (values 4 and 5), 45% indifferent (value of 3) and 34% in dislike-disllike extremly (values between 2 and 1). The acceptance level was different between the two formulations, having a preference for F1 and had the highest protein content and lower fat content.

Keywords: Frozen Dessert, Requeson Cheese

Morphological Variability and Physical Chemistry Wild Blackberries (*Rubus* Subgenus *Eubatus*) in Areas Surrounding a Uruapan, Michoacán

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Rubus is one of the genres most complex plants to taxonomic level due, among other factors, the diversity in levels of polyploidy, the presence of apomixis and hybridization between species, which creates some confusion of boundaries between one species and other. Moreover, there is great diversity among species in the content of bioactive compounds, an aspect which can be used, among other factors, for genetic improvement. In the present work it had as main objective to make a morphologic and physicochemical characterization of the main wild blackberries located in areas near Uruapan, Michoacán. For this purpose, materials were collected at nine different sites, which were propagated in the greenhouse. Of these materials, it became a morphological description using as reference descriptones of the International Union for the Protection of New Varieties of Plants (UPOV); both qualitative and quantitative variables were evaluated; morphological variability was determined by a principal component analysis. In physicochemical analysis parameters were quantified as phenol content, total soluble solids and titratable acidity, among others. From the results, it was observed that the first seven components explained 80% of the total variability, of which 23.55%, 22.36% and 10.81% was for the first, second and third factor, respectively. *Rubus glaucus*, *R. humistratus*, *R. coriifolius*, *R. sapidus* and *R. adenotrichos*: five different species were identified. Likewise, *R. cymusus* and *R. adenotrichos* showed variability among themselves in the different collection sites. With regard to physicochemical analysis, significant differences in the content of phenols is found; in this respect, *R. coriifolius* showed the highest content of gallic acid (24.64 ± 2.6 mg); this species also had the highest amount of total soluble solids (13.6 ° Brix). It is concluded that there is wide variability both morphological characters physiochemical between different species assessed; this can provide support to strengthen breeding program.

Keywords: variability , polyploidy , descriptors

Development and Evaluation Chemical and Microbiological Rice Crackers from Enriched with Beans

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Gluten is a component of foods found in some cereals such as wheat, rye; consists of 80% proteins (gliadin and glutenin), and the remaining 20% is made up of lipids, residual starch, carbohydrates and water-insoluble proteins in the dough are entrapadas. However, a certain percentage of the population suffers from chronic intestinal autoimmune disorder with a strong genetic component, whose symptoms resulting from the ingestion of gluten, these are known as celiac disease. Therefore new gluten-free foods, one of the most used for these purposes cereal is rice are evaluated; however, due to lack or cereals are low in some essential amino acids, the WHO recommends combining cereals and legumes to complete the intake of the eight essential amino acids. The aim of this work was to develop a biscuit made of rice flour (R) and beans (H). Two mixtures were made of flour, of proportions of R and H of 80%-20% (TX1) and 60%-40% (TX2) were performed respectively. The cookies were subjected to chemical analysis to evaluate the nutritional content and microbiological analysis. An analysis variance was performed with the program InfoStat v2015 to establish a Least Significant Difference (LSD) ($P \leq 0.05$) between the treatments. The higher moisture content is presented in TX1 of 11.14 and 7.55 for TX2; on the contrary in the TX2; as much ash found a 2.39 compared to 1.49 in the TX1. The fat content was between 17.65 in TX1 and 9.74 in TX2. For fibre between 14.01 in TX1 and 15.38 in TX2; of protein values were obtained 14.93 and 14.87 for TX1 y TX2 respectively. Finally the carbohydrate content was 40.94 for TX1 and 50.13 in TX2. There was no presence of aerobic mesophilic, coliforms and fungi, indicating good handling in the preparation of cookies. In this paper the formulation of crackers rice flour and beans, without adding wheat was obtained. The introduction of rice as a replacement of wheat flour can be performed smoothly within the food industry, in addition to the nutritional benefits it can be consumed by celiac population. This cookie is an alternative easily accessible and given its nutritional content, is a healthy alternative for the entire population.

Keywords: gluten free, celiac disease, nutritional content

Carotenoid Profile of Different Tissues of Two Spanish Prickly Pear (*Opuntia ficus-indica* spp.) Cultivars

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Carotenoids are extensively distributed phytochemicals among fruits with a high nutritional value since they contribute to their appearance and attractiveness and can act as dietary antioxidants. The carotenoid profiles of two Spanish red and yellow prickly pear (*Opuntia ficus-indica* spp.) cultivars were determined with high-performance liquid chromatography-diode array detection (HPLC-DAD), using a reverse phase C30 column. The identification of these compounds was done by comparison with the UV/Vis and mass spectrometric characteristics as well as the retention times of commercial standards. Extracts of peel, pulp and whole fruit of each cultivar were saponified with methanolic potassium hydroxide in order to compare and analyze the free carotenoid species and other carotenoid species present as xanthophyll esters. The total carotenoid contents for the red and yellow *Opuntia* varieties were 430 and 410 µg/100 g fresh fruit, respectively. The prickly pear peel showed much higher values of total carotenoids such as 1,550 and 1,330 µg/100 g fresh peel for the red and yellow variety, respectively. The predominant carotenoid was lutein and was found in high quantities in the peel of the fruit, mainly as a free carotenoid in the red variety and partially as a xanthophyll ester in the yellow variety. The main carotenoids found were neoxanthin, violaxanthin, lutein, zeaxanthin, β-carotene and lycopene. The pulp from the yellow variety presented a higher carotenoid content and more complex profile than the red variety's pulp and lycopene was only found in the red variety. This is the first time, to our knowledge, that the complete carotenoid profile and quantification in prickly pear fruit tissues (peel, pulp and whole fruit) has been reported.

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Keywords: *Opuntia*, carotenoids, xanthophyll esters, lutein, β-carotene)

Bioactive Constituents of Spanish Prickly Pear (*Opuntia ficus-indica* spp.) Cultivars and their Correlations with the Antioxidant Activity of Different Tissues

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Vitamin C, phenolic compounds (flavonoids), betalain and carotenoid contents of two Spanish red and yellow skinned prickly pear (*Opuntia ficus-indica* spp.) cultivars were determined. Their bioactive constituents present in peel, pulp and whole fruit were investigated and related to each tissue's antioxidant potential assessed by 2,2-diphenyl-1-picrylhydrazyl radical assay (DPPH) and the oxygen radical absorbance capacity assay (ORAC). The concentration of total phenolic compounds was 482 and 493 mg of gallic acid equivalents/100 g of fresh fruit for the red and yellow variety, respectively. The highest concentration of phenolic compounds was observed in the peel. The red variety showed a higher betalain content (3.57 mg equivalents of betanin/ 100 g of fresh fruit and 3.04 mg equivalents of indicaxantin/ 100 g of fresh fruit). Regarding the carotenoids, lutein was the dominant carotenoid present in both varieties followed by β -carotene. The peel showed the highest antioxidant activity (DPPH) with no statistical differences between varieties, meanwhile the peel of the red variety showed the highest antioxidant activity (ORAC). The DPPH assay values presented a high correlation with total phenolic compounds and carotenoids, while the ORAC assay values showed the highest correlation with vitamin C content. The bioactive constituents present in prickly pear varieties are mainly responsible for the antioxidant capacity of their tissues, therefore their study and quantification is fundamental for the development of functional ingredients with a potential bioactivity.

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Keywords: *Opuntia*, bioactive compounds, antioxidant activity, ORAC assay, DPPH assay

Bioaccessibility of Bioactive Constituents in Two Spanish Prickly Pear (*Opuntia ficus-indica* spp.) Cultivars and in Prickly Pear Based Beverages

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Prickly pear fruit as a health-promoting ingredient could represent an opportunity to increase the functionality of food products since they are a rich source of phytochemical compounds such as betalains, phenolic compounds, carotenoids and vitamin C which have shown antioxidant, anti-atherosclerotic and hepatoprotective properties. Before becoming bioaccessible, these constituents must first be released from the food matrix and modified in the gastrointestinal tract. In this study, the bioactive constituents of Spanish red and yellow skinned prickly pear varieties and demi-skimmed milk and soymilk beverages formulated with prickly pear were evaluated. The betalain and flavonoid profiles in beverages were analyzed and their bioaccessibility was assessed in an *in vitro* simulated oral, gastric and small intestinal digestion which was compared with the digestive stability of the consumption of prickly pear fruit. Beverages formulated with the red *Opuntia* variety showed the highest betalain, total phenolic content and antioxidant activity determined by the oxygen radical absorbance capacity assay (ORAC). The soymilk beverages showed a higher phenolic content due to the presence of soy isoflavones. Betalains, indicaxantin and betanin, were evaluated individually (HPLC method) throughout each stage of *in vitro* digestion. This analysis showed that a greater degradation of betalains took place in the gastric fraction due to the low pH (2.0) in the stomach. Indicaxantin proved to be more resistant to gastric conditions resulted more bioaccessible than betanin. Although the concentration of bioactive constituents after *in vitro* gastrointestinal digestion was significantly lower than in the non-digested product, a significant amount of these bioactives were found to be bioaccessible. This data suggests that the appropriate design of prickly pear based beverages could improve the bioaccessibility of bioactive.

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Keywords: *Opuntia*, *in-vitro* digestion, betalains, flavonoids, functional beverages

Effect of a Simulation Digestive System on the Antioxidant and Protectant Activity of the Proteic Hydrolyzate from *Mucuna pruriens* L.

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Obesity represents one of the main causes of mortality worldwide. In 2012, WHO reported 347 million of diabetic patients in the world, and it is estimated that by 2030 this number will increase to 540 million; one in each ten adults presents obesity, in 2015 there were 2,300 and 700 million people with overweight and obesity respectively. Among the etiologic factors of these diseases, oxidative stress is one of the most important, since the REDOX disequilibrium favors the development of the disease and its chronic complications. The hydrolysate and peptidic fractions of the legume *M. pruriens* L have demonstrated important biological effects. In this study, the antioxidant and protector potential of the protein hydrolysate of *M. pruriens* was evaluated in a simulation of a digestive system, with gastrointestinal proteases, in order to evaluate its possible role as functional ingredient in the development of food products with therapeutic potential. Seeds of *M. pruriens* were obtained from farmers in the State of Yucatan, Mexico, and were processed to obtain a proteic concentrate; this concentrate was hydrolyzed with pepsin-pancreatin enzymatic mixture for 90 minutes, to obtain the proteic hydrolysate (PH). This was then subjected to a digestive simulation for 5 hours and the antioxidant and protective effects were evaluated *in vivo* using HeLa cell line. The proteic concentrate of *M. pruriens* has 46.03% protein and a degree of hydrolysis of 20.46%±2.09. After the digestive simulation, the PH reduced 2.2 times the generation of EROS, in contrast with the positive control with H₂O₂ (3.2 times related to the negative control), while the 24 h treatment with PH had 1.8 lower generation of EROS than the positive control. Regarding the protector effect, the PH exhibited 80%±9 of cell viability, which was even higher than the protective control (NACT, 70%±2). Therefore, the protein hydrolyzate of *M. pruriens* presented an important antioxidant and protective activity after the treatment of 5 h of enzymatic digestion.

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Preliminary evaluation of antimutagenic properties in *Casimiroa edulis* and *Amaranthus hypochondriacus* leaves

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The use of preservative substances in food industry is a common practice for extending shelf life; however, consumer for being artificial does not accept most of them. The aim of this job was to evaluate the antimutagenic properties of *Casimiroa edulis* and *Amaranthus hypochondriacus* leaves. Methodology consisted on to make grow a wild strain of bread mold in potato dextrose agar containing ethanolic extracts of leaves. The extracts were obtained by ultrasound technic. Other two assays consisted on making bread by adding leaves powder or ethanolic extracts. Methanolic and ethanolic extracts of *Casimiroa edulis*, added to potato dextrose agar inhibited the growth of mold for 30 days. The powder of *Casimiroa edulis* leaves added to bread delayed then growth of mold more time than *Amaranthus hypochondriacus*.

Keywords: Antimutagenic properties, *Casimiroa edulis*, *Amaranthus hypochondriacus*

Antioxidant capacity of *Amaranthus hypochondriacus*, varieties Creole and Amaranteca

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Amaranteca is an improved variety of *Amaranthus hypochondriacus*, it has not been characterized thoroughly. That is why the aim of this job is to determine the antioxidant capacity and to compare it with the antioxidant capacity of a creole variety. Antioxidant capacity was determined by DPPH method, and total phenolic compounds by Folin Ciocalteau method. The functionality of antioxidant compounds, to delay oxidation in food, was tested by adding flour of amaranth grain in a bread formulation. Peroxide index was to measure in bread. Results showed that Amaranteca variety had more antioxidant capacity than creole variety (Tukey test, $p \leq 0.05$). Phenolic compounds do not presented significant difference ($p \leq 0.05$). Bread enriched with 10% of amaranth flour, Amaranteca variety, does not presented peroxide index during 15 days, different to bread control which presented peroxides at 5 days.

Keywords: Antioxidant capacity, *Amaranthus hypochondriacus*,

Effect of Traditional Nixtamalization on Anthocyanin Content and Profile and Antioxidant Capacity in Mexican Blue Maize (*Zea mays* L.) Landraces

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Mexican blue maize (*Zea mays* L.) grains have been poorly evaluated regarding their potential as functional food ingredients. The aims of this research were to identify and quantify anthocyanins and evaluated antioxidant capacity by chemical method ORAC (Radical Absorbance Capacity Oxygen) from fifteen Mexican blue maize accessions of Elotero Sinaloa landrace recollected in the northwestern region of Mexico. Additionally, the effect of traditional nixtamalization processing on these compounds was evaluated. The acyl type anthocyanins, such as cyanidin-3-(6''-succinylglucoside) (Cy-Suc-Glu) and cyanidin-3-(6''-disuccinylglucoside) (Cy-diSuc-Glu) were the most abundant compounds in blue maize, accounting for 52.1% and 15.6% the total anthocyanins, respectively. Other predominant anthocyanins included cyanidin-3-glucoside (Cy-3-Glu), pelargonidin-3-glucoside (Pg-3-Glu), pelargonidin-3-(6''-malonylglucoside) (Pg-Mal-Glu) and cyanidin-3-(6''-malonylglucoside) (Cy-Mal-Glu). The raw blue maize presented a similar anthocyanins profile dominated by cyanidin derivatives on (86.9% on average). Nixtamalization processing increased the relative percentage of glycosylated anthocyanins (Cy-3-Glu, and Pg-3-Glu) and decreased the acylated anthocyanins (Cy-Suc-Glu, and Cy-diSuc-Glu) when were compared to raw kernels. The transformation process of raw grain to tortilla resulted in a retained of total antioxidant capacity by an average of 46.2% over the unprocessed grain. Results obtained indicate that the studied Mexican native blue maize contained anthocyanin patterns predominated by acylated cyanide derivatives and high retention of antioxidant capacity. This information could be useful to select the best pigmented maize for the derivation of food products with nutraceutical potential.

Keywords: Nixtamalization, blue Mexican maize, tortilla

Cellular Antioxidant Activity of Tortillas Produced from Mexican Blue Maize (*Zea mays* L.) by Traditional Nixtamalization

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The measurement of antioxidant activity using biologically relevant assays is important to screen fruits, vegetables, natural products, and dietary supplements for potential health benefits. The cellular antioxidant activity (CAA) assay quantifies antioxidant activity using a cell culture model and was developed to meet the need for a more biologically representative method than the popular chemistry antioxidant capacity measures. The objective of this study was to determine the CAA, total phenolic contents, and oxygen radical absorbance capacity (ORAC) values of Mexican blue maize and tortillas made by traditional nixtamalization. Tortillas by traditional nixtamalization showed retention of total phenolics content and antioxidant capacity of 51% and 62%, respectively compared to raw kernel. CAA values were the highest on raw grain compared to tortillas in both protocols (with PBS and without PBS). The bound phenolics content of raw grain and tortillas showed the highest values of CAA. Increased cereals and their products consumption is an effective strategy to increase antioxidant intake and decrease oxidative stress and may lead to reduced risk of developing chronic diseases, such as cancer and cardiovascular disease.

(Key words: Cellular antioxidant activity, nixtamalization, blue Mexican maize, tortilla)

ACE-inhibiting peptides obtained from fermented milk by *Lactococcus lactis* strains – Stability to simulated gastrointestinal digestion.

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It has recently been demonstrated that the proteolytic activity of lactic acid bacteria involved in the fermentation of milk, might contribute to the generation of potentially antihypertensive peptides. The antihypertensive activity of these peptides has been associated mainly to its ability to inhibit angiotensin converting enzyme (ACE), an enzyme that plays a fundamental role in regulating blood pressure. Furthermore, some studies have evaluated the ACE inhibitory activity of peptide under gastrointestinal simulated conditions in order to predict whether they will retain their effect at physiological level. Hence, the aim of this work was to determine the ACE inhibitory activity of aqueous extracts (<3 kDa) obtained from fermented milk with four *Lactococcus lactis* strains after and before exposure to gastrointestinal enzymes in an *in vitro* model. The results showed that the ACE inhibitory activity was significantly ($p < 0.05$) increased while IC_{50} (peptide concentration required to inhibit ACE by 50%) was significantly ($p < 0.05$) decreased as elapsed time of fermentation, being aqueous extracts from strains Q₂ and Q₃, those with IC_{50} values lower than 21 $\mu\text{g/mL}$, even after gastrointestinal simulation process. These results suggest that milks fermented by these two strains could present ACE inhibitory activity at physiological levels and thereby exert an antihypertensive effect in an *in vivo* model.

Keywords: Angiotensin converting enzyme, digestion, antihypertensive, *Lactococcus lactis*.

Optimization for the Aqueous Extraction of Polyphenols from *Cladocolea loniceroides*, using the Method Response Surface (MSR).

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Cladocolea loniceroides (mistletoe), is a parasitic specie it grows in Xochimilco, Mexico city. This specie gets its nutrients from the host, till the dead of the host. In last works it's demonstrated than steems, sheets, and fruits from mistletoe contains a lot of polyphenols of different chemical nature. The objective of this project is establish the optimal conditions to maximize the aqueous extraction from steems, sheets, and fruits from mistletoe. The method used for the optimization was response surface (MSR) $Y = \beta_0 + \sum_{i=1}^k \beta_i x_i + \sum_{i=1}^k \beta_{ii} x_i^2 + \sum_{i=1}^k \sum_{j=1}^k \beta_{ij} x_i x_j + \varepsilon$, with Box Behnken design. To optimize the extraction, were evaluated three factors: extraction temperature (20-100°C), extraction time (15-45min), and the relation between water/sample (5-25 ml/g sample). The determination of the total phenolic content in the extracts was made by the Follin- Ciocaltau reagent, and the antioxidant activity was evaluated by the inhibition of the DPPH* radical (2, 2-diphenyl-1-picrylhydrazyl). The optimal conditions for the extraction of polyphenols was: steam 64°C, 23 min, relation 5:1; leave 20°C, 22 min, relation 5:1; green fruit 54°C, 45 min, relation 5:1; ripe fruit 58°C, 24 min, relation 5:1. The optimal conditions for the antioxidant activity, steam 80°C, 29 min, relation 5:1; leave 61°C, 31 min, relation 5:1; green fruit 60°C, 23 min, relation 5:1, ripe fruit 73°C, 45 min, relation 5:1.

Keywords: optimization, mistletoe, polyphenols.

Improving Functional Properties of Mango by Osmotic Dehydration with Emulsion as Osmotic Agent

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This study assesses the effect of the osmotic dehydration (OD) of mango slices in an emulsion (600 g solids kg⁻¹ emulsion) prepared with inulin and piquin-pepper oleoresin. The influence on water loss (WL) and solids gain (SG) during the OD process was analyzed. Furthermore, oil gain, total free phenolic content, as well as 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity and the antiproliferative effect on breast cancer cell line MDA-MB-231 in mango slices after 120 min, were studied. Samples treated with the emulsion at 40°C showed highest oil gain and bioactive compound retention. In addition, their ethanolic extract exhibited significant radical scavenging activity and antiproliferative effect against the cancer cell line tested, compared with that of flesh sample extracts, in a dose-dependent manner. Images of mango slices treated in emulsion revealed the presence of inulin microcapsules with oil embedded in mango microstructure. Based on these results, this technique can be used to impregnate mango slices with oils and polymers with functional attributes to produce nutritious foods, which may serve as a potential source of phenolic with anticancer activity.

Keywords: Osmotic dehydration, Emulsion, Mango, Functional foods.

Cellular antioxidant activity of tortillas based on yellow maize prepared by Nixtamalization process

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The cellular antioxidant activity (CAA) assay quantifies antioxidant activity in cell culture and was developed to meet the need for a more biologically representative method than the popular chemistry antioxidant capacity measures. Mexican pigmented maize (*Zea mays* L.) landrace grains have been scantily evaluated regarding to their potential as a functional food. In this study, Mexican yellow maize accessions of Tabloncillo landrace collected in the northwestern region of Mexico, were processed into tortilla by traditional nixtamalization process to determinate the total phenolic content, their Oxygen Radical Absorbance Capacity (ORAC), CAA and quality of phenolic compounds in the free and bound fraction of the unprocessed maize and tortillas. The bound fractions of the unprocessed maize and tortillas showed >80% of total phenolics content and 71.6 to 92.8% of the total antioxidant activity assayed as ORAC. Also, the unprocessed maize showed the highest CAA values compared to tortillas elaborated from nixtamalization process (35 and 24 μmol quercetin equivalents QE / 100 g, dw). However, nixtamalized tortillas showed the highest Total Cellular Antioxidant Quality (TCAQ). The nixtamalización process decreased ($p < 0.05$) the total CAA values in tortillas made with yellow maize. However, the process of nixtamalization improved the TCAQ compared with the unprocessed grain. Yellow tortillas elaborated by nixtamalization process could show some potential health benefits associated with consumption.

Keywords: Antioxidant Activity, Cellular Antioxidant Activity Assay, Maize, Nixtamalization, Tortilla.

Stability of the Antioxidant Activity of Aqueous Extracts of *Melissa officinalis* L.

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Lemon balm or Melisa (*Melissa officinalis* L.) is a plant commonly used in traditional medicine. It has been reported in the literature that this plant possesses antimicrobial, antiinflammatory and antioxidant activity, which has been related to their phenolic (cinnamic, chlorogenic, caffeic and rosmarinic acids) and terpenic (geranial, neral and citral) content. For that reason, the objective of this study was to evaluate the antioxidant activity of aqueous extracts of *Melissa officinalis* L. by the technique of radical DPPH * to know its stability over time. Melisa sample was purchased in the supply center from Pachuca, Hidalgo, Mexico. Samples were dried at room temperature and under aeration for a period of 15 days. Melisa infusions were prepared adding 1 g of sample (leaves, stems and leaves with stems) in 100 mL of deionized water at different temperatures (25, 55 and 90°C). Extraction times were 5, 10 and 20 minutes. The antioxidant activity was measured using the method of DPPH radical * at 515 nm. Absorbance was read every 60 minutes for 6 hours until obtaining a constant value or, otherwise, a decrease in the same absorbance. Finally, kinetics of extracts from different parts of Melisa plant were obtained. The results showed that the extraction temperature influenced the release of antioxidant compounds to the aqueous medium. Extracts with higher antioxidant activity (> 3000 mg Trolox / 100g) were obtained at 90 °C. The aqueous extracts from leaves were those with the highest antioxidant activity showing values higher than 4000 mg Trolox/100 g. All aqueous extracts showed stability since their antioxidant activity remained constant during the hours of study.

Keywords: *Melissa officinalis*, Antioxydant activity, DPPH.

Phytochemical screening and antioxidant activity of extracts of flour and coffee
Brosimum alicastrum

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Brosimum alicastrum is a species belonging to the family of Moraceae; the fruit is mainly used in Mexico and Guatemala, as an alternative medicine to counter respiratory conditions, also it has anti-inflammatory property. It is consumed as flour and ground roasted grain, which is similar to coffee sensory characteristics. However, it has not been characterized antioxidant activity under these process conditions; so the objective of this research was to conduct phytochemical screening and evaluating the antioxidant activity of aqueous and methanol extract of flour and roasted grain (EAH and EAGT, EMH and EMGT). Aqueous and methanolic extraction flour and roasted grain fruit of *Brosimum alicastrum* was made, the condition of this process was at room temperature for 3 h. From each extract, phytochemical screening was performed using specific qualitative evidence. The total polyphenol content (CPT) was determined by the Folin-Ciocalteu method, the antioxidant activity by ABTS and DPPH, for these determinations microplate technique was used. A variance analysis of one route ($p \leq 0.05$) for a design was applied completely random and mean comparison tests with Tukey technique ($p \leq 0.05$) was performed. Phytochemical screening by the presence in the EAH, EAGT, EMH and EMGT Flavonoids, sesquiterpenlactones, alkaloids, establishment, phenolic oxidrilos, coumarins, lactones, triterpenes, but no steroids was revealed. Greater CPT was found in the EAH and EAGT, 2.71 ± 0.121 and 3.58 ± 0.309 mg EAG/g m, respectively. The sequestering activity of the extracts by DPPH method ranged from 38 to 87 % ABTS and no difference was found statistically significant, sequestering activity values were 96 % for all extracts. These results confirm the effect of the process of the fruit of *Brosimum alicastrum*. The fruit of *Brosimum alicastrum* under conditions toasted flour or grain is a source of compounds with antioxidant activity and the roasting process not adversely affected their activity

Effect of Ripening on the Content of Bioactive Compounds of Strawberry Fruits

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Strawberry fruits (Cv. 'Albion') cultivated under organic conditions were sampled during ripening (from white to dark red) and evaluated for quality. Tested fruits were rich in sugars and acids, two chemical components that influence the quality of this fruit. The content of fructose and glucose showed two periods of fluctuation during ripening. Fructose was the most abundant sugar, followed by glucose and sucrose. Citric, malic and ascorbic (vitamin C) acid followed a descending, irregular, or increasing pattern, respectively, during ripening. Total anthocyanin content increased continuously during ripening, while the opposite was observed for total phenolic content. Tested fruits presented a high content of anthocyanins and a moderate to high content of vitamin C and total phenolic compounds, demonstrating the nutrition and health benefits of the tested fruit. Most of quality attributes were higher than those reported for strawberries cultivated under conventional cultivation mode.

Keywords: *Fragaria x ananassa*, antioxidants, nutrients, physical attributes, chemical composition

Effect of nixtamalization and production of tortillas on inhibition of α -glucosidase and aldose reductase from four varieties of maize (*Zea mays* L.)

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Trials on diabetes control and complication show that hyperglycemia is a key factor in the development of diabetic complication, therefore inhibition of α -glucosidase in order to retard the digestion of glucose and inhibition of aldose reductase to normalize the overproduced sorbitol could prevent the hyperglycemia-induced diabetic complications. The high utilization and consumption levels of maize in developing countries calls for investigations in methods of processing to improve the functionality and nutrient quality of maize-based foods. This study was carried out to determine the effect of nixtamalization for tortilla production on the functional characteristics of maize. Phytochemical composition of four different types of kernels (purple, black, red and yellow), raw corn, masa and tortilla were analyzed in terms of total phenolic compounds and in inhibition of α -glucosidase and aldose reductase in order to know if those phenolic compounds are effective in either preventing or retarding complications associated with diabetes. The greatest degree of degradation of phenolics was observed when the yellow variety was processed into nixtamal with respective declines of 64.1% to 38%. Among the pigmented varieties, the relative losses of phenolics when the kernels were processed into nixtamal were from 43.1% to 30.4%. The level of activities for raw corn, masa and tortilla ranged from 60.3-89.6%, 45.3-58.8%; 52.3-72.5% (for α -glucosidase) and 56.7-69.6%, 39.6-55.5%, 66.8-90.2% (for aldose reductase) respectively. The inhibition activities were affected significantly ($P > 0.05$) by nixtamalization, but not by processing masa into tortilla. The yellow variety and its corresponding products showed the greatest capacity to inhibit the enzymatic activity among the varieties, and the purple variety ranked highest on the pigmented varieties.

Keywords: hyperglycemia, maize, nixtamalization, phenolic compounds)

Antioxidant and antimicrobial activities of garlic (*Allium sativum* L.) and onion (*Allium cepa* L.) Extract on common carp (*Cyprinus carpio*) restructured meat during storage at 4 °C

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Aquaculture is an activity that has been the basis for numerous investigations that have been reflected in important technological advances. Common carp (*Cyprinus carpio*) is a species that has great adaptability and reproductive capacity; additionally it is a source of high quality protein. In particular, the flavors of meat and meat products constitute one of the most important considerations in the food industry. However, oxidative products produced during storage and resulting in undesirable rancidity could be developed by microbial spoilage or lipid oxidation. The application of natural ingredients containing antioxidants and antibiotics may prove useful as an antioxidant and antimicrobial source in meat and meat products without any quality defects. The *Allium* family of plants (Garlic and Onion) contains a number of sulfur and phenolic compounds, which has excellent antioxidant and antimicrobial activity. The objective of this study was to evaluate the effect of antioxidant and antimicrobial activities of garlic and onion mix extract on common carp (*Cyprinus carpio*) restructured meat and restructured without extract as a control during refrigerated storage at 4 °C. Antioxidant and antimicrobial activities on *Cyprinus carpio* restructured meat and control (restructured without extract) were evaluated at 4°C. Significant differences in peroxide value were observed in both products. Thiobarbituric acid reactive substance value in restructured was significantly lower than the control. Total plate counts in *S. aureus*, *E. coli* and *P. aeruginosa* were lower in restructured than the control. These results might suggest that the use of carp meat in combination with garlic and onion mix extract are an alternative of consumption of this species of economic importance and can be a conservation method of low cost.

Keywords: *Cyprinus carpio*, garlic, onion, antioxidants, antimicrobial

Wound-induced Production of Bioactive Compounds in Carrot and its Transformation into a Nutraceutical-rich Powder Ingredient

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Metabolic syndrome has become a worldwide health issue that results in the increased risk of obesity, diabetes, and cardiovascular diseases. These metabolic conditions could be prevented if the intake of nutraceuticals is increased. Therefore, it is relevant to explore different strategies for the production of nutraceutical compounds in order to raise its consumption and availability among the population. It is well known that the postharvest application of wounding stress in horticultural crops induces the production of bioactive compounds, mainly phenolics. In order to take advantage of this technology, wounded crops could be transformed into a powder and added as an ingredient in food formulations. As a proof of concept, 6 batches of carrots were subjected to wounding stress (shredding) and stored for 48 h at 15 °C. Then, shredded carrots with increased levels of nutraceuticals were dehydrated at 60 °C for 30 h. Finally, dehydrated carrots were grounded in a blade mill and passed through a sieve (0.425 mm) to obtain a fine powder (stressed carrot powder, SCP). Concentration of phenolics and carotenoids were evaluated by HPLC-DAD after carrots were transformed into a powder. Carrot not stored was used as a control (non-stressed carrot powder, CP). Statistical analyses were performed with 6 different batches and mean separation was performed using LSD test ($p < 0.05$). SCP showed $612.06 \pm 64.40\%$ higher levels of chlorogenic acid (the main phenolic compound in carrot) as compared to CP. Concentration of α -carotene and β -carotene in wounded carrot was 179.01 ± 3.98 mg/kg and 308.16 ± 6.64 mg/kg, respectively, where no difference ($p > 0.05$) was detected between SCP and CP. Since vitamin A deficiency is an important public-health issue in developing countries, the use of this powder as a source of pro-vitamin A precursors, could help to reach the recommended daily intake of this vitamin. Likewise, rich concentration of chlorogenic acid present in this powder, have shown some beneficial properties in health, especially in the prevention of the metabolic syndrome. Here we discussed potential uses of SCP as food ingredient or as raw material for the extraction of high value compounds with applications in the dietary supplement and food industries.

Keywords: wounding stress, chlorogenic acid, nutraceuticals

Formulation of a high protein beverage produced from walnut, sesame seeds, oats and soybeans and *in vitro* determination of its antihypertensive and antioxidant capacity

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Cardiovascular diseases are the principal cause of death in Mexico and around the world, the main risk factors are high blood pressure, overweight, obesity and diabetes; one associated factor with its development is the oxidative stress, which leads to high concentrations of lipid peroxidation products. Therefore, is necessary the search for natural antioxidant compounds that prevent oxidation by free radicals. These compounds can be derived from plants, such as cereals, legumes and oilseeds, which are characterized by a high protein value and whose potential is attributed in part, to the presence of antioxidants and antihypertensive peptides. Hence, this study aimed to formulate and develop a functional drink based on walnut, oat, sesame seeds and soy to evaluate *in vitro* its antihypertensive an antioxidant capacity. Our beverage was formulated by the method of protein digestibility–corrected amino acid score (PDCAAS). Subsequently, the total protein was extracted and hydrolyzed with trypsin. The hydrolysates obtained were analyzed by 2D-PAGE and liquid chromatography coupled to mass spectrometry for the identification bioactive peptides. The tryptic hydrolysates were analyzed and it antihypertensive capacity was determined by the ACE inhibition assay (Cushman and Cheung, 1971) (using captopril as control) and the antioxidant activity was evaluated by the methods ORAC and DPPH. This beverage has a 100% quality protein (contains no limiting amino acids), its protein content covers 48% of the Recommended Daily Intake. The proteomic analysis by liquid chromatography coupled to mass spectrometry of 3 points from 2D-PAGE determined to the presence of antihypertensive (34.34%) and antioxidant (23.34%) peptides. It was observed that 600µg/mL of hydrolysates inhibited 85% of the enzymatic activity of ACE-1, while 500µg/mL of the positive control inhibited 89.29%, showing significant difference by Tukey method ($p < 0.05$). For antioxidant activity, the ORAC method showed for the tryptic hydrolysates a capacity of 98.65 µmolET/g in contrast with the 38.44 µmolET/g obtained by the DPPH method. In conclusion, this drink marks a positive impact on the population that is vulnerable to cardiovascular diseases and it proves to be an excellent alternative to treatment and/or prevention of hypertension.

Keywords: Beverage functional, Peptides, Antioxidant, Antihypertensive.

Determination of Polyphenols, Anthocyanins and Antioxidant Capacity of Red Cabbage Extract (*Brassica Oleracea*) Using Mid and Nir Spectroscopy and Regression Pls-Ops

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A method was developed to determine the antioxidant properties of red cabbage extract (*Brassica oleracea*) by near (NIR)- and mid (MID)-infrared spectroscopy and partial least squares (PLS). Ethanollic 70% (v/v) extracts of red cabbage were concentrated to 9 °Brix and further diluted (5 to 100 %) in water. Total anthocyanins (21.95–595.72 mg·L⁻¹), monomeric anthocyanins (23.08–588.24 mg·L⁻¹), total polyphenols (42.94–1073.39 mg·L⁻¹) and antioxidant capacity (0.20–5.90 and 0.23–4.90 μM trolox·mL⁻¹ by the ABTS (2,2-azino-bis(3-ethyl-benzothiazoline-6-sulfonate) and DPPH (2,2-diphenyl-1-picrylhydrazyl) methods, respectively, were obtained by NIR (10000–4000 cm⁻¹) using absorbance and MID (4000–650 cm⁻¹) using attenuated total reflectance. Ordered predictors selection (OPS) was used for feature selection, before PLS regression. Simultaneous regression was applied to all properties (PLS-2). The PLS-OPS models presented excellent prediction results with a correlation coefficient > 0.99 and ratio of performance to deviation > 5.80. NIR was the best model for monomeric anthocyanins and antioxidant capacity by ABTS and DPPH methods, with 32.23, 0.21 and 0.13 root mean square error of prediction (*RMSEP*), respectively; however, MID was more predictive for total anthocyanins and total polyphenols, with 14.31 and 34.62 *RMSEP*, respectively. The approach provided a simple, rapid and accurate determination of red cabbage extract antioxidant properties and is suitable for use in the food industry.

Keywords: phenolic compounds, rapid prediction, functional compounds.

Evaluation of Antioxidant Activity of Aqueous Extracts from *Melissa officinalis* L. using a Box-Behnken Experimental Design

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Lemon balm, also known as Melisa, is an annual plant belonging to the Lamiaceae family and it is native to southern Europe, Asia Minor and North America. In Mexico, it grows wild in the municipalities of Acaxotitlán, Pacula and Valle del Mezquital located in Hidalgo, State. Lemon balm infusions have been used historically for therapeutic purposes. Another potential use of this plant is as a natural source of antioxidants; since within the composition of the essential oil of lemon balm, it has been reported the presence of phenolic and terpene type compounds. Therefore, the objective of this work was to determine the antioxidant activity and total phenol content of aqueous extracts of lemon balm by spectrophotometric techniques to assess its potential use as a natural source of antioxidants. Melisa sample was purchased in the supply center of Pachuca, Hidalgo. Samples were dried at room temperature and under aeration for a period of 15 days. The extraction conditions were established using a Box-Behnken experimental design. The variables analyzed were: time (5, 15 and 25 minutes), temperature (20, 55 and 90) and sample concentration (2, 6 and 10%). The antioxidant activity was measured using a modification of FRAP assay at 593 nm, the radical DPPH* method at 515 nm while total phenol content was quantified by the Folin-Ciocalteu method at 760 nm. All aqueous extracts analyzed showed antioxidant activity values from 286 to 3522 mg Trolox/100g and from 2799 to 37500 mg Fe²⁺/100 g. The total phenol content was from 557 to 2459 mg GA/100 g. The highest antioxidant activity and the higher total phenolic content were obtained by extracting 2% sample at 90° C for 15 minutes. The experimental design allowed obtaining aqueous extracts of lemon balm with different antioxidant activity; being temperature the determining factor for the extraction of compounds with antioxidant activity.

Keywords: *Melissa officinalis*, Toronjil, Box-Benhken

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Control of Glucose Serum Levels by the Consumption of a Traditional Maize Food Containing 10% (w/w) Pectin was seen in a Human Trial

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Contribution withdrawn

Valuation and Use of Barley (*Hordeum vulgare*), For Manufacture of Brewing Malts

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Specialty beer represents an emerging market in Mexico, providing consumers new ways to satisfy your palate. Currently, it is necessary to innovate in the process and in the formulation of a beer, mainly to provide sensory attributes that satisfy the consumer. It is why this work focused on the production of malt beer using a new variety of barley (Doña Josefa), and in the evaluation of two varieties of barley that allowed to compare them. The varieties of Emerald, Pastor Ortiz and Doña Josefa; they were obtained by a simple random sampling in the region of Apan, Hidalgo. He was performed in a physicochemical and germination capacity analysis. The Doña Josefa variety showed high percentages of germination (86-92%). All varieties of barley had values of germination, indicating that they were suitable for brewing malts (85%). However, the Doña Josefa variety showed better physico-chemical composition with percentage of total carbohydrate of 77.4% and protein of 10.93%. Therefore, it was concluded that this variety was the most viable to develop the malts. From this range were different malts (Pilsen, Vienna, Melano, coffee and Chocolate). Which became less analysis of concentration of fermentable sugars among others. Pilsen malt presented the highest values in concentration of sugars (90 g/mL). Other malts had values below 50 g/mL. Therefore it was concluded that Pilsen malt can be used as base malt in the production of beer, mixing with specialty malts as coffee malt and chocolate that give color and scent to beer, while Pilsen malt will provide sugars for conversion into alcohol.

Keywords: beer, malt, barley.

Angiotensin I-Converting Enzyme Inhibitory Peptides in a Whey Probiotic Beverage.

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The objective of this study was to evaluate the angiotensin I-converting enzyme (ACE) inhibitory activity, proteolysis, peptide and aromatic amino acids profiles, of a probiotic fermented beverages prepared from Chihuahua cheese whey. Four beverages were prepared and evaluated throughout their shelf life (at the 0, 7, 14 and 21 days), three of them added with probiotics cultures: ABC, ABT-4 and C, all from Chr Hansen® (A- *Lactobacillus acidophilus*, B-*Bifidobacterium lactis*, C- *Lactobacillus paracasei* subsp. *paracasei*, y T-*Streptococcus thermophilus*), and the control (unfermented). The experimental design was a randomized block with repeated measurements over time. An analysis of main components with the measured variables (total protein, proteolysis, ACE inhibitory activity, peptide profile and aromatic amino acids) and a contrast analysis were performed using statistical package SAS (version 9.1.3) with a significance of $p < 0.05$, using the instructions MIXED, PRINCOMP and ESTIMATE respectively. In all beverages, the ACE inhibitory activity was detected throughout its shelf life, while the control beverage maintained it constant at 100 %. Meanwhile, the treatment ABT-4 had an inhibitory activity between 80 to 100 %, and in ABC and BCT-1 it was highly variable with a sharp decline after 14 days. The correlations between the variables presented significant differences and they were within the range of 0.9 to 0.0. The total peptide concentration did not change in any of the beverages throughout the shelf life ($p > 0.05$), and no correlation of this variable with others was observed. However, the highest correlations were recorded between the ACE inhibitory activity variable with the content of aromatic amino acids and the peptide profile variables. The BCT-1 treatment had the highest correlations between these variables $R = 0.913$ and $R = 0.98$, respectively. Meanwhile, the ABC treatment had the highest correlations between the variables content of aromatic amino acids and the peptide profile $R = 0.928$. The results obtained here evidence that beverages elaborated with cheese whey and fermented with selected LAB (Lactic Acid Bacteria) strains might be used for developing novel functional fermented beverages with specific properties.

Keywords: Whey, Peptides, ACE-Inhibitory activity.

Optimization of an Extrudate Product with the Addition of Moisture Milling Barley.

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The objective of this research was to incorporate the product of the wet milling barley (barley protein) in the preparation of an extruded food and use it as a food alternative. Two types of pasta were produced. Noodle type and spaghetti type. The extrusion process was optimized using a central composite design extrusion; the conditions were moisture content of 35% of feed, screw speed 15 rpm and 110 °C of temperature of die. A control for both pasta dough with 100% semolina and 4 formulations replacing barley protein 5, 10, 15 and 20% were obtained. In the noodle type pasta, sedimentation rate increased by adding barley protein, whereas the absorptive capacity decreased. The hardness was also affected, decreasing with high percentages of protein barley. Cohesiveness, gumminess and chewiness showed the same trend as in hardness. Adhesiveness showed a difference by incorporating protein barley, increasing the values of adhesiveness. In type spaghetti pasta, sedimentation rate also increased with increasing percentage of protein. The water absorption capacity was not different by incorporating 5 to 20% protein, only 10 and 15%, decreases the water absorption capacity. Hardness and cohesiveness presented low values when the percentages of substitution of barley were 5 and 10. The physical appearance of the pasta was appropriate, therefore possible to use the by-product of the wet milling of barley in the preparation of a pasta in a ratio not greater than 20%, because if the percentage of product increases, increases the percentage of loss during cooking of pasta.

Keywords: Barley protein, extrudate, pasta.

Obtaining and Characterization of Protein Hydrolysates from Blue Corn Gluten Meal by Wet Milling Process

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Corn (*Zea mays L.*) is the major crop around the world. Among the uses of corn there is starch production which is based on wet milling process (WM). WM is an industrial process to separate the parts of corn in starch, gluten, germ and fiber fractions. Corn gluten meal (CGM) is one of the main byproducts of corn WM, which has a large amount of protein. In recent studies, there is reported that enzymatic treatments to some byproducts high in protein can produce protein hydrolysates, which can be a source of bioactive peptides. The aim of this work was to obtain CGM by WM process and to characterize it chemically. Also, to obtain hydrolysates from CGM and to evaluate their antioxidant activity (AOX). Materials and methods: Was used blue landraces to make CGM, using the technique proposed by Eckhoff et al (1996), modified. Once the CGM was obtained the chemical composition was performed by determining protein, fat and ash by AOAC (1999) methods and carbohydrates were obtained by difference. A hydrolysate was made of CGM using the method of Megías et al. (2009) using pepsin and pancreatin during 3 hours each enzyme consecutively; aliquots were taken at the following times, 180 min pepsin, 20, 50, 80 and 180 min pancreatin. After that the protein solubility was measured by Montoya-Rodríguez et al (2014) method and AOX by Ou et al. (2001) and Prior et al. (2005) method to the different times hydrolysates. Results: The obtained fractions by WM process were the following, starch 48.71%, soaking solids 2.78%, germ 3.79%, fiber 25.53% and gluten 7.08%. The chemical composition of CGM was 13.56 % fat, 0.44% ashes, 31.59% protein and 54.39% carbohydrates. The range of solubility several of 12.04 to 16.04 mg/mL from 20 and 180 minutes pancreatin respectively. While the AOX was from 253.26 to 508.97 $\mu\text{mol TE/mg}$ soluble protein from 20 and 180 minutes pancreatin respectively. Conclusions: The CGM is a byproduct of WM that can be used as functional food, since the results in this investigation show that after conducting an enzymatic hydrolysis can generate a greater amount of antioxidant peptides.

Keywords: wet milling, corn gluten meal, protein hydrolysates, bioactive peptide.

Frozen and Unfrozen Water Contents in Seven Varieties Barleys by Differential Scanning Calorimetry

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The properties of frozen and unfrozen water in seven varieties barley, were determined by using differential scanning calorimetry (DSC) aiming to describe interactions between water and food solid matrixes as a key factor for understanding the physicochemical events occurring during processing. The characterization of water in food materials, ice crystallization temperatures and melting enthalpies, measured by DSC on the same sample, allowed precise determination of the amount of frozen water and its enthalpy, as a function of total water content, especially at low water contents near the unfreezing water limit. As a reference, enthalpy crystallization (285.2J/g) and melting (312.9J/g) values of pure water were determined from the total heat flow curves. For the seven different cultivars barley, linear regressions described changes in frozen water content calculated from enthalpies of freezing or melting. The unfrozen water content (UFWC) calculated in barley was 24.99-30.93% db.

Keywords: barley, crystallization, hydration, melting, sorption water, unfrozen water.

Phenolic compounds and Antioxidant Properties of *Nephelium lappaceum* Peel Cultivated in Veracruz México

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Nephelium lappaceum L., commonly known as rambutan and belonging to the Sapindaceae, is a tropical fruit native from Malaysia and Indonesia, widely distributed in southern regions of Thailand. In Mexico is cultivate since 1950, mainly in the Soconusco region in the Chiapas State, and other States such as Tabasco, Oaxaca and Veracruz. This fruit is consumed fresh, and its consumption produces large amounts of waste such as seeds (up to 30% total fruit) and peels (up to 40% total fruit). In this investigation rambutan peels were collected at El Palmar, Tezonapa Veracruz México. Ethanolic (70% and 96% ethanol/water), aqueous and ethyl acetate extracts were obtained by maceration, concentration and lyophilization process. The extract yield (%), phenolic content by Folin-Ciocalteu, antioxidant capacity measured by DPPH, ABTS, β -carotene bleaching, and Nitric Oxide methods were evaluated. The main compounds were identified by HPLC-MS and HPLC-DAD. Ethanol/water 70/30 extracts yield was 35% w/w, phenolic content are from 347 to 575 mg GAE/g dry extract. The aqueous extract was found to be the most active DPPH inhibition, as shown by their 50% concentration, 385 μ g/mL. Ethyl acetate extract had the best activity in β -carotene bleaching (91.3%) and ABTS (97.0%), while the two ethanolic extracts had the best effect on nitric oxide assay. The main compounds in rambutan peels are gallic acid, ellagic acid, and the tannin geraniin. Mass analysis shows signals of anthocyanins as pelargonidin-3-O-hexoside. Looking to use waste, rambutan peels could be an important nutraceuticals source, and further utilized as medicine and in the food industry.

Keywords: *Nephelium lappaceum*, rambutan, phenolic compounds, antioxidant, geraniin

Effect of blueberry extract encapsulated ingredients over the growth of probiotics and pathogens.

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It has been recognized that blueberry extract (BE) contain phenolic compounds, sugars, anthocyanin and others; It has beneficial effects on gut microbiota. However, the disadvantage of this kind of extracts is that they have a short life time due to their high water activity so it is necessary to use techniques that can facilitate handling and increase their shelf life. For this reason it uses encapsulation of bioactive used as wall material gum Arabic (GA). The aim of this study was to evaluate the interaction between the materials involved in the formation of microencapsulated and microorganisms through the growth kinetics with medium modified and unmodified. Probiotics chosen were *L.paracasei*, *L. plantarum* and *L. rhamnosus* and pathogenic *S. typhimurium*, *S. aureus* and *L. monocytogenes*, because there are representative genus of generic microbiota. For these tests were used modified MRS medium depletes in carbon source it was substituted by: gum Arabic (GA mod) and blueberry extract (BE mod); MRS unmodified plus GA or BE and normal MRS medium was used as control. The test solutions were filtered through 0.45 µm filter paper and 16 hours active microorganisms at 37 ° C were used as inoculum. Microbial growth was determined by O. D. at 600 nm, the kinetic time of grow was 20 hours; each tests was made by triplicate. BE was consumed by probiotics and pathogens, tests are performed to evaluate the appropriate concentration of extract to obtain the desired effects. *S. typhimurium* and *S. aureus* both showed a constant growing during all the kinetic time with GA mod; this event was not observed in another evaluated bacteria. The results suggest further evaluation of the GA used in generating encapsulated because it present an increment in the O. D. in presence the *S. typhimurium*, *S. aureus* respected to the control. The composition of the microbiota is very complex, however in this work we show the encapsulate ingredients interaction with bacteria under study. Knowing the interactions between probiotics and pathogens with food ingredients can help to design and improve food functionality for the following evaluations *in vitro* and *in vivo*.

Keywords: Blueberry, gum Arabic, probiotics, pathogens

Phytochemicals and Antioxidant Activity of Bean Genotypes Harvested in the Center North of Mexico

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Mexico is the main center of origin and distribution of bean (*Phaseolus vulgaris* L.) and in the state of Zacatecas located in the center north of Mexico; there is a high genetic biodiversity of this legume. However there are no studies about the evaluation of the phytochemicals and antioxidant activity content of these kinds of beans. The present research evaluated the anthocyanin, flavonoid and phenolic content, in addition to the antioxidant activity from nine varieties of beans, harvested in the state of Zacatecas. The total phenolic and flavonoid content varied from 67 to 204 mg of gallic acid equivalents /100 g (bs) and 16 to 103 mg of catechin equivalents/100 g (bs), respectively. The anthocyanin content, of the nine genotypes evaluated, showed values from 0.22 to 3.45 mg cyanidin 3-glucoside/ 100 g (bs), The higher contribution of phenolics (64 to 93%) and flavonoids (55 to 81%) were found in their bound fraction. With regard to the antioxidant activity measured by the DPPH method, the obtained values varied from 243 to 1282 micromoles of Trolox equivalents/ 100 g (bs).

Effect of Flour *Chayotextle* (*Sechium edule*) in the Performance and Physico-Chemical Characteristics of Panela Type Cheese Made with Milk Bovina

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The chayote (*S. edule*) is a crop of Mesoamerican origin, grown in different countries, mainly Mexico and Central America. It belongs to the family *Cucurbitaceae*, this plant leaves, stems, fruits and roots are used, all comestible. Chayote tuber known as "chayotextle" contains a chemical composition rich in carbohydrates, proteins, ascorbic acid, niacin, phosphorus, starch and protein. In spite of the nutritional content of tubers, their use and consumption are generally limited, due to their nutritional losses postharvest process for their high moisture content, sustained metabolism and microbial attack. This problem can be solved by converting a perishable tuber to nonpercedero performing a drying process for obtaining flour product. For the above was raised the following research where flour "chayotextle" was used in the production of panela cheese type where the effect on performance and physicochemical characteristics was evaluated. In this work a design of experiments, where a witness and four treatments with the addition of flour "chayotextle" 0.5, 1.0, 1.5 and 2% were performed. The methodology for the physico-chemical determinations were performed according to the A.O.A.C. (1997). The results show that flour is rich in protein and carbohydrates with 10.36 and 75.27% respectively. With respect to the physico-chemical characteristics (moisture, ash, fat, chlorides, Protein, pH and acidity) of cheeses made with different concentrations shows that there are significant differences in all treatments. Higher values moisture (60.58%), ash (3.86%), acid number (15.16 °D) and fiber (0.038%) were found in cheeses with the addition of 2% of flour, to yield an increase is observed in the different treatments performed initiating a 12.18% (0% flour) to a 18.03% (2% flour).

Keywords: panela cheese, bovine milk, chayotextle.

Phytochemical Characterization of Blue Corn Tortilla (*Zea mays L.*) Produced By Nixtamalization

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Corn (*Zea mays L.*) is one of the main foods consumed in Mexico, and Central America. It is also one of the most important cereals worldwide. There are different races of maize within which landraces are distinguished for presenting different pigmentations. These pigments are due to the presence of different bioactive compounds, like phenolic, carotenoids and tocopherols which have been demonstrated to have human health benefits. In Mexico, the main form of corn consumption is tortillas. One of the techniques used to obtain tortillas is nixtamalization, a traditional technique consisting of alkaline cooking and partial removal of the pericarp. The aim of the present study was to evaluate the chemical, phytochemical and antioxidant capacity of tortilla made of endemic blue corn of Sinaloa state by nixtamalization. Materials and methods: 10 g of flour tortilla was used to determine the chemical composition such as protein, fat and ash using the AOAC (1999) method; followed by analysis of the total phenolic content (FT), and antioxidant activity by Absorbance Capacity Oxygen free radicals (ORAC). Statistical analysis: all experiments were analyzed using Minitab version 16 with a confidence level of ($P < 0.05$). Results: the total phenolic content of raw landrace blue corn was 143.805 mg GAE/100g of Dry Weight while blue tortilla contains 120.800 mg GAE/100 g. The traditional nixtamalization process (<0.05) decreased significantly the total phenolics and ORAC-H assays when compared to raw kernels. Traditional tortillas retained among 84.04% of total phenolics and 85.48% ORAC-H levels, respectively when compared to raw kernels. These results indicated that nixtamalization allows greater retention and released of phenolic phytochemicals content and antioxidant capacity in tortillas than raw landrace blue corn.

Keywords: nixtamalization, antioxidant activity, phenolics, phytochemicals.

Functional Properties of Dietary Fiber Concentrates From Fruit By-products

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The food industry generates a large quantity of food wastes resulting into severe environmental and economic problems. Research has been focused on the utilization of these residues, such as fruit by-products, due to its content of compounds of interest. Fruit by-products are non-conventional sources of dietary fiber (DF), which is well-known for its physiological and technological effects. In recent years, the food industry has gained interest in the obtaining of dietary fiber concentrates (DFC) from fruit by-products, not only to promote the consumption of DF, but to take advantage of novel functional properties to develop new products. The aim of this study was to evaluate some functional properties of fiber concentrates obtained from different fruit by-products, in order to use them as a DF source in food formulations. Five fruits were utilized (banana, mamey sapote, meyer lemon, tamarind and watermelon). Fruit peels, or bagasse in the case of tamarind, were separated from pulp and freeze-dried to obtain the DFC. Proximate composition (protein, fat, ashes, soluble solids, and DF) of the DFC was analyzed following the AOAC methodologies. The functional properties evaluated to each concentrate were water retention capacity (WRC), swelling capacity (SC), oil retention capacity (ORC), and solubility (SOL). SOL was conducted at different pH (2, 3, 4, 5, 6 and 7), while WRC and SC were performed at pH 7. Analysis of variance and Tukey test were performed to verify the differences of the studied variables (p -value <0.05). The content of DF was between 40 to ≈ 70 g/100g (d.b.). WRC ranged between 1.7 to 5.6 ml/g, while ORC values were between 1.5 to 3.0 ml/g, being tamarind and watermelon the ones with the less and the highest values respectively in both cases. Additionally, SC showed values between 4.8 to 15.1 ml/g (sapote mamey and watermelon, respectively). An increase in SOL was observed from pH 5 to pH 7, being watermelon concentrate the one with the highest values at the studied pH range. The characteristics of the DFC founded in this study suggest the possibility of its utilization as food ingredients for the development of innovative fiber-enriched foods.

Keywords: Fruit by-products, dietary fiber concentrate, functional properties

Effect of Blanching and Osmotic Dehydration on the Antioxidant Properties of *Byrsonima Bucidaefolia*

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The fruit of *Byrsonima bucidaefolia*, they are traditionally consumed in fresh and pickle in the Yucatan peninsula, the fruits are immersed in hot water and preserved with salt. These fruits have potential as natural antioxidants, thus the objective of this research was to evaluate the combined effect of blanching (50 °C and 100 °C for 5 minutes) and osmotic dehydration (solution 5 and 10 % NaCl) on the antioxidant properties of *Byrsonima bucidaefolia*. Seven treatments were evaluated: a control by dipping samples for 5 minutes in distilled water (C); blanching to 50 °C (E50); blanching to 100 °C (E100); blanching to 50 °C with application osmotic dehydration 5% (E50-5); blanching to 50 °C with application osmotic dehydration 10 % (E50-10); blanching to 100 °C with application osmotic dehydration 5% (E100-5); and blanching to 100 °C with application osmotic dehydration 10% (E100-10). To determine the antioxidant properties two methods were used: the antioxidant capacity was evaluated through the DPPH method and the total phenolic content was determined according to the Folin-Ciocalteu assay. The significant differences between treatments was performed with ANOVA followed by Tukey test was applied to determine the difference between the medians. The level of significance was set at $p = 0.05$ for all analysis. In the antioxidant capacity, the higher percentages of inhibition free radical were found in the treatments E50 (95%) and E50-5 (94%). The total polyphenols content was decreased with blanching, showed a small loss E100 (120 mg A.G/g extract), while osmotic dehydration the total polyphenols content was increased obtaining E100-5 higher content with 172 mg A.G / g extract. In the antioxidant capacity, significant differences were obtained during blanching and osmotic dehydration ($p \leq 0.05$). Regarding the content of polyphenols was decreased with blanching ($p \leq 0.05$). For osmotic dehydration the content of polyphenols was increased ($p \leq 0.05$). It is concluded that the fruit blanching at 50 °C with osmotic dehydration 5% showed an increase in antioxidant activity, in terms of total polyphenol, the scalding temperature to 100 °C and osmotic dehydration with 5% salt showed greater polyphenol content.

Keywords: *B. bucidaefolia*, antioxidant capacity, polyphenols, blanching, osmotic dehydration.

Optimization of Bioactive Compounds Extraction, Present in *Cabernet Sauvignon* Grape Pomace from Querétaro, México

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In recent years, has been increased the interest in the use of grape waste as a dietary antioxidant supplements. Furthermore, grape pomace is characterized by high phenolic contents, this has been reported on several researches. During the wine making process some phenolic compounds are transferred to the wine, however it is not an exhaustive extraction therefore the byproducts still have a significant amount of polyphenols. The aim of this study was to compare two methods of phenolic compounds extraction: by maceration and matrix solid phase dispersion (MSPD). The best conditions by both methods were identified. Phenolic compounds and antioxidant activity were the response variables. For the extraction by maceration a central composite design was used (software Minitab 17); the extraction time and different ratios of acidified ethanol (HCl 1%) were the two factors analyzed. On the other hand, for the MSPD extraction two dispersant were chosen for evaluation: sea sand and natural clay, a 2² factorial design was used for each dispersant (software Minitab 17), being the elution volume and the ratio of sample/ dispersant the two factors analyzed in both cases. The best extraction method were MSPD using sea sand as dispersant, 96 mL as elution volume and 1:2 ratio of sample/dispersant. Under these conditions a value of 14.01 ± 0.19 mMol TEAC/100 g dm of antioxidant capacity of grape pomace was obtained while the total phenolic content was 2836.73 ± 41.90 mg GAE /100g dm. These conditions are close to those predicted by the model. Once the optimum extraction conditions were established, antioxidant capacity was also determined by the ABTS reagent (8.97 ± 0.23 mMol TEAC/100 g dm), as well as the total anthocyanin (41.65 ± 1.74 mg Cyan-3-glu E/100 g dm), total flavonoids (595.50 ± 19.14 mg QE/100 g dm), and total tannins (2.31 ± 0.02 g/L).

Keywords: optimization, extraction, grape pomace

Characterization of Bioactive Compound from Blue Tortilla Obtained by Lime-Cooking Extrusion

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Corn (*Zea mays L.*) is a major crop in the world, and is used as the basic ingredient on the diet of the Mexican population. It has a great genetic diversity within which at least 59 landrace are known in México. This contains many bioactive compounds which are responsible of the yellow, black, red and blue color corns, it also contains phenolic compounds, carotenoids and tocopherols. In Mexico, and Central America, the main form of consumption of maize is tortillas providing significant amounts of calories, proteins, minerals and vitamins. One of the technologies used for the production of flour is extrusion-cooking, which is a process that combine different unit operations such as mixing, cut, heating, cooling, likewise compression exerted on the raw material to form semisolid mass under controlled conditions, and finally it is forced to pass this semisolid mass through a tiny area at a certain speed. The aim of this study was to characterize chemically and evaluate the phytochemical characteristics of blue corn tortilla through the extrusion process. Materials and methods: Blue landrace corn was used to obtain tortillas trough the lime-cooking extrusion process using Milán-Carrillo et al. (2006) technique. The chemical composition was performed by determining protein, fat and ash by AOAC (1999) method. Results: the results are presented as a percentage of dry basis, in protein it was obtained raw corn 7.7, 7.1 for the tortilla made by the extrusion process, for lipids was obtained raw 3.7 and 2.7 tortilla. More studies analyzing free and bound, phenolic compounds and antioxidant activity need to be performed to know the bioactive compounds from blue tortilla obtained by extrusion. Conclusion: In Latin America the consumption of blue tortilla is the main source of phenolic compounds. The use of lime-cooking extrusion is an alternative process that increases the bioavailability of bioactive compounds to prevent chronic degenerative disease such as diabetes and hypertension.

Physical Chemical and Sensory Evaluation of Nugettes Chicken With Peanut (*Arachis hipogea*) to Increase Its Protein Content

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Numerous studies have described positive health impacts associated with the incorporation of nuts, including peanuts, into the diet. Frequent peanut consumption improves indices of cardiovascular health, glucose metabolism, weight management and overall diet quality. Regular consumption is likely necessary to realize health benefits, and this requires a sustained behavioral change. Obesity is the most common nutritional disorder in the developed world and it is considered to be a risk factor associated with the development of the major human diseases, including cardiovascular disease, diabetes, and cancer. The objective of this work was formulate a protein nugget and his acceptance by consumer. Chicken nuggets were processed by substitution of fat by peanut at 0, 15, 20, 25 and 35% (NC, N15, N20, N25 and N35), protein and lipids content were evaluate, with these results and using a statistical model of randomized mixtures, the amount of peanut and chicken was determined to use to get the highest percentage protein nugget (NOp), using the statistical program Statgraphics Plus 5.1; fatty acid profile were evaluated by HPLC. A test for measuring the degree of satisfaction of the product was performed using a 5-point hedonic scale. All nuggets with peanuts had higher protein content than the control ($p < 0.05$), 44% for N15 and 43% N20, 37.84 and 39% for N30 and N25 respectively and NO with 33%. The lipid content increased in direct relation to the increase in peanut (from 15% for N0 to 32% for N32). Nuggets with peanuts had higher percentage of oleic and linoleic acid. The NOp had less unsaturated acids and greater amount of linoleic acid (31.7%). Protein content was 45.76 % for NOp being significantly different whit other groups ($p < 0.05$). The addition of peanut affects the sensory quality, only N25 and N30 nuggets were not well accepted. NOp was well accepted. In conclusion replacement for peanut flour used in making nuggets raises the protein content of the product. It is possible to cover the protein requirements of a child from 7 to 10 years with the intake of two to four nuggets

Keywords: nuggets, peanut, functional food.

V. NUTRITION AND NUTRIGENOMICS

Fatty Acids and Phospholipids Content of Select Oil Sources used in the Mexican Diet

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The Mexican diet includes foods with lipid composition high in ω -6 fatty acids. This is more evident in fried foods due to the use of vegetable oils for frying. Consequently, we might expect a Mexican diet where the ω -6 to ω -3 ratio is higher than the recommendation established by the World Health Organization (WHO). Unfortunately, information regarding the fatty acid composition of vegetable oils commonly used in the Mexican diet is scarce. In the same way, there is lack of information about the composition of the commercial supplemental oils used by the Mexican consumer to compensate the low ingestion of ω -3. With this framework, the objective of this study was to determine the fatty acid composition of traditional vegetable oils used in the Mexican diet, and also of several supplemental oils. This with particular relevance to the phospholipids content, since fatty acids are best absorbed and incorporated to the human metabolism when they are esterified to phospholipids rather than to triglycerides. We analyzed 10 vegetable oils (7 cooking oils and 3 gourmet oils in salad dressings) and 7 commercial supplemental oils (vegetable, salmon, and krill oils). The fatty acid composition was determined by gas chromatography following the official method of the AOCS (method Ch2a-94), using as internal standard heptadecanoic acid. The phospholipids' content was determined by HPLC. As expected, most of the cooking and gourmet oils showed a ω -6: ω -3 ratio above the recommendation of the WHO. The only exceptions were canola oil ("Canoil") and olive oil ("Filippo Berio"). Of all the supplemental oils analyzed, the salmon oil ("Natural Made") showed a concentration of ω -3 that provides a ω -6: ω -3 ratio within the interval recommended by the WHO. However, the corresponding fatty acids were as triglycerides limiting their absorption and subsequent metabolism by the human. The supplemental oils obtained from krill showed appropriate ω -6: ω -3 ratios and a concentration of phospholipids above the 50%. These results show the need to modify the Mexican diet to include better sources of ω -3 fatty acids. Meanwhile, to compensate the low ingestion of ω -3 the best supplemental oil is the one extracted from krill.

Effect of Calcium intake during breakfast in alimentary thermogenesis and postprandial fat oxidation in overweight women.

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High calcium intake has been related to a higher alimentary thermogenesis and fat oxidation in patients with excess malnutrition. The objective of this study was to relate the level of calcium intake during breakfast with the variation in post-breakfast alimentary thermogenesis and fat oxidation in women with excess malnutrition. The study was experimental, prospective and transversal. An aleatory sample of 16 university Chilean women (20-25 years old) were divided in two groups, the experimental and the control group. The Body Mass Index (BMI) was evaluated, as well as the corporal composition by Bioimpedenciometry, metabolic rate in repose (MRR) during fasting and postprandial by indirect calorimetry, fat oxidation by the respiratory quotient (RQ), and seric vitamin D by radio immune assay. Two types of isocaloric breakfast (337 kcal) were randomly administered, one with high calcium content (625 mg) and the other with low calcium concentration (306 mg); the concentration was verified in the laboratory. Results are shown with central tendency and dispersion measurements. In order to compare results, the Mann Whitney test was used. Average BMI was $26,3 \pm 0,9$ kg/m² for the experimental group and $26,3 \pm 1,6$ kg/m² for the control group, the average percentage of fat mass and fat-free mas was of $30,7 \pm 3,6\%$ and $69,2 \pm 3,6 \%$ in the experimental group and $32,3 \pm 2,3 \%$ y $67,6 \pm 2,3 \%$ in the control group respectively ($p=0,372$). Seric vitamin D had an average of $28,6 \pm 7,3$ ng/mL in the experimental group and $24,8 \pm 5,4$ ng/m L in the control group ($p= 0,247$). The experimental group, in contrast with the control group showed a statistically significant increase ($p=0,035$) in postprandial thermogenesis in the MRR. Both groups showed a median in postprandial RQ of 1 ($p=0,848$), with preferential oxidation of carbohydrates. In this study, women that ingested a breakfast with high calcium concentration, presented a higher alimentary thermogenesis, but not a higher postprandial fat oxidation.

Keywords: fat oxidation, thermogenesis, calcium obesity, vitamin D

How do Undergraduate Mexican Students Use Their Knowledge about Nutrition and Health to Interpret Food Labels?

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The New Mexican Official Standard on front-labeling reopened concerns regarding usefulness and understanding of the claims and Nutrition Facts of food labels while triggering the necessity to further emphasize nutrition and health conceptions that national basic education was lacking until very recently. The aim of this study was to assess undergraduate students' understanding of food labels and evaluate knowledge about nutrition and health key concepts. 643 students from public and private universities in the state of Puebla were asked to respond a 27-item questionnaire. Front-labeling and Nutrition Facts were evaluated for understanding. Selected food labels were utilized to evaluate the Nutrition Facts panel. Discrepancy between degree of awareness and motivation to have an adequate food intake behavior was also assessed. Internet (online media and social networks) was the largest source where students learn about health and nutrition, followed by dietitians/nutritionists, physicians, and food labels. Main information they usually read in a label includes expiration date, brand, and generic product name. "Portion size" was a key information that most students didn't know what it means. Total content of calories, fat, and sugar, respectively, were very interesting claims for them. Students agree that food labels should be standardized and that important information is missing in many food labels such as health claims, recommended serving, and further information about the ingredients. With regards to Nutrition Facts, over 50% of the students failed on calculating the total content of fat or sugar per serving while nearly 60% succeeded on quantifying the servings per container. Almost 75% of students reacted positively with regards to front-labeling, arguing that it is more visible in the package and summarizes relevant information. Students were able to describe the meaning of an adequate food intake but 49.9% mentioned other substances as essential components of diet. As much as students demonstrate appropriate ideas regarding nutrition, are familiar with national guidelines for adequate food intake and state concerns about fat, sugar, and calories in food products, they are unable to use them when it comes to understand Nutrition Facts. In general, they agree that government should standardize food labels and support front-labeling.

Keywords: nutrition, nutrition facts, diet-health

Development of a nutritive and liking beverage as supplement for children's breakfast

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Breakfast is essential for children. In the morning, foods and beverages provide the necessary energy for cognitive and psychomotor activities. However, busy lifestyles and bad eating habits contribute for children to miss breakfast. The aim of this study was to develop a beverage with high nutritional value and sensory acceptance by children. The beverage formulation included natural ingredients as coconut water and pulp, amaranth flour, casein, honey, cocoa, vanilla and artificial chocolate flavor (1%). The amaranth flour was obtained by grinding toasted (103°C/15min) amaranth grains. The beverage-making process included homogenization of ingredients in coconut water at 63°C and a heat treatment at 85°C for 5 min. The beverage was packaged in sterilized bottles. The moisture, protein, fat, ash and total carbohydrates were determined by AOAC procedures. Direct methods for aerobic mesophilic bacteria, total coliforms, and fungus and yeast were used to evaluate the microbiological safety of the beverage. An acceptance test was conducted in 107 children (11.4±0.06 years) using a 7-points "smiling face" scale. Additionally, weight and height of children were recorded and BMI was calculated for each child. Food records were done using a questionnaire according to 24-hour recall method. Proximate composition was: moisture 82.5%, protein 3.5%, total fat 4.0%, ash 1.1% and total carbohydrates 8.9%. The food energy of 100 mL of beverage was 86 cal. The microbiological analysis showed a safe product according to the official regulations. The beverage was accepted from "like slightly" to "like very much" by 67.3% of the children (p<0.01). Malnutrition status was identified in 10.3% and overweight and obesity in 42.1% of the participants. Children that do not eat breakfast at home (NEBH) (10.3%) consumed lower dairy (p<0.01) and fruits (p=0.03) than children that eat breakfast (EBH). Children NEBH with overweight or obesity consumed lower dairy (p=0.01), breakfast cereals (p=0.03) and higher sweets and baked products (p=0.04) than children EBH with normal BMI. Finally, a beverage with important protein content and food energy similar to dairy products was obtained. The product is free -lactose and -conservative additives and may be a practical supplement for children's breakfast.

Keywords: beverage, breakfast, nutritive, liking, supplement.

Essential metals in some vegetables by atomic absorption

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The problem of modern food concerning its nutritional value has led to the knowledge of the content of vegetables which as well to provide fiber also includes essential metals for many metabolic reactions. The objective of this work was to determine metals such as copper, calcium, magnesium, iron and zinc, for these determinations some vegetables consumed in different geographical regions were selected. The selected vegetables were: chard, celery, watercress, broccoli, spinach, huauzontle, cactus, aloe, purslane and xoconostle, metals determined were: calcium, copper, iron, magnesium and zinc. Flame atomic absorption technique was used. Metal quantification was made by calibration curve. A vegetables sample was wet digested and metal content was determined, another sample was subjected to boiling and the filtrate were analyzed to quantify the essential metals. The results of the sample digested vegetables showed the highest amount of zinc, copper and magnesium in huauzontle; calcium and iron Purslane watercress. From the filtrate it was found that comparatively, the highest content of essential metals in vegetables were: magnesium and calcium in aloe vera and nopal; zinc in broccoli; copper and iron in chard and huauzontle.

Keywords: essential metals, atomic absorption, vegetables

Effect of Antioxidant Gallic Acid on the Replication of Hepatitis C Virus (HCV)

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Gallic acid (GA) is a phenolic compound present in natural sources including plants, fruits and vegetables. It has various applications in industry, where it is used mainly as an additive to prevent oxidative food deterioration. In addition, it is used in pharmaceutical industry as an intermediate for the manufacture of trimethoprim. Furthermore, it has various biological effects such as anti-inflammatory, antibiotic, cardiovascular protection, anticancer and antiviral. *Aim:* We investigated the effects generated by different doses of GA in HCV-replication, using the subgenomic replicon cell system (Huh7-HCV-replicon) that expresses HCV-nonstructural proteins. Cells were exposed to 100, 200, 300 μM GA at different times (0-72 h), then we evaluated GA cytotoxicity in Huh7 replicon cells by MTT assay. In addition, total RNA and proteins were extracted from treated and untreated cells (control). Expression levels of HCV-nonstructural proteins NS3 and NS5A proteins were evaluated by Western blot analysis and real time RT-PCR for each time. Furthermore, the effect of GA on HCV replication was also evaluated by RT-PCR. Experiments were performed in triplicate and analyzed using a Tukey test ($P < 0.05$). We observed that GA treatment did not produce toxicity in Huh7 replicon cells. The expression levels of NS3 and NS5A proteins were down-regulated by 200 μM GA, compared with the control without GA (40% and 50%, respectively). Furthermore, GA modulates virus replication (HCV-RNA) negatively, decreasing it 40% at 24-48 h at the concentrations of 100, 200 and 300 μM GA. *Conclusions:* These results suggest that GA treatment reduces *in vitro* HCV protein expression and HCV-RNA replication, causing a transcriptional and translational effect by modulating expression of proteins involved in viral cycle, as NS3 and NS5A nonstructural proteins, without affecting cell viability. For this reason GA could be consider a potential natural adjuvant in the treatment of chronic HCV infection. No conflicts of interest between authors. Work supported by CONACYT- BASICA-CB2010-01-155082 to AMRE and FONCYT-COECYT-COAH-2002-C08-C37 to JAMC.

Keywords: antioxidant, Hepatitis c virus, gallic acid

Nutritional and Nutraceutical Potential of Cold Press Safflower Oil from Mexican Varieties.

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The objective of this research was to assess variation of the total phenolic compounds, α -tocopherol (α -T) content and fatty acid composition in a set of six safflower varieties (oleic and linoleic types) seed cold press oils. The polar phenolic compounds in the oils were isolated by extraction with methanol and the concentration of total polyphenols was estimated using the Folin–Ciocalteu reagent. Using gallic acid (GAE) as standard. The α -tocopherol content was determined by high-performance liquid chromatography with a diode array detector (HPLC-DAD), the compounds were separated on a Discovery HS-C18 column with gradient elution of formic acid 0.015%, acetonitrile and methanol and the detection wavelength was 293 nm. The fatty acid composition of the seed oils was analyzed by simultaneous extraction and methylation followed by gas chromatography–mass spectrometry (GC-MS) injection. All determinations were conducted in three independent experiments. The data were analyzed by one-way analysis of variance (ANOVA) followed by Tukey's range test using STATGRAPHICS program. Values with $p < 0.05$ were considered significantly different between the samples. Our results show that total phenolic compounds and α -tocopherol contents of the seed oils ranged from 14.98 ± 3.87 to 27.46 ± 4.03 mg GAE/100g and 148.92 ± 2.66 to 214.26 ± 4.96 mg α -T/kg, respectively; being the linoleic types the highest in these contents compared to the oleic type's varieties. Moreover, saturated (SFA), monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA), palmitic acid (C16:0; 10.07%–10.52%), oleic acid (C18:1; 3.32%–70.29%) and linoleic acid (C18:2; 24.18%–83.98%), respectively, were found predominant; as expected the linoleic types were predominant in their linoleic acid content and the oleic types in oleic acid content. Overall, these results indicate that safflower seed oils being rich in α -tocopherol, could be a valuable source of natural antioxidants, and safflowers could be an alternative oilseed crop in Mexico, used in production of cold press oil as a valuable source of bioactive compounds that impart functional food and natural antioxidant properties.

Keywords: Safflower oil, cold press oil, phenolic content, tocopherol, fatty acids

Expression of Starch Biosynthesis Genes and Its Relationship with Endosperm Modification in Quality Protein Maize.

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Quality protein maize (QPM) was developed by introgression of modifier genes that convert the soft endosperm of the *opaque-2* (*o2*) mutant into a vitreous phenotype. Previous studies using recombinant inbred lines (RIL) derived from the cross between K0326Y-QPM and W64A*o2* suggested that *o2* endosperm modification is associated with alterations in starch physicochemical and structural properties. The aim of this study was to determine the expression at the transcript and protein levels of starch biosynthesis genes and its relationship with the vitreous phenotype of QPM. RNA was extracted from developing endosperms (20 and 30 days after pollination, DAP) of the parental lines and RILs contrasting in kernel virtuousness and the genotype of SSR markers linked to this trait. The transcript levels of six starch biosynthesis genes (*Bt2*, *Sh2*, *Wx1*, *Ae1*, *Su1*, *Zpu1*) were determined by qRT-PCR. Starch granules and their associated proteins (SGAP) were isolated from developing (20 and 30 DAP) and mature endosperms (50 DAP). SGAP were separated by electrophoresis and quantified by densitometry. Starch and amylose contents were determined using commercial kits. One way analysis of variance (ANOVA) and the Fisher test were performed with a $P < 0.05$. At 20 DAP, opaque genotypes showed the highest transcripts levels for *Bt2*, *Wx1*, *Ae1*, *Su* and *Zpu1*, as well as a greater accumulation of granule-bound starch synthase I (GBSSI), which is encoded by *Wx1* and is responsible for amylose synthesis; this corresponded with the higher amylose content observed in opaque endosperms. However, an opposite effect was observed at 30 DAP, vitreous genotypes showed the highest transcript levels and greater accumulation of GBSSI. The highest transcript levels of the *Wx1* gene corresponded with the greater accumulation of GBSSI and amylose in vitreous endosperms at 30 DAP and mature stage (50 DAP). The results of this study suggest that endosperm modification in QPM is associated with higher expression of starch biosynthesis genes at the transcriptional and protein levels, resulting in granules with higher amylose content that may favor their packing and the vitreous phenotype.

Keywords: Quality protein maize, endosperm modification, starch, gene

Expression of Genes Encoding Starch Biosynthetic Enzymes and Storage Proteins in Chickpea Genotypes

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Chickpea (*Cicer arietinum* L.) is the second most important legume in the world and represents a good source of proteins and carbohydrates for human nutrition. The accumulation of these components changes during seed development and their contents in the mature seed usually show a wide variability associated with the genetic diversity of chickpea, which is useful in breeding programs. The analysis of gene expression in multiple chickpea genotypes represents a strategy to identify functional markers for traits of interest. However, transcriptomic studies in chickpea have been focused mainly on stress-related genes. The aim of this study was to determine the expression at the transcript and protein levels of genes encoding starch biosynthetic enzymes and storage proteins in chickpea genotypes. Flours were prepared from mature seeds of two desi and two kabuli genotypes and then used to determine starch content and composition, storage protein profiles and starch granule-associated proteins (PAG). RNA was also extracted from developing seeds (30 days after anthesis) to analyze the expression of genes encoding starch biosynthetic enzymes and storage proteins by qRT-PCR. Data was analyzed by one way analysis of variance (ANOVA) and the Fisher test ($p \leq 0.05$). Starch (36.7-43.2 g / 100 g flour) and amylose content (20.6-29.5 g / 100 g starch) varied significantly among the genotypes. Granule-bound starch synthase, an enzyme responsible for amylose synthesis, was the most abundant among the PAG and its accumulation correlated with amylose content. The storage protein profiles showed that globulins (legumin 11S and vicilin 7S) were the most abundant in all genotypes, whereas the albumins fraction showed the greatest variability and higher accumulation of lipoxygenase in desi than kabuli genotypes. The transcript levels of genes related to amylopectin synthesis, starch branching enzyme (SBE) and isomylase 1 (ISA1), were lower in genotypes with higher amylose content. In general, higher levels of transcripts and proteins were observed for lipoxygenase and legumins in desi genotypes. The results suggest the potential use of these genes for the development of molecular markers in breeding programs.

Keywords: Chickpea, Gene Expression, Starch, Protein

Nutritional Profile of Moringa (*Moringa oleifera*) Leaves

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The aim of this study was to determine the macronutrient content of *M. oleifera* leaves. The dried leaves were ground sprayed in an analytical mill until the particle size passing through the 110 mesh screen and was stored in a cool, dry place until use. A proximal chemical analysis was realized according to the official techniques; humidity at 110 ° C, ash by incineration in muffle at 550 ± 1 ° C, crude protein by Kjeldalh method, lipids by Soxhlet method and carbohydrates were calculated by difference from the other macronutrients. Each determination was performed in triplicate and expressed as mean ± standard deviation. The energetic content of *M. oleifera* leaves was calculated according to according to Mexican standards and reported in KJ and Kcal. It was found that the leaves of *M. oleifera* contain 14.67 % moisture, 20.65 % protein, 3.21 % lipids and 60.69 % carbohydrates. These values were compared with other foods. The results suggest that the nutrient content of leaves of *M. oleifera* it is similar to other traditional foods, and are a good source of proteins and therefore constitute an alternative to prepare nutritious food source.

Keywords: *Moringa oleifera*, proximate analysis, energetic content

Activity of Starch Biosynthetic Enzymes and its Relationship with Endosperm Modification in Quality Protein Maize

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Quality protein maize (QPM) was developed by the conversion of the soft *opaque2* (*o2*) endosperm into a vitreous phenotype. However, the biochemical bases of endosperm modification in QPM are still poorly understood. Previous studies using the lines K0326Y-QPM and W64A*o2* suggests that this modification is associated with alterations in starch properties as a consequence of changes in the expression of starch biosynthesis genes. The aim of this study was to analyze the activity of starch biosynthetic enzymes and its relationship with the vitreous phenotype in QPM. Endosperms from the K0326Y-QPM and W64A*o2* lines were obtained after 20 and 30 days after pollination (DAP). Extracts were prepared to evaluate the activity of ADP-glucose pyrophosphorylase (AGPase), granule bound starch synthase (GBSSI), soluble starch synthase (SSS), starch branching enzyme (SBE) and pullulanase (PULL). Starch granule associated proteins (SGAP) were separated by electrophoresis and quantified densitometrically. Starch and amylose content were also determined. Data were evaluated by one way analysis of variance (ANOVA) and Fisher test at $p \leq 0.05$. At 20 DAP, the vitreous line (KY0326Y-QPM) showed higher activities of SBE and PULL than W64A*o2*, while GBSSI and SSS showed non-significant differences; AGPase activity was higher in W64A*o2*, which corresponds with higher starch content observed in this line. At 30 DAP, the QPM line showed higher activities of GBSSI, SSS and PULL than W64A*o2*, while AGPase showed non-significant differences. The activity of GBSSI, the enzyme responsible for amylose synthesis, corresponded with the greater accumulation of the protein and the higher amylose content observed in the QPM line; SBE activity was higher in W64A*o2*, which corresponded with the higher amylopectin content of this line. The results show that changes in activities of starch biosynthesis enzymes are associated with changes in the starch content and composition. Starch granules with greater proportion of amylose may favor their compaction and contribute to the vitreous phenotype in QPM.

Keywords: Quality protein maize, endosperm modification, enzymatic activity, starch

Bromatological Evaluation of Corn from Polyembryonic Genotypes Grown at Two Different Environments

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Maize (*Zea mays* L.) is the most important ingredient in the Mexican diet which is utilized in different forms such as tortillas, bread, tamales, among many others. On the other side, polyembryony is a characteristic that can be advantageous in maize because multiple embryos may increase protein and oil content, and reduce amount of seed utilized per crop unit. Therefore, the objective of this study was to compare the environmental effects (population density and fertilization) over the bromatological quality of two genotypes of polyembryonic maize (both in individual and polyembryonic form) against conventional maize. The material was obtained from 2 different assays: 1) a yield experiment, and 2) a population density and fertilization experiment. Analyses of lipids, ash, and crude fiber were performed according to the AOAC protocols. Results in experiment 1 (E1) showed that the genotype NAP-PE (polyembryonic) had the greatest percentage in lipids, while the conventional maize Caiman had the lowest value. Besides, it is observed in the crude fiber analysis that NAP-PE had also the greatest percentage, being AE-IND (individual) and AE-PE those that showed the lowest values. In the experiment 2 (E2), treatments were evaluated just for the genotype AE. First the treatments with low population density and low fertilization versus low population density and high fertilization were compared; and then the treatments with low fertilization and low population density versus low fertilization and high density population. The statistical analysis (ANOVA) showed that there are no significant differences between any of the treatments mentioned in the E2. Moreover, comparing the results from E1 versus E2, it is observed that lipids in E2 are lower than genotypes in E1; in contrast, percentages of ash and crude fiber were lower in E1 against E2. In conclusion, NAP-PE had the greatest values in lipids and crude fiber (ash showed no statistical differences for any of the genotypes) in E1; while treatments for genotypes in E2 had no statistical differences also in the three analyses performed. Nevertheless, posterior analyses are programmed for a better comparison for each genotype in both experiments.

Keywords: maize, polyembryony, bromatological analyses

Antioxidant Activity and Color in Refrigerated Pork Meat with Different Qualities of Intramuscular Fats

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The objective was to determine the changes in the antioxidant activity and in color during storage of pork meat with different intramuscular lipid profiles. Loins from 60 pigs with the same weight (100 ± 3.5 kg) and fed with one of three different diets rich in unsaturated fatty acids C18:1, in C18:1+C18:2 and C18:1+C18:2+C18:3. Therefore, for each treatment, there were 20 loins. Each loin was cut in chops of 2.5 cm and placed in Styrofoam trays covered with self-adhesive PVC film. The trays with the chops were stored up to 9 days in refrigeration conditions (4 ± 0.4 °C), every three days a chop from each loin was taken, for a total of 5 samplings. The changes of color with a Hunter colorimeter (L^* , a^* and b^*), pH with a puncture electrode, ferric reducing antioxidant power (FRAP), inhibition of the radical DPPH, and the activity of the antioxidant enzymes catalase (CAT), and glutathione peroxidase (GPx) were determined. The data was analyzed with mixed procedures (PROC Mixed) of the statistical package SAS®. Every evaluated parameter had the expected change during time ($P < 0.0001$). The pH, color parameters (L^* (luminosity), a^* (red) and b^* (yellow)), and the activity of the GPx enzyme not differences between chops of Treatments ($P > 0.39$). The DPPH activity was higher (14.97% inhibition, SEM=0.32) in the meat with C18:1, and equal between the meats with C18:1+C18:2 and C18:1+C18:2+C18:3 (13.12% inhibition, SEM=0.45). FRAP activity was higher in the meat with C18:1+C18:2+C18:3 (12.84 eqTrolox/g meat, SEM=0.63) vs 11.00 eqTrolox/g meat, SEM=0.54. Only the activity of the CAT enzyme was different between Treatments, higher for the meat with C18:1+C18:2 (171.57 U/g, SEM=4.72). Even though different lipid profiles were present, the quantity of intramuscular fat was low (<1.5%) in order to affect the antioxidant activity and color stability. Some of the variables might be muddled by the microbial growth during storage (microbiological analysis was not planned). The evaluation of the antioxidant activity by itself, cannot completely explain the changes during storage of meat with different lipid profiles; it is indispensable to complement with lipid and protein oxidation evaluation.

Keywords: unsaturated fatty acids, pork, quality, antioxidant activity

Effect of a natural plant extract added to diets for dairy cattle on productive performance

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Feed additives based on plant extracts are considered a technical and economic alternative to replace another growth promoter. The use of these products in animal nutrition has some advantages such as the safe use due to their low residues in animal edible products. The aim of this study was to evaluate the effect of the consumption of a plant extract on productive performance in dairy cattle. Twenty heifers, 8 months confirmed pregnant, were allocated randomly into two groups: the control group (CG; n=10) received regular diet only and the experimental group (EG) received the regular diet added with a plant extract after calving daily for 305 days. Body condition (BC), feed intake (FI), milk production (MP), physicochemical properties of milk (PHPM), feed efficiency (FE) and cost of production (CP) were assessed in both groups. Data were evaluated via Analysis of variance (ANOVA) and Tukey's multiple range test (SAS, 1999). There were not significant differences between groups regarding to BC. Conversely, significant differences ($P < 0.05$) were observed in: FI (CG: 38.8 ± 5.7 kg/cow/day vs. EG: 29.8 ± 4.9 kg/cow/day); MP (CG 26.3 ± 3.7 L/cow/day vs. EG: 27.1 ± 2.5 L/cow/day); FE (CG of 1.39 ± 0.5 kg feed/L vs. EG 1.02 ± 0.52 kg feed/L). Also PHPM values were better in EG than CG. Therefore, in this study, the addition of a plant extract to animal feed showed benefic effects on productive performance and over milk quality, without evident impairment on nutritional status or animal health.

Keywords: Plant extracts, production parameters, dairy cows, feed intake.

Metabolite Production During *In Vitro* Colonic Fermentation of Indigestible Fraction Isolated From Istmo Totopos And Two Commercial Nixtamalized Corn-Products

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Diet is a major factor driving the composition and metabolism of the colonic microbiota. In Mexico, nixtamalized products are widely consumed. However, there are no reports addressing the production of metabolites during the colonic fermentation of their indigestible fraction. The aim of this work was to determine the chemical composition, resistant starch (RS), dietary fiber (DF), and changes in antioxidant capacity (AOX: DPPH and FRAP), pH, and short chain fatty acids (SCFA: acetic, propionic and butyric acid) during *in vitro* colonic fermentation of indigestible fraction (IF) isolated from a traditional corn-product (Istmo Totopos “IT”) and two commercial nixtamalized corn products (corn tortillas “CT” and baked toast “BT”). With this aim, IFs were isolated after withstanding a simulated *in vitro* gastrointestinal digestion, and it was used as substrate for *in vitro* colonic fermentation using a human fecal batch culture model, sampling at 12, 24, and 48 h. Fermentation extracts were characterized by gas chromatography–mass spectrometry analysis using a headspace solid-phase micro extraction technique. Significant differences ($p < 0.05$) were found on pH and AOX values and a time dependence was observed. The Δ pH (initial–final time) were 1.78, 1.83 and 1.85 for IT, BT and CT, respectively. The changes in pH observed in the corn samples may boost butyrate production and relative abundance of butyrate-producing bacteria. CT and BT presented the highest DPPH values at 24 h of fermentation (60.21 and 53.21 mmol TE/gIF, respectively). Thus, microbial metabolites and IF composition can influence the AOX. Total SCFA production was higher for CT (1123.72 mmol·L⁻¹) at 48h, which was similar to that found for raffinose, with an increased production of butyric acid in CT ($p < 0.05$). The structural features of RS in the samples may be of importance for the amount and proportion of SCFA production. Nixtamalized corn-products may have positive effects on gut health.

Keywords: Nixtamalized corn-products, Colonic fermentation, Microbial metabolites, SCFA production, Gut health

Effect of High Pressure Cooked on the Nutritional Composition and *in vitro* Bioaccessibility of Phenolic Compounds of Two Common Bean (*Phaseolus vulgaris* L.) varieties

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In Mexico *P. vulgaris* consumption is about 10 kg/pp year. It is a recognized worldwide edible legume because of its nutritional features and bioactive substances, such as phenolic compounds (PC). However, the beneficial effects of these compounds depend on their bioaccessibility and bioavailability. After cooking, the beans are commonly ground or ground-frying to be consumed, and the preparation of the beans could modify the bioaccessibility of PC. The aim of this work was to evaluate the effect of food preparation; grounded (G) and grounded-frying (GF) on nutritional composition, indigestible fraction (IF), available starch (AS), resistant starch (RS), hydrolysable polyphenols, condensed tannins (CT) and total soluble polyphenols (TSP), antioxidant capacity (AOX) (ABTS, and FRAP), and *in vitro* bioaccessibility of PC in two varieties of common beans 'Azufrado' (A) and 'Negro Jamapa' (NJ) cooked to controlled pressure (15 psi). Repeated measures design with four treatments was used. The treatments were as follows: G-A, G-NJ, GF-A, and GF-NJ. The IF and RS contents for GF-A and GF-NJ treatments were higher (≈ 40 and 5%, respectively) than for G-A and G-NJ treatments ($p < 0.05$). These results suggest that consumption of ground and fried beans could increase the concentration of short-chain fatty acid (products of RS fermentation) in the colon. Moreover, GF-A showed the highest TSP content (4.35 mg GAE/gDW). Besides, the highest AOX values were obtained for G-NJ as evaluated by ABTS (95.46 mmol TE/gDW) and FRAP (88.31 mmol TE/g DW). The decrease of antioxidant activity in fried samples could be attributed to Lipid-PC interactions. In that sense, bioaccessibility values for G-A and G-NJ were 53.58 and 48.44 %, respectively, and for GF-A and GF-NJ 39.36 and 31.00%, respectively. The food matrix and indigestible compounds may develop interactions that lead to reduced bioaccessibility of PC during the digestion process. The *in vitro* method is a predictive methodology to assess the potential bioaccessibility of PC in this commonly consumed legume.

Keywords: Bioaccessibility, phenolic compounds, common beans, indigestible fraction, resistant starch

Effect of the Intake of Guava (*Psidium guajava* L.) Puree on Biochemical Markers in Two Murine Models

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In recent years, has been strengthened the hypothesis about the healthy effects attributed to the consumption of tropical fruits, such as guava, and the decreased risk of develop non-communicable diseases such as hypercholesterolemia (HC) and hyperglycemia (HG). The aim of this study was to evaluate the effect of consumption of guava puree in biochemical markers in two murine models. Guava puree was provided by Purés y Derivados (Guava Sauce, Nayarit, Mexico), and analyses of indigestible fraction (IF), total soluble polyphenols (TSP), and antioxidant capacity (AOX, ORAC) were performed. The *in vivo* assay was conducted with Wistar rats provided by the Universidad Autónoma de Nayarit, animals were separated in three groups (n=5): healthy control, rats induced to HG by a single dose of streptozotocin, and rats induced to HC (cholesterol supplemented diet). The control groups were fed with a commercial diet. Treatment groups (HG and HC) were fed with the commercial diet plus 10 % of guava puree. After 4 weeks, the animals were euthanized (NOM-062-ZOO-1999), and blood samples were collected for determination of cholesterol, glucose, and triglycerides, and liver samples for analysis of histologic sections. The data obtained were analyzed using Statistical software (Version 10.0). The guava puree showed important values TSP (4.12 mg EAG / g FW), AOX (118.01 mmol TE / g FW), and IF (10.24 ± 0.70 g / 100g FW), higher values than those reported in complete guava fruits. In the *in vivo* assay, not significant difference (p> 0.05) was observed in the blood glucose concentration in both diseased models, and in HC group was observed a reduction (p <0.05) in cholesterol levels of diseased animals fed with the puree, compared to control animals. Meanwhile the analysis of histologic sections of liver showed a regenerative effect in both HG, and HC animals fed with the puree; this effect can be attributed to phenolic compounds of the puree, which have been associated with the induction of antioxidant enzymes, and induction of signaling to initiate cell mitosis in liver tissue, which can induce liver regeneration. Therefore we conclude that the guava puree can be considered a source of IF and phenolic compounds, and its consumption could contribute to the regeneration of liver cells.

Keywords: hyperglycemia, hypercholesterolemia, *Guajava psidium*, phenolic compounds

New breading process using two legume flour: chickpea (*Cicer arietinum*) and pea (*Pisum sativum*).

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New trends in food consumption and changing lifestyles have led to focused on seeking healthier food products which in addition to their nutritional intake, have a beneficial effect on health. Specially, fast food industry is actually looking for newer ways to maintain consumer's health. The aim of the present study was to find an adequate formula for a powder legume breading that in addition with a carboxymethylcellulose pasta base for meat and other food products could reduce oil uptake levels due to legume low porosity, increase product acceptability and nutritional qualities. The study was based on the use of carboxymethylcellulose (CMC) solution on some pieces of chicken nuggets as a coating product followed by breading with powdered dried legumes (peas and chickpea), finalizing with a conventional frying process. The intention was to measure oil uptake, cooking yield, juiciness and the acceptability of the final product. Also bromatological analysis was conducted for breaded product with different legume's flour. Comparisons between egg coating in addition with crumbs breading (Traditional breading) and CMC with chickpea flour and CMC with pea flour were made. A total of three samples were measured by triplicate. The obtained data was analysed using analysis of variance and Tukey's test with a 95% level of confidence. The results showed that CMC + chickpea breading had the highest ($p < 0.05$) protein content along with the highest level of juiciness. Nevertheless, CMC + pea breading showed the lower levels of oil uptake and the higher level of cooking yield. In the same way, there was no significative difference ($p > 0.05$) in overall acceptability between CMC + chickpea breading and traditional breading. It was concluded that CMC + chickpea breading is a better alternative for fried products due to its protein and nutritional content reducing oil uptake without affecting product's sensorial quality juiciness.

Keywords: carboxymethylcellulose, chickpea, pea, breading.

Rich Extracts in Betalaine Pigments Obtained from the Fruit of Garambullo using Ultrasound and Antioxidant Activity

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Currently the food industry is looking for alternative products as substitutes for food additives, such is the case of the dyes, which in many cases have become harmful to health for its synthetic origin. However, there are alternatives of natural source that can help compensate for this problem, one of which are the pigments obtained from plants, such as of betalains present in the Garambullo's fruit (*Myrtillocactus geometrizans*), which besides being a pigment can attributable to food sensory properties, possesses antioxidant activity. The aim of this study was to determine the content of betalains and color in three different extracts obtained by ultrasound. The fruit of garambullo was obtained in a local market the city of San Luis Potosi, Mexico; the sample was frozen and lyophilized for subsequent grinding. The betalains extraction was carried in aqueous condition, ethanol (10%) and methanol (80%) using ultrasound; in the extracts were determined the content of betalains by its fractions betaxanthins and betacyanins following the method of Nilson; also colorimetric study using a 3NH colorimeter was performed. Its antioxidant activity was determined by the ABTS method, for this analysis were used where 96-well microplates and a reader BioTek Synergy HTX Multi-Mode Reader. Each study was performed in five copies and analyzed by ANOVA for completely randomized design with a $p < 0.05$, statistical differences between the extracts were found, with the aqueous and ethanolic medium who presented higher content of betalains. Moreover, the three extracts showed magenta color tones according to the readings obtained by the colorimeter. Regarding the ABTS radical scavenging activity, the results show superior catches to 98%. Whereas the statistical results and the costs of extraction, it is convenient the aqueous extraction of betalains by ultrasound. Besides that no risk of toxicity and high nutraceutical potential than will be explored in future work.

Keywords: betalains, ultrasound, colorimetry

VI. POSTHARVEST TECHNOLOGY

Postharvest Quality of 'Persian' Limes (*Citrus latifolia*, Tanaka) Harvested at Different Locations in Sinaloa, Mexico.

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Mexican exportation of 'Persian' lime represents one of the main economies considering overall fruit and vegetable commerce. It is distinguished by seedless, oval shape, green-yellowish pulp, juicy, sour flavor and characteristic fragrance. In terms of fresh consumption, quality of 'Persian' limes is directly related to the skin green color, flavor and percentage of juice. Mexican growers supplies domestic and foreign markets as well, because cultivation is favored by the prevalence of positive climate conditions in several areas around the country. Among them, Sinaloa state has a strategic location, watering and climate for being a potential citrus supplier. In this work, the postharvest behavior of 'Persian' limes harvested at three locations in Sinaloa state was evaluated. Fruits were identified as A, B & C lots (north, center and south-center from the state, respectively). Determinations of weight loss, firmness, color (skin and pulp), pH, titratable acidity and total soluble solids were determined at 0, 7 and 12 days of storage under simulated marketing conditions (20°C & 70% RH). Morphological parameters (length, diameter, peel thickness and peel yield), bagasse and juice content were determined. Initial firmness was 56, 78 and 76 N for A, B and C lots, respectively. Spectrophotometric peel color measurement showed a slight evolution from 110 to 100 °Hue after 12 days in all lots, meaning a loss of green pigmentation. Lots A and C presented a higher fruit weight (110 and 121 g) and juice content (56 and 54%) respectively. Average of citric acid content was statistically different among locations with 6.4, 6.1 and 5.5% for C, A and B lots respectively. Soluble solids content was also different with 9.4, 8.2 and 7.9°Brix for A, C and B lots.

Keywords: Lime, quality, postharvest, flavor

Effect of Storage Condition on the Quality Attributes of Cherry Plum (*Prunus salicina* cv Moscatel)

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The aim of this work was to evaluate the effect of storage condition on quality attributes of cherry plum (*Prunus Salicina* cv Moscatel). Cherry plum was irradiated with UV-C (0.356 kJ/m²) in order to increase the bioactive compounds and antioxidant capacity, and reduce the microbial load. A 3² experimental design was performed with temperature (5, 15 and 22°C) and packaging (without packaging, perforated packaging and closed packaging) as factors. During the storage were evaluated some physicochemical (titratable acidity, total soluble solids, color, weight loss and firmness), antioxidant (phenolic compounds, total anthocyanins and antioxidant capacity), microbial (mesophylls and molds plus yeasts) and sensorial characteristics (with the storage condition that show the better results). It was observed that UV-C light significantly increases the phenolic compounds and total anthocyanins. Furthermore, cherry plums stored at 5°C and closed package showed a long shelf life, maintaining for 40 days the quality characteristics compared with other conditions that presented only 15 days of storage. On the other hand, a negative correlation was observed between color parameters (a and b) and total anthocyanins and antioxidant capacity. Sensorial attributes show that after 40 days of storage, cherry plums were evaluated in “like very much” in color and texture, while taste and smell parameters were moderate accepted. This study shows that the shelf life of cherry plum can maintain for 40 days without adverse effects on their overall quality.

Effect of Blue and UV-C Light Treatment on Physicochemical and Antioxidant Compounds in Hawthorn (*Crataegus mexicana*) During the Storage

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The aim of this work was to evaluate the effect of blue and UV-C light on some physicochemical characteristics and bioactive compounds of hawthorn (*Crataegus mexicana*) during the storage. In order to know the effect of both lights, an exploratory treatments were performed varying the doses of blue (2.9, 5.7, 8.6, 11.5, and 14.3 kJ/m²) and UV-C lights (0.7, 1.4, 2.0, 2.7, and 3.4 kJ/m²). Afterwards, one dosage of each kind of light and a combination of both were used to treat hawthorn and evaluate some physicochemical characteristics (color, titratable acidity and total soluble solids) and bioactive compounds (vitamin C, total flavonoids, phenolic compounds and antioxidant capacity) during 30 days of storage at room temperature. Exploratory studies indicate that 1 min of treatment with each lamp significant ($p < 0.05$) increases the vitamin C (15-17%), total flavonoids (27-49%), phenolic compounds (10-17%) and antioxidant capacity (4-16%) of hawthorn. During storage, it was observed that physicochemical characteristics were not significantly affected ($p > 0.05$) by treatments (compared to control). However, at the end of the storage, treatment with blue light plus UV-C maintained the total flavonoids and phenolic compounds, compared with control and other treatments. Treatments with blue and UV-C light may be used to increased bioactive compounds and antioxidant capacity in hawthorn.

Use of simplex optimization for performance evaluation of commercial coating mixtures based on weight loss in chayote (*Sechium edule*)

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Chayote (*S. edule*) is a fruit of great economic, social and nutritional importance in Mexico. Product quality allows exports to the United States equivalent to 8.76 million USD. It has nutraceutical properties as a diuretic, anti-inflammatory and hypotensive activity. Several studies are focused on improving shelf life and slowing down the metabolic processes occurring in the fruit. The aim was to optimize a mixture coatings focused on reducing the percentage of weight loss during shelf life. Three commercial coatings CYTECSA® (CT-50 SMG, TG and CT-50 CT-50 CAA) were evaluated in the percentage of weight loss of chayotes stored at room temperatures ($27^{\circ}\text{C} \pm 2.6^{\circ}\text{C}$) for a period of 30 days. Seven formulations were made using the method simplex lattice design. A control treatment was included for comparison. Comparisons between treatments were analyzed with a repeated measures design. The test LS-means clustering ($\text{Alpha} = 0.05$) showed that treatment with higher and lower weight loss were S50L50G0 (31.7227%) and S100L0G0 (12.6303%) respectively, the remaining treatments were similar in behavior to the control (23.3037%). The optimization with the simplex method indicated that the mixtures were not suitable because they have a high values in terms of weight loss. In conclusion weight loss was reduced in treatments where coatings were applied without mixing.

Keywords: coatings, optimization, weight loss, mixtures

Solid Lipid Nanoparticles Based Edible Coating for Preservation of Saladette Tomato.

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The objective of this work was to evaluate the effect of different edible coatings prepared with solid lipid nanoparticles (SLN) over quality parameters of saladette tomatoes stored in refrigeration. SLN were prepared with 100 g/L of Candeuba[®] wax and polyvinyl alcohol (50 g/L) and characterized evaluating particle size (PS), polydispersion index (PDI) and zeta potential (ζ). For preparation of coatings, concentrations of 5 and 10 g/L of the SLN system were used (N5P and N10P) with 3 g/L of xanthan gum as support and a mix (50:50) of polyethylene glycol and glycerol as plasticizers (10 g/L). Tomatoes were washed, disinfected and drained to remove excess water, coatings were applied by immersion and then dried at room temperature, they were packaged in polystyrene containers and refrigerated at 12 °C being evaluated in a 26 day period where changes over physicochemical and mechanical properties (pH, acidity, soluble solids, color changes, lycopene concentration and firmness) of tomato were monitored and compared with a xanthan gum (GXS) coating batch; ANOVA of two factors was performed. Colloidal systems were of nanometric size (779.10 ± 5.47 nm) with a PDI = 0.18 ± 0.0029 and stable ($\zeta = |24.07| \pm 0.06$ mV). It was observed that N10P coating presented a better functionality for retarding color changes along storage time; brightness (L^*) remained constant with values between 27 to 36 and showed the better appearance; also presented the smallest variation in parameter a^* with values between 40 and 45, and a constant behavior along storage time respect °h with values between 34 and 38. According to firmness, N10P batches showed a homogeneous and lower decrease with values of 25 to 20 N. All batches presented a pH increasing (4 to 4.5) and acidity decreasing (between 0.5 y 0.8 %) along storage time and soluble solids between 4.5 and 5.5 °Brix. Lycopene content grew in all batches being lower in N10P coating (7.5 to 12.5 mg 100 g⁻¹ pulp) which can be related with changes in parameters a^* and °h. SLN based edible coatings are an effective alternative for preservation and extension of shelf life of tomatoes.

Keywords: Edible coating, fresh tomato, Candeuba[®] wax, color changes, firmness

Extending Shelf Life of Papaya 'Maradol' After Cold Storage by Using Low Dose of 1-Methylcyclopropene (1-MCP)

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Papaya is a highly perishable fruit with a short shelf life which causes major postharvest losses during long distances transportation. In order to manipulate an extended shelf life of papaya 'Maradol' at the time of color uniform, fruits were treated with ethylene alone or in combination with the potent ethylene inhibitor 1-Methylcyclopropene (1-MCP) after harvesting at maturity $\frac{1}{4}$ (20-25% of skin yellow color) and then grouped into three lots for treatments application. Control (untreated), ethylene (100 $\mu\text{L/L}$ for 8 h at 20°C) and ethylene plus 1-MCP (100 $\mu\text{L/L}$ of ethylene plus 50 nl/L of 1-MCP for 12 h at 10°C) were included in this experiment. Treated and untreated fruits were then stored at 10°C and 90% RH for 10 days to simulate refrigerated transport condition to long distances distribution. After that, fruits were placed under simulated marketing conditions (20° C and 70% RH) for 5 days. Fruit firmness, external and internal color, weight loss, soluble solids, titratable acidity, pH, sugars, and organic acids were evaluated. Statistical analysis was performed with a randomized two factors design. Data was analysed by ANOVA and when needed, comparison by Tukey's test were applied (5%) using software Minitab ver. 17. After 10 days of cold storage, fruits treated with Ethylene plus 1-MCP retained firmness up to 5 days under simulated marketing conditions, maintaining acceptable fruit quality for 3 additional days (> 20 N) compared with control or ethylene only treatments. Significant differences in weight loss, flesh and skin color and total soluble solids were observed among treatments. No differences were obtained in titratable acidity and pH, sugars and organic acids. Papayas treated with ethylene plus 50 nl/L of 1-MCP can reach long distances markets extending shelf life and preserving desired quality characteristics as skin color development, flesh firmness and sugar content.

Keywords: Fruit softening, postharvest quality, shelf life

Effects of Poly(Vinyl Acetate) Coatings Added with Chitosan in Mexican Acid Lime (*Citrus aurantifolia*, S.).

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Population growth, global food demand, and postharvest losses have generated searching for alternatives and new technologies to increase food availability, extending the shelf life of fruits and vegetables. One of the technologies with increasing acceptance is coating of horticultural products. The most interesting compound that has been used in the formation of coatings is chitosan (oligosaccharide). Chitosan's performance in coatings can be improved by adding new compounds in the formulation. In our group, good results have been obtained using polyvinyl acetate (PVAc) latex in fruit and vegetable products. Thus, the aim of this study was to evaluate the effect of PVAc latex coatings added with chitosan on postharvest quality and shelf life of fruits. The study was conducted at the Departments of Plastics in Agriculture and of Polymerization Processes at the Research Center for Applied Chemistry, during the summer of 2016 in Saltillo, Coahuila (Mexico). Commercial fruits of acid limes (*Citrus aurantifolia* S.) were washed, dried and weighed, and subsequently coated with a thin layer of PVAc (with or without chitosan) applied manually and air dried. Fruits were stored at 4 °C in an environmental chamber (LAB-LINE, 680-A, Benchtop Environ Cab) and at 25 °C (room temperature). Four fruits in each of the treatments were employed in triplicate. Treatments were: 1) uncoated, 2) PVAc coated, and 3) PVAc + chitosan (2%) coated. Fruits were evaluated every 7 days during three weeks. The evaluated parameters were: weight loss (WL), color (L*, a*, and b*), juice extracted, titratable acidity (TA, citric acid), pH, and total soluble solids (TSS) of juice. At 4 °C, PVAc – coated fruits yielded the lowest weight loss within the allowed limit (<5 %, p=0.0022). Uncoated fruits turned their color from green to yellow, an undesirable feature in acid limes. pH was maintained in the range from 2 to 2.5 (p=0.295396). At 25 °C, fruits treated with PVAc had higher TA (p=0.0042) and better yields to SST (p=0.0047), desirable in acid limes. PVAc coating is a good choice for storing the acid limes postharvest. PVAc + chitosan coating did not improve the properties of PVAc.

Keywords: Coatings, Polyvinyl acetate, Chitosan, Postharvest quality, Shelf-life.

Determination of Antioxidant Capacity and Bioactive Compounds in Mango Peel Subjected to Hydrothermal-calcium Treatment before Storage at Low Temperature

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Mango is a climacteric fruit which ripens quickly after harvest. The storage at low temperatures allows reducing its metabolic activity increasing its shelf life. The adaptation process of the fruit to low temperatures begins in peel, causing activation of a response mechanism in order to prevent oxidative stress and cell damage. Previous studies showed that application of hydrothermal treatment (HT) for short times generate a moderate stress in the fruit that prepare it for a greater stress, generating the accumulation of bioactive compounds and changes in the antioxidant system. However, the application of a heat treatment often produce tissue softening, so the use of calcium salts could be a good alternative to maintain postharvest quality and also to increase the biological activity of mango. Therefore, the aim of this study was to evaluate the changes in antioxidant capacity and bioactive compounds in mango peel which received a hydrothermal-calcium treatment before storage at low temperature. Mangoes cv. Keitt in mature-green stage were separated in 4 lots (Control, HT (46.1°C, 75 min), calcium lactate (Ca, 0.5% w/v) and HT-Ca) and stored for 30 days at 5°C. Data were analyzed by ANOVA and Fisher's LSD. Deterioration index, firmness, phenolics, flavonoids, carotenoids and antioxidant activity (ABTS and DPPH) were evaluated every 10 days. Results showed that HT and HT-Ca presented the lowest deterioration index during storage. Ca and HT-Ca presented the highest retention of firmness during storage. Total phenolics were reduced in all treatments obtaining HT and HT-Ca the highest values. On the other hand, HT-Ca treatment presented the highest reduction in total flavonoids content, losing 68.6% of its initial content. Total carotenoids showed a reduction for all treatments except for Ca which increased during the first 20 days of storage. With respect to antioxidant capacity, HT showed an increase in activity in both assays obtaining the highest values at day 30, while HT-Ca presented the lowest activity in ABTS and Ca in DPPH assay. Results indicated that the application of HT was more effective to reduce deterioration and to increase antioxidant activity; also it maintained the higher contents of bioactive compounds.

Keywords: Hydrothermal, calcium, antioxidant activity, bioactive compounds, low temperatures.

Sequential application of two hydrothermal treatments in mango fruit. Effect on quality and induction of tolerance to chilling injury

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Storage and postharvest distribution of mango involve the use of low temperatures, unfortunately this product is susceptible to chilling injury (CI), which is a physiological disorder which occurs in many fruits and vegetables as a result of their exposure to low temperatures. CI symptoms reduce the quality of the fruit and generate great economic losses. Recently, this physiological disorder has been related to the increase in oxidative stress. Hydrothermal treatments (HT) have shown to reduce CI symptoms in mango fruit and are quarantine protocols established for commercial exportation. Also, it has been reported that the application of two HT help to maintain the quality and to decrease CI symptoms, as well as to activate the antioxidant system. The objective of this study was to analyze the effect of the sequential application of two HT on the induction of tolerance to CI, physiological indices and antioxidant system in mango stored at low temperatures. Mature-green fruits were divided in 4 lots: one was used as control, a second received a HT1 (46.1°C, 75-90 min), another received a HT2 (55°C, 5 min) and the last one, HT3, was subjected to a sequential application (HT1+HT2). All were stored at 5°C for 30 days and then at 21 °C for 8 days for the development of CI symptoms. CI index, electrolyte leakage (EL) and malondialdehyde (MDA) content and antioxidant system enzymes (superoxide dismutase, catalase and ascorbate peroxidase) were measured using a completely randomized design and the means were compared by Fisher test ($\alpha=0.05$). CI index increased in all treatments during storage but HT3 presented the lowest values. For EL, HT3 had the lowest increase at low temperature while for MDA the values were not significantly different. Superoxide dismutase, catalase and ascorbate peroxidase enzymes had the highest increase in fruit treated with HT3. The application of a double sequential hydrothermal treatment is a viable alternative to induce chilling injury tolerance in mango fruit stored at low temperatures, as well as to activate antioxidant system enzymes.

Keywords: Chilling injury, hydrothermal, antioxidant system, mango.

Transcriptional Analysis of Genes Associated with Chilling Injury Tolerance Induced by Hydrothermal Treatment in Tomato Fruit

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Tomato (*Solanum lycopersicum* L.) is susceptible to chilling injury (CI) when is exposed to temperatures below 12 °C; this physiological disorder results in several symptoms that affect the fruit quality. Hydrothermal treatments (HT) have shown to reduce CI symptoms in tomato fruit, but the molecular mechanisms involved are poorly understood. This tolerance was associated with differential accumulation of proteins involved in heat stress, antioxidant system, energy metabolism and regulation of gene expression in tomato fruit cv. Imperial; however there is no information about changes in gene expression related to CI tolerance in this commercially important tomato cultivar. The aim of this study was to analyze the expression at the transcriptional level of genes encoding proteins associated with CI tolerance induced by HT in tomato fruit cv. Imperial. Mature-green tomatoes were divided into two lots, one of which received a HT (42 °C, 5 min) and the other was used as control; both lots were stored at 5 °C for 20 days and then at 21 °C for 7 days for the development of CI symptoms. CI index (CII), electrolyte leakage (EL) and malondialdehyde (MDA) content were measured to evaluate the effectiveness of HT; the transcriptional analysis was conducted by qRT-PCR. One way analysis of variance (ANOVA) and the Fisher test were performed with a $P < 0.05$. HT fruits showed significantly lower values of EL, MDA and CII than non-treated fruit after the storage at 5 °C and ripening period. This reduction in CI parameters corresponded with increased expression of genes encoding heat shock protein (*HSP17.6*), antioxidant enzymes (*SOD*, *APX*, *TPX*, *GST*), xilose isomerase, glycine-rich RNA-binding protein (*GR-RBP*), phytoene synthase (*PSY*) and ACC oxidase (*ACO*). Non-treated fruits showed higher incidence of CI symptoms and increased expression of genes for enzymes involved in energy (TPI, MPP) and cell wall (PG) metabolism. The results suggest that CI tolerance in HT tomatoes is associated with up-regulation of genes encoding proteins for heat and oxidative stress, which may be working together to maintain the cellular homeostasis and membrane integrity, preventing CI symptoms such as uneven ripening by up-regulation of genes involved in carotenoids and ethylene biosynthesis.

Keywords: Tomato fruit, chilling injury tolerance, hydrothermal treatment, gene expression.

Effect of edible coatings with nanocomposites NPs-Ag- Chitosan in minimally processed strawberry

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Nowadays, nanotechnology has quickly emerged as one of the most promising and attractive research fields in food industry. Nanoparticles and nanocomposites may contribute to barrier properties and functionality of coatings for fruit preservation since these systems show an increased surface area. Actually, submicronic systems allow better distribution and homogeneity on the fruit skin with several advantages for various applications and uses. Fruits and vegetables are living tissues subjected to quality changes after harvesting. The loss of strawberries can reach 40% during storage. In order to investigate the effects of nanocomposite edible coatings on shelf life and quality characteristics of strawberry fruit, an experiment was conducted with two types of chitosan: from *Cherax quadricarinatus* (QL) and commercial chitosan (Sigma-Adrich) (QC). They were synthesized chitosan-silver nanocomposites (NPs-Ag) by reducing AgNO_3 with NaBH_4 in a microwave reactor (CEM, 908005). The NPs-Ag-QC / NPs-Ag-QL obtained are added to the dispersions formed by biopolymers QC or QL (1.5%) in a ratio 1:40, stirred for 24h. It dipped strawberries, stalks, washed and sanitized (NiconPQ) in the edible coatings (QC, QL, QC-NPs-Ag-QC, QC-NPs-Ag-QL, QL-NPs-Ag-QL and QL-NPs-Ag-QC) and stored at 10 ° C to facilitate dry /120 min, then were packed in polystyrene bags at 4 ° C. Sanitized only strawberries were used as a blank and not sanitized strawberries as control. Was analyzed color (Minolta CR-400; CIE-L*, C_{ab}* and h_{ab}*), decay rate (Arbitrary scale; 0 undamaged 5 high damage), texture (Texture analyzer; TAXT2; skin firmness (N) and elasticity (mm)) and weight loss (%) at 7 days of storage. Decay rate, color, skin firmness and elasticity of the strawberries (uncoated and coated with the six different edible coatings) not show statistical differences at the end of storage possibly although in this period not damage tissue collapse, presence of micelle and apparent dehydration are recorded (7 days). For the weight loss was significantly higher for control, blank samples (>10% with respect to initial weight 0 day), samples coated with QC-NPs-Ag-QL and QL-NPs-Ag-QL registered weight loss of 10% possibly due to an increase in the permeability of water vapor of both edible coatings, all other coated strawberries reported weight losses of ≤ 4%.

Keywords: Nanocomposites, Edible coatings, Chitosan, Minimally Processed, Strawberry

Characterization of Bioactive Compounds, Vitamins and Dietary Fiber in Five Species of Mango Peel

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The study of non-common *Mangifera* species is of the interest in Florida International University and Fairchild Tropical Botanic Garden, this species from Asiatic-Southeast are under characterized, and the interest in the study of mango peel as a by-product is related with their nutritional features and bioactive compounds. The objective of this work was to evaluate some bioactive compounds, vitamins, and dietary fiber (DF) in mango peels of 5 species: *M. casturi*, *M. lalijiwa*, *M. odorata*, *M. zeylanica*, and *M. indica* 'Tommy'. The analyses performed were: chemical composition, total dietary fiber (TDF), vitamins B, C, and E, total soluble polyphenols (TSP), hydrolyzable polyphenols (HP), and antioxidant capacity (AOX); all data were expressed on a dry weight (DW). Univariate random design, ANOVA and LSD Fisher test ($\alpha=0.05$) was used. The results in protein content varied from 7.89-10.80%, lipid 2.74-4.83%, ash 3.64-5.22% and carbohydrates 27.32-58.10%, having *M. casturi* and *M. zeylanica* higher values due to differences in peel metabolism. TDF, *M. odorata* presented 71.28%, insoluble DF content was higher than soluble DF, because the contents of cellulose, hemicellulose and lignin in the peel, besides *M. indica* 'Kent' showed the highest soluble DF. *M. indica* showed 280.26mg/100g DW in vitamin C, although; vitamin E in *M. casturi* had 86.02mg/100g DW. A minimum content of vitamin B was observed, probably influenced by soil conditions and light intensity. TSP, *M. casturi* highlighted with 20.60 g GAE/100g DW, corresponding this species with the highest AOX for ABTS, DPPH and FRAP with 4252, 615 and 1560 mmol TE/g respectively; the peel of this specie has purple pigments. HP content was, *M. lalijiwa* with the highest amount (1.76g/100g DW). HP in *M. indica* has been identified in terms as the higher polyphenols in mango peels. In conclusion, the species studied showed variability in the profile of bioactive compounds and AOX with values higher than the common *M. indica*. In vitamins C and E, in the peel of *M. casturi* the highest values were found. Vitamin B was identified in all peels where data had not been reported before. *M. casturi* TSP and AOX indicative of compounds having higher functional interest to those reported for most studied *M. indica* specie.

Keywords: Mango peel, *Mangifera* species, nutritional compounds, bioactive compound.

Comparison between Two Different Methyl Jasmonate Postharvest Treatments Protocols In The Aroma Compounds Production Of Papaya (*Carica papaya* L. cv 'Golden').

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The Brazilian papaya production corresponds to 12,5% of the worldwide production. The maintenance of these fruits under low temperatures (10°C) during the exportation to Europe and the USA may damage the volatile compounds of the aroma. Since methyl jasmonate (MJ) is already described in the literature as a plant hormone that can increase the volatile compounds in fruits and vegetables, many different protocols has been studied. The aim of this work was applying methyl jasmonate by the evaporation method in the concentration of 10 ppm during 24h and evaluate its effects in the fruits. The first protocol include one single application and the second one includes two applications of MJ - one application with the unripe fruit and the other one using the same fruits already ripe. It was verified some differences between both groups. When compared to the control group that was not treated with MJ, the fruits treated seem to be more attractive and the peel was greener than the control fruits. There were some differences between the volatile compounds evaluated in both fruit groups. Fresh volatile aroma from heptanal, 1-heptanol and isoamyl butirate were detected in the protocol with two MJ applications and it was not detected in fruits treated only once.

Keywords: papaya, volatile, aroma, methyl jasmonate.

Avoiding Berries Decay throughout Hydrothermal Microwave-Assisted Treatments

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Berries are fruits highly appreciated by their color, flavor and recently by their antioxidant activity, due to the presence of important biocompounds, such as phenolics and anthocyanins. However, these fruits are highly perishable, and attacked by molds even at temperatures under 5°C. In order to avoid mold decay during refrigerated storage, hydrothermal microwave-assisted treatments were developed for raspberry (*Rubus idaeus* L.) and blackberry (*Rubus adenotrichus* Schldtl.) fruits. Four batches of each berry were studied, one batch was left untreated (control), the other three, were immersed in water (berries 100 g in tap water 200 g) and treated in a microwave oven at 270 W, 380 W or 470 W power. Berries in water were heated to a target temperature of 48°C, maintained for 4 min; according to Villa-Rojas *et al.* 2012, *Botrytis cynerea* is controlled under this conditions in strawberry puree. Immediately, fruits were transferred into ice cold water for 1 min. Target temperature was reached at 60, 75 and 90 s for 270, 380 and 470 W, respectively. After the treatment, berries were stored at 7°C in ventilated trays. pH, titratable acidity total soluble solids, firmness, color and content of anthocyanins, phenolic acids and flavonoids compounds were analyzed. Anthocyanin contents decreased after the application of microwave treatment in both berries at all conditions studied ($p < 0.05$). In raspberry, higher contents of total phenolic compounds were achieved after 8 days of storage, being higher in berries treated at 270 and 380 W in comparison to the control fruits ($p < 0.05$). After 15 days of storage, berries treated with microwaves did not show mold presence; pH was significantly higher in berries treated at 470 W ($p < 0.05$). The better treatment for both berries was the one at 270 W, under these conditions mold presence was prevented, berries did not show changes in the physico-chemical properties and preserved their biocompounds contents.

Keywords: raspberry, blackberry, microwave treatments, postharvest treatments, biocompounds

Activity Pattern of Lipoxigenase Enzyme and their Putative Isoforms from Chayote (*Sechium edule* Jacq. Sw.) Fruit During Shelf Life Period.

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The aim of this work was evaluate the lipoxigenase (LOX, linoleate:oxygen reductase, E.C.1.13.11.12) enzyme activity from chayote fruit and their putative isoforms, in relation to physiological changes that affect the ripening, sprouting and senescence process during shelf life period. The fruits were harvested at 18-21 d after anthesis, and then, measurements were made each four days to reach 29 d in postharvest. The enzyme activity was measured according to Gökmen *et al.* (2002) by spectrophotometric assay of LOX. The determination of molecular weight (by SDS-PAGE) and the identification of putative isoforms in polyacrilamide gels (zymograms) was made according to Rojas *et al.* (2014). In addition, correlation analysis were carry out for physiological and biochemical variables (CO₂ and ethylene production rate, volume and weight losses, lipid profile, total solids contents, pH, trititable acidity, color changes -L, Hue and Crome- and fruit firmness). The results showed positive correlation coefficients between the LOX enzyme activity and the variables volume and weight losses, linolenic and linoleic acid contents, which were associated to speedy dehydration, sprouting and senescence of chayote fruits. In our study, this changes presumably may be regulated in chayote fruit by five putative isoforms of LOX detected in the zymogram. Each isoform shown different activity patterns during shelf life period. We propose the name *Se*LOX for each discovery isoform. In this sense, *Se*LOX-1 were assigned to the principal isoform that display activity during whole postharvest life. *Se*LOX-2, 3, and 4 were assigned to actives isoforms between physiological maturity and germination (sprouting). Meanwhile, *Se*LOX-5 was given to isoform that turn up specifically during senescence stage. The partial characterization of this isoforms of LOX shown changes in their activities in function to pH and temperature levels, as well as the source of plant tissue (root, steam or leaves).

Keywords: LOX isoforms, Enzymatic assays, Non-Climacteric Fruit, Postharves physiology.

***In vivo* Antifungal Activity of Chitosan-PCA Nanoparticle Biocomposite Against *Aspergillus niger* on Tomato (*Solanum lycopersicum* Roma)**

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Currently nanotechnology has made its way into the design of systems with application in pest control and post-harvest diseases. In its formulation it has been sought to use compounds with low environmental impact and low toxicity, as example, chitosan and compounds of microbial origin. The aim of this study was to evaluate the antifungal effect of chitosan biocomposite-ácidopirrol-2-carboxylic acid (PCA) on the growth of *Aspergillus niger* (NRRL-3) on tomato. To carry out the test tomato *Solanum lycopersicum* 'Roma' was selected because of its composition. Prior to the study, the fruits were disinfected with sodium hypochlorite (NaClO) to 1.5%. Subsequently, 10 healthy fruit were selected for each treatment (380, 760 and 1140 $\mu\text{g} / \text{mL}$ CS-PCA) and for controls. A fruits was wounded with a bodkin (2 mm deep and 2 mm wide) at the top of the fruit. 10 mL of each of the treatments were placed by a hand sprayer on the surface of each of the tomatoes (10 fruits per treatment). Finally, 30 μL was inoculated with a suspension 1×10^6 spores/mL of *A. niger*. Storage was performed at 25 °C and 80-95% RH in a growth chamber (Novatech, CA-550) with controlled humidity and temperature; where every two days of storage the lesion diameter was measured on each fruit using a Vernier caliper to calculate the percentage reduction of the severity ($\alpha = 0.005$). The results show the concentration of 760 $\mu\text{g}/\text{mL}$ was able to inhibit the average diameter of injury compared to control ($p < 0.05$) until the fifth day storage, also has an effect in reducing the number of infected wounds for nine days storage. Therefore the biocomposite CS-PCA is emerging as a preventive treatment with potential to inhibit growth of *Aspergillus niger* postharvest tomato.

Keywords: Postharvest; *Aspergillus niger*; Antifungal; Nanoparticles; Chitosan

Chemical Markers Study by ESI-MS During the Roasting Coffee Process.

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The coffee roasting process can be approached from the mechanical point (type of roaster), thermal (heat transfer mechanisms to the coffee bean) and operational (batch, continuous, conventional and pressurized), these principles impact significantly on the final product quality. The roaster type most commonly used worldwide is the horizontal rotating drum, in Mexico only a few studies of their impact on aroma and flavor precursors have been made. The aim of this study was to investigate the effect of temperature profiles in a roaster horizontal rotating drum, on precursors, physicochemical properties and attributes in the coffee drink using the technique of mass spectrometry with electrospray ionization (ESI-MS). 3 profiles of temperature roasting were applied: P1 = 220, P2= 240 and P3 = 250 ° C to 3 degrees of roasting to batches of 3 kg of green coffee (*Coffea arabica* L.) from Huatusco, Veracruz, México. Metabolic profiles were determined in samples of roasted coffee by ESI-MS and a certified taster made a descriptive analysis to the drink obtained (scale 0-5). 40 chemical ions that allowed discrimination between the 3 profiles applied were selected. The P3 showed a different chemical map than P1 and P2, and was the one that showed greater impact on color changes. Among the most important differential ions were: m/z 195 (caffeine); m/z 176 (trigonelline, adducts K +); m/z 138 (trigonelline protonated); m/z 104 (malonic acid protonated) and m/z 94 (alkylpyridines). The attributes of the drinks that showed greater changes were acidity, bitterness and astringency, when high temperatures are used. These results can be explained due to thermal degradation of some compounds as trigonelline, lipids and esters generating compounds such as malonic acid and variation in concentration of caffeine during temperature changes tested. It is possible to set chemical markers of roasting process by ESI-MS study in non-volatile fraction of coffee, that impact the sensory proprieties in the drink.

Key words: Coffee, Rotating Cylinder, ESI-MS and Sensory Analysis.

Impact of Turning and Temperature During Cocoa Beans (*Theobroma cacao* L.) Fermentation on the Sensory Attributes

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To ensure the good quality of cocoa is important a good farming management including adequate post-harvest practices (fermentation and drying). In Mexico the ways to ferment are carried out in empirical way, this originates the obtaining of cacao with different quality and high variability. The consistency of the quality wished in the fermentation process, demand the suitable development of essential events such as the anaerobic and aerobic stage of the cocoa fermentation. The objective of this work was to study the effect of mixing in the semi-industrial cocoa fermentation on wood boxes of 100 kg of capacity, on the physicochemical characteristics and the sensory attributes in green bean. Three fermentation protocols (P1, P2, P3) were proposed with different number of mixings (3-5) and intervals between mixings (each 24h or 48h), the samples were analyzed and the pH tests, total and volatile acidity, cut test, ammoniacal nitrogen, humidity and sensorial analysis of the green beans cacao were realized. The end of the anaerobic stage was at 24.65 ± 1.9 h with a temperature of 34.2 ± 1.2 °C. The results obtained were compared with the NMX-F-352-S-1980 standard. The quality of the fully fermented beans was assessed visually by using the cut test. Cocoa beans of good quality were produced in in the P2 and P3. All protocols yielded beans with volatile acidity elevated mainly the P3, which is the most used by the producers in Mexico. The sensory evaluations showed 18 descriptors that built the aromatic profile of the cocoa studied, identifying flavors like: chocolate, dairy, vinegar, sugar and honey. The present study revealed a high influence of turning on the final quality of the fermented beans.

Keywords: *Theobroma cacao* L., Fermentation, Sensory Analysis.

Effect of Seasonality and Storage Temperature on *Rigor Mortis* Energetic Processes Produced in the Adductor Muscle of Lion-paw Scallop

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The effect of seasonality, storage temperature (0, 5 and 10°C) and transportation on the main metabolites related to *rigor mortis* energetic was evaluated. Adenosine 5'-triphosphate (ATP), adenosine 5'-diphosphate (ADP), adenosine 5'-monophosphate (AMP), glycogen, arginine phosphate, and arginine in the adductor muscle of lion's paw scallop *Nodipecten subnodosus* were determined during storage (48 h). Also, adenylate energy charge (AEC) for recently collected and *post* transport organisms in the four seasons of the year were measured. The season affected all metabolites, except arginine. Transport only affected the concentration of ATP and level of AEC in spring, summer and autumn, as well as the concentration of ADP and AMP in spring and autumn, respectively. At 0°C, ATP concentration was lower than at 5 and 10°C. Season didn't show an important impact on the metabolites over the storage. Energetic levels at 5 and 10°C are related with a beneficial delay on *rigor mortis* development.

Keywords: *Nodipecten subnodosus*, seasonality, temperature, *rigor mortis*, energetic processes

Physicochemical Characterization of Fruits of Jaltomate (*Jaltomata procumbens*) From Three Locations of Michoacán

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The *jaltomate*, *tomate de arena* (tomato of sand) or *pichecua* (*Jaltomata procumbens* (Cav.) J. L. Gentry) is a kind of native plant of the Solanaceae family that grows inside of the Mexican state of Michoacán. For several years, the fruits of this plant have been used in the elaboration of sauces and consumed fresh during the period of rains (august to november), actually the plant is threatened by increased of agricultural areas. Recently some investigators has been studied the effect of the gibberellins in the germination of seed's from this plant, and although the plant was described completely, there are no studies about the physical and chemicals properties of his fruits. For this reason, the principal objective of this work was evaluated the physical, chemicals and proximal properties of the jaltomate. For them, protocol proposed by the AOAC (2002) for fresh fruits was followed. It was determined the longitudinal and equatorial diameter, weight, quantity and weight percent of seed's, shelf-life, moisture content, color, dry weight, juiciness, soluble solids, caloric content, titratable acidity, pH, percentage pulp, protein content, fat content, ash determination, etc. The parameters were compared with the properties of fruits from the commercial Solanaceae plant Cherry Tomato (*Solanum lycopersicum* L.) and the fruits of the also wild plant *tinguaraque* or wild tomato (*Solanum lycopersicum* var. *cerasiforme* D.M. Spooner). Preliminary results show that the caloric content of the *jaltomate* fruits is higher than the tinguaraque and cherry fruits, also the dry content, juiciness and shelf-life. In factors like soluble solid, the jaltomate fruits were higher than cherry tomatoes, but lower than tinguaraque fruits. For this reason, the jaltomate is a fruit with economical potential for his trade and the plant it's apt to be proposed in breeding programs and conservation.

Keywords: tomate de arena, pichecua, Solanaceae, wild plant, bromatological analysis

Texture Profile Analysis of Parthenocarpic Fruits Mango 'Ataulfo'

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Parthenocarpic mango fruit are seedless fruits, from a size 2 to 3 times less than normal fruit and a high content of soluble solids. These fruits has a lower economic value because it does not meet the standards of the norm, commercialization is limited to national and local market. Parthenocarpy in mangoes fruit has reached an incidence of 27.3 % up to 54.2 in Nayarit and Guerrero. These fruits represent a technological challenge, which requires prior characterization to define their use. The aim of this study was to characterize parthenocarpic mango fruits 'Ataulfo' through a texture profile analysis (TPA). During a TPA test samples are compressed twice using a texture analyzer TA.XT. plus using one compression plate of 75 mm in diameter at a speed of 2 mm / s, up to 20 % compression, a waiting time between compression stages 10 s. TPA parameters are hardness, elasticity, cohesiveness, gumminess, chewiness and resilience. 100 experimental units (5 batches of 10 normal fruits and 5 batches of 10 parthenocarpic fruits) at maturity, which were stored at 24 ± 1 ° C in an incubator low temperature for 5 days were used. The tests were performed every 24 h for 5 days. ANOVA analysis and Tukey test using the software SPSS v.22. The textural characteristics showed a rapid decline in their behaviour until mangoes got ripened and thereafter, the decline became almost constant indicating the completion of ripening. However, the rate of decline in textural properties was significantly less in normal fruit. The hardness was the parameter that showed highest significant changes.

Key words: Texture Profile Analysis, mango, parthenocarpic fruit

Antioxidant Capacity and Postharvest Quality of Strawberry Using Edible Coatings

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Strawberry fruit (*Fragaria × ananassa* Duch.) is recognized by its nutritional composition (vitamin C, total phenols and anthocyanins), antioxidant capacity and sensory properties (color, texture and flavor). This fruit is consumed fresh and its postharvest life may decrease by factors such as temperature mainly and the presence of microorganisms, which cause up to 20 % of losses. Therefore, it is necessary to implement postharvest technologies able to slow down transpiration, reduce mechanical injury and inhibit microorganisms, and at the same time, compatible with the environment. In this regard, edible coatings of chitosan combined with plant extracts and essential oils might be an important alternative due to its not toxic effects on environment and human health. The aim of this research was then to evaluate the postharvest quality of strawberry treated with a coating of 0.4% chitosan + 0.02% + cinnamon essential oil + hibiscus flower extract (15 g·100 mL⁻¹). Fruit were placed in clamshells and stored at 5±1 °C for 16 days. The study also included a group of non-treated fruit. Each group contained 18 experimental units with 100 g of fruit. Weight loss, soluble solids content (SSC), titratable acidity, color and antioxidant capacity (% reduction of DPPH[•]) were evaluated. Experiments were arranged in a completely randomized design. Results indicated that the applied coating allowed a twofold increase in postharvest life of strawberry (16 days) and 20% less SSC than control group. Weight loss, titratable acidity, color and antioxidant capacity did not show significant differences ($P \leq 0.05$) compared with control fruit. The applied edible coating may be an appropriate technology for this fruit, since it extended strawberry storage life and delayed ripening.

Keywords: chitosan, hibiscus extract, canola oil, cinnamon essential oil

Influence of Maturation Stage on the Physicochemical Composition of Ginger Cultivated in the Northern Highlands of Puebla (Mexico)

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Ginger is native to the tropics of Southeast Asia and has been naturalized in countries like Mexico. The aim of this work was to determine the physicochemical composition of ginger cultivated in the northern highlands of Puebla, through official techniques, in order to know changes attributable to different stages of maturation. Fresh rhizomes of organic and freshly harvested ginger were analyzed in three stages of maturity: 3 months (3M), 5 months (5M) and 8 months (8M). The physical characterization (size, weight, volume and number of branches) of ginger rhizomes analyzed was conducted to determine the caliber of the samples as established by the *Codex Alimentarius*. The external color of ginger rhizomes was measured instrumentally using a HunterLab colorimeter. The proximate composition of ginger was carried out using official AOAC techniques. Quantification of minerals was performed by atomic emission inductively coupled plasma (ICP). Finally, the chemical compounds present in the essential oil of ginger were determined by Proton Nuclear Magnetic Resonance (1H-NMR). Regarding the results of the physical analysis, ginger variety grown in the northern highlands of Puebla is smaller compared to the standards established by size in the *Codex Alimentarius*. The chemical composition varies with the state of maturation; as it noted an increase in fiber content. The ginger essential oil extracted revealed a mixture of compounds of terpene type. The stage of maturity seems to have no influence on the components of the essential oil; however, the chemical composition is affected.

Keywords: *Zingiber officinale*, Chemical composition, Essential oil.

Effect of Quality of Tomato Fruits Grown Under Three Different Shade Nets and One Plastic Cover

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Internal and external quality of fruits are highly variable depending on the interaction of numerous factors, such as the same genetic variety, environmental factors and cultural practices. Of these factors, environmental have the advantage that can be controlled by grown under protected environments. Among protected environments used for growing tomatoes, we can highlight the shade nets, since it is possible to manipulate the radiative levels through shading degrees inherent to each type of net. Therefore, the aim of this study was to evaluate the effect of using 3 different shade nets (gray, black and crystal) and a plastic cover compared to open field cultivation on the quality of tomato fruits. A randomized design was used with five treatments and four replications. Statistical significance of the effect of treatments was estimated by ANOVA 5%, followed by Duncan test. Three different samples were taken for the analysis of fruit quality variables. The variables assessed were: firmness, color, lycopene, pH, vitamin C, °Brix, citric acid and maturity index (°Brix/titratable acidity). Additionally, photosynthetically active radiation (PAR) and temperature inside shadehouse structures were monitored. The results show that plastic cover and the 3 shade nets: crystal, black and gray reduced the PAR in 66%, 59%, 40% and 35% respectively with respect to control (open field). With respect to the variable lycopene content, all treatments showed significant difference from control having higher values. However the concentrations vary depending of the date of sampling ranging from 14.3- to 21.2 mg/100gr. Showing that both the quantity and quality of light, are crucial factors for high concentrations of lycopene. Firmness and pH showed no significant difference between treatments. The greatest accumulation of °Brix was for plastic cover (7.49). For vitamin C, the crystal net had the highest accumulation with 8.72 mg/100 g. Finally, the maturity index were higher for gray and crystal nets, indicating that it was the treatments with the sweeter fruits. In general, the results indicated that the three shade nets and the plastic cover, reduced radiation and modifies the temperature inside structures; altering the microclimate and therefore the quality parameters of the tomatoes fruits evaluated.

Keywords: shade nets, microclimate, tomato quality, protected environments

VII. SENSORY EVALUATION

Characterization of Artisanal Goat Fresh Cheese of the Central Region of Veracruz

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The aim of this scientific work was to characterize the goat cheese analyzing the interaction between production systems, climate factors, milk quality and sensory properties of the cheese and consumer preference. The study revealed that the goat fresh cheese of the central region of Veracruz is ingrained to territory and his manufacturing shows similarities with European fresh goat cheese with respect to the starter culture, pressing used and type of salted and it differentiates for the use of natural rennet from the stomach of the calf and the use of pasteurized milk in its manufacture. The two models established by Regression Partial Least Square technique coupled to Multiple Factor Analysis showed that the production system influences directly on the physicochemical characteristics of the cheeses and indirectly on color, texture and sensory parameters, which explained their preference and classification. Through this scientific work the potential of goat fresh cheese produced in this area to achieve a distinctive brand was established in terms of its characteristics of typicity.

Keywords: artisanal cheese, preference, causal models

Influence of Manufacturing and Cultural Contexts on the Performance of Trained and Consumer Panels for Sensory Profiling of Traditional Goat Cheese.

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This research aimed to determine the best type of panel for sensory profiling of fresh and ripened traditional goat cheese. The evaluation of panels was based on sensory profiles and level of discrimination of trained and consumer panels performing under two cultural and manufacturing contexts. The panels used included panels two panels closely related to the production zone (Coatepec, Veracruz, Mexico) of traditional goat cheese (trained and consumers) and two panels (trained conventional and consumers) independent from de production zone (Veracruz, Mexico). The sensory techniques used were Flash profile and Quantitative Discriminative Analysis for consumer and trained panels, respectively. Comparison of the effect of cultural factor between consumer panels and also the comparison of manufacturing context between trained panels was performed using Generalized Procrustes Analysis (GPA) and Principal Component Analysis. The Hierarchical Multiple Factor Analysis (HMFA) technique was used in two levels (level 1= comparison among all panels and level 2=comparison between panels of two zones) for comparing the sensory profiles generated by all panels according to their zone. The confidence ellipses were used to differentiate the panels according to their power for sensory discrimination. Results from GPA indicated the cultural context influenced the consumer panels but did not affected the trained panels where the PCA technique also revealed similar sensory profiles between these panels. The HMFA results indicated that panels from the same zone generated similar sensory profiles. Confidence ellipses revealed a higher discriminative power in panels with training and a higher appropriateness of these panels for characterization of traditional goat cheese.

Keywords: Flash profile, GPA, HMFA, QDA, PCA

Physical and Sensory Quality of Precooked Bread Stored in Freezing

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The aim of this study was to determine the physical and sensory quality of precooked bread stored in freezing. The bread was prepared by the sponge and dough method, loaves are precooked for 15 min at 210 °C, cooled and placed in polyethylene bags. Half of the prebaked loaves were stored directly frozen at -4 °C, while the other half was frozen with liquid nitrogen and then stored at -4 °C. The storage was performed for 1, 2 and 3 months. The volume and the weight were determined in all precooked and cooked bread. The sensory analysis was realized in cooked bread. All tests were performed for triplicate. Analysis of variance and means were compared by the Duncan's test. In general the weight and volume of previously frozen pre-baked bread and nitrogen, showed significant difference $p < 0.05$ with baked bread stored directly in freezing during the 3 months of storage. Compared the volume and weight of the baked bread and previously frozen with nitrogen showed no significant difference $p < 0.05$ compared to control bread for 2 months storage. Weight loss and formation of a hard crumb texture of precooked and frozen bread with nitrogen was less than for breads subjected to slow freezing. The flavor and texture of bread that was baked and previously frozen with nitrogen showed no significant difference $p < 0.05$ with control bread. Overall global acceptance decreases for bread stored directly precooked and frozen. The rapid freezing with liquid nitrogen baked bread helped keep longer the characteristics of bread quality. This can be attributed to the formation of ice crystals of the masses stored in slow freezing that could have damaged the gluten network and contribute to deform the starch granules modifying the characteristics of the bread.

Keywords: Precooked bread, physical sensory quality, freezing

Physical and Sensory Quality of Steamed Bread

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Bread Chinese steamed is a type of bread cooked with steam. The objective of this work was to determine the effect of different concentrations of xanthan gum on the rheological properties of wheat dough, and physical and sensory properties of the steamed bread. Rheological tests of the doughs with different concentrations of xanthan gum (0.5, 1.0 and 1.5%) were determined using the Brabender Farinograph and Extensograph. Straight dough method was used to produce steamed bread. Once obtained the different dough, these were fermented for about 60 min at 28°C. Later the doughs fermented were molded and divided into ball shaped pieces and were placed at 28°C for 30 min in the fermentation chamber. Immediately after the dough pieces were cooked with steam for 10 minutes. The bread obtained was cooled to room temperature and stored in cellophane bags. The weight and the volume of bread were evaluated. Sensory analysis was performed and the internal and external characteristics of bread were determined also. All samples were tested in triplicate. Statistical analysis ANOVA was performed. At all levels of incorporation of xanthan gum the water absorption increased from 61.2 to 64.5 %, but the time of development of dough from 6.20 to 5.60 min, was reduced. The breaking time increased from 37.3 to 40.5 min, and the mixing tolerance index from 72.3 to 74.6 BU also. These showed significant difference ($P < 0.05$) compared to the control. The flavor of the breads made with different concentrations of xanthan gum no showed significant difference ($P < 0.05$) with the control. The characteristics as texture, symmetry, uniformity and the internal characteristics of the crumb, were improved in direct relation to the increase concentration of xanthan gum showed significant difference ($P < 0.05$) with the control. The shelf life of bread with added xanthan gum was extended from one to two weeks.

Keywords: Steamed bread, quality, xanthan gum, quality

Identification of Sensory Attributes Responsible for the Consumer Preference of Traditional Fresh and Matured Goat Cheeses

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The objective of this research was to identify the attributes responsible for the consumer preference of traditional fresh and matured goat cheeses from the central region of Veracruz, Mexico. The study was conducted in three phases: 1) Quantitative Descriptive Analysis (QDA[®]) was performed for characterizing products. Validation and representation of the sensory profiles was conducted with a 3-way ANOVA (product, judge and session with a product*judge interaction), Principal Components Analysis (PCA) and confidence ellipses at 95%. 2) Determination of consumer preference. The consumer test was conducted at the local market in Coatepec, Veracruz. Regular consumers of fresh (80) and matured (76) cheeses participated in the study. 3) Identification of attributes responsible for the preference was done using the External Preference Map technique (Prefmap) with a vectorial model. ANOVA results determined the panel was discriminant, consensual and repetitive, and validated the sensory profile of traditional cheeses. The PCA and confidence ellipses techniques confirmed both, fresh and matured, cheeses were correctly differentiated by the sensory panel. The Prefmap technique identified tact firmness, mouth firmness, goat flavor, goat aftertaste and fat aftertaste as responsible for the consumer preference of fresh cheese. Aroma attributes (goat, fermented, fruit, and wet wood), flavor (goat, fermented, and fungus) and salty taste contributed to the preference of consumers for matured cheeses. According to these results, aromas and flavors highly contributed to explain the preference of consumers for traditional cheeses in this study.

Keywords: Confidences ellipses, performance panel, preference mapping, pca

Typification of Matured Goat Cheese Produced in the Central Mountainous Zone State of Veracruz, México

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The climatic conditions of the mountainous region of the state of Veracruz, Mexico are favorable for the manufacturing of matured goat cheese. These type of cheeses is traditionally prepared in that region. However, there is limited information based on scientific studies revealing the typical sensory characteristics of that type of cheeses. The objective of the study was to typify the matured cheese from this region by studying the interrelations between climate factors, animal production system, analytical measurements and consumer preferences. Chesses used were sampled from the municipalities of Coatepec, Perote and Tatatila, Veracruz and had seven weeks of maturation. Analytical techniques included: microbiological analysis, physicochemical characteristics, color, texture, sensory characterization, and preference (76 consumers). The analysis of interrelation was conducted with causal models determined by Multiple Factor Analysis (MFA) and represented with Partial Least Squares Regression (PLS-path modeling). The models were validated with the GoF index. Microbiological analysis indicated that cheeses were safe for consumption. ANOVA indicated significant differences in physicochemical variables, color, texture, sensory and preference among municipalities. The PLS-path modeling analysis demonstrated the production system (semi-intensive) and feeding of goats results in variations in aromas and flavors. These sensory attributes where related with the preference of consumers in 55.3%. The results were supported by the GoF values of 0.66 and 0.68. In conclusion, aromas and flavors are responsible for the typical characteristics of this type of cheese and may be used as an evidence for pursuing a regional distinction from the Instituto Mexicano de Propiedad Intelectual.

Keywords: Multiple Factorial Analysis, PLS-path modeling, production system, preference

Sensory and physicochemical profile of Chihuahua cheese according to the consumer preferences

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The Mexican dairy industry has an important contribution in the economy of country. Chihuahua cheese is a typical dairy product that distinguishes to Chihuahua State. This cheese is the second cheese most consumed in Mexico by the particular characteristics in texture and taste. The aim of this study was to evaluate the sensory and physical-chemical properties of Chihuahua cheese, produced in Chihuahua State and determine the relationship with the consumer preferences. Ten samples of cheese produced in Chihuahua State were collected. The sensory characterization was performed using a descriptive analysis with a trained panel, which evaluated attributes in olfactory and gustative phase using a 9-point box scale. The physical-chemical analysis included the determination of pH, acidity, moisture, protein, fat, ash and total carbohydrates determined by AOAC procedures. Additionally, a protein profile of cheese was determined by SDS-PAGE. Preference ranking, with estimation of magnitude (15-point box scale), and acceptance tests (9-hedonic balanced scale) were conducted in 120 consumers of Chihuahua cheese. Data were analyzed by ANOVA with multiples comparisons of Fisher, Chi² and Friedman tests. The results showed variability in different Chihuahua cheese samples. This cheese was characterized by an odor in middle to middle-high intensity, with main descriptors such as fresh milk, boiled milk and melted butter; taste (sweet, sour, salty and bitter), firmness, moistness and fat-character had a middle-low intensity. Proximate composition showed a protein content at 17.6-21.4%, fat at 26.2-34.2%, moisture at 38.8-44.9%, sodium at 319.1-610.8 mg/100g, acidity at 0.27-0.91% lactic acid and pH at 5.8-6.5 (p<0.01). In protein profile of cheese predominated peptides at 24.0 to 34.7 kDa (estimated mass), and less than 10% of peptides were less than 12 kDa. Consumer preferences were directly related to the physico-chemical composition and sensory profile of cheese and three samples of Chihuahua cheese were the most preferred by the consumers (p<0.01). Sensory and physico-chemical models for Chihuahua cheese were established according to the consumer preferences. These models are a new strategy, and they may be useful tools for the standardization of the cheese as a product with recognized quality and acceptance.

Keywords: Chihuahua cheese, consumer preferences, sensory profile, physicochemical profile, cheese composition, profile models.

Sensory Optimization of a Food Product Based on Fail-to-Pop Kernels of Amaranth

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Amaranth is a grain with high protein quality that has been promoted for consumption in Mexico and other developing countries. Production of this grain has increased in the recent years. However, diversity of processed food products available in the market is still limited. The main thermal process for including amaranth in food products is popping of kernels in order to destroy anti-nutritional factors. Some kernels remain unpopped after this operation and are not used for the manufacturing of food products. The aim of the study was to develop a milkshake-like product based on unpopped grains of amaranth. A total of nine formulations were tested according to a three component (refined sugar, coffee and cocoa) simplex lattice mixture design. All formulations (dry ingredients) were composed with 60% unpopped amaranth flour and 40% with one of the nine combination of mixture components. The dry ingredients were blended with milk. A consumer study with 252 students was conducted for evaluating product acceptance and purchase intent with attributes such as appearance, color, odor, particle size, flavor, aftertaste and overall taste, by using a balanced incomplete block design. ANOVA results indicated consumers detected differences in appearance, particle size, flavor, and aftertaste among formulations. MANOVA confirmed these findings. Multiple logistic regression analysis identified flavor and aftertaste as critical attributes for product acceptance. Appearance, color and flavor were critical for purchase intent. Consumers preferred formulations with sugar and cocoa more than those with coffee. According to McNemar analysis, informing the consumer about the nutritional quality of amaranth has significant effect in shifting consumer responses for purchase intent from NO to YES. Using unpopped amaranth grains remained after popping for developing milkshake-like products is suitable when mixed with sugar and cocoa, and the consumer is adequately informed about the nutritional characteristics of the product.

Keywords: product development, amaranth, unpopped, optimization

Sensory characterization of Mexican chilli varieties *Capsicum annuum*

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Chilli pepper is an important product in the Mexican agriculture. This food has not been typified completely, generating unequal competition with similar imported products. The aim of this project was to determine sensory and physicochemical characteristics of most marketable *Capsicum annuum* varieties. Five fresh varieties of green-chilli (GC) (JN-jalapeño-cultivated in Chihuahua, P-poblano C-chilaca, B-bell pepper, JI-jalapeño-commercialized in USA) and 3 varieties of dry-chilli (DC) (Ch-chipotle, A-ancho, PS-pasilla) were selected. A descriptive analysis was realized by a trained panel of 10 judges, considering visual, smell, tactile and taste attributes. The sensory panel used a 150 mm liner scale labeled at the ends. Five random and balanced GC samples were presented to each judge. In visual attributes the panel used a Pantone® reference and the linear scale. For other attributes, the panel used eye-cover mask. The DC samples were evaluated the same way that GC, but only three samples were presented to the panel. Duplicate tests were carried out in individual booths. A physicochemical characterization was realized using AOAC procedures. Data were analyzed by ANOVA and t-Student tests. Differences were observed in GC and DC samples. P and PS had the higher color than other samples ($p < 0.01$). A sample had more brightness that Ch and PS ($p = 0.02$). JN and B samples were more firm ($p < 0.01$) and JN and PS were the smoothest samples by each group ($p < 0.01$). In odor, GC were described as fresh pepper, fresh herb and sweet, and DC was described as dry soil, spicy, and smoked. In taste, B was sweet and JN and Ch were spicier than JI and, A and PS, respectively ($p < 0.01$). Proximate composition for GC and DC was: moisture 92-95% and 8.2-9.1%, protein 0.7-1.4% and 8.7-13.6%, lipids 0.04-2.18% and 2.83-13.32%, ash 0.37-0.58% and 6.10-7.30% and total carbohydrates 4.4-5.9% and 60.6-63.5%, respectively. Acidity, pH and Aw for GC and DC were: 0.05-0.08 % and 1.1-1.7% ascorbic acid, 5.4-5.8 and 2.5-3.0, and 0.986-0.998 and 0.286-0.493, respectively. In conclusion, *Capsicum annuum* varieties evaluated had unique characteristics that distinguish from other domestic and imported varieties. Sensory and physicochemical profiles are important quality references for the national and international commerce.

Keywords: chilli pepper, *Capsicum annuum*, sensory profile, proximate composition.

Consumer Acceptability of a Prebiotic Ready to eat Pork Product based on Landscape Segmentation Analysis and Just About Right Evaluation

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Nowadays, consumers are seeking food products that can offer not only a nutritious characteristic but can promote health. Prebiotics have this characteristic and can be used as functional ingredients. Therefore a pork ready to eat product was designed using inulin in a 3 percent, so that it could be considered a functional food according to Mexican Regulations. Sensory analysis is nowadays used as a marketing tool for research and development of new products. Consumer acceptance of the prebiotic prototype was evaluated and compared to 5 commercial leading brands by 62 consumers through Landscape Segmentation Analysis (LSA) and Just About Right (JAR) through IFPrograms™. Attributes studied were: odor, color, acidity, chili sensation, salt, flavor, juiciness, and texture. CATA test (Check all that apply) was also applied and eight descriptors were analyzed, 4 of them considered positive: species odor, chipotle flavor, adequate firmness, natural color, and 4 of them negative: oxidative color, dryness, acid, and insipid. LSA (Subject R squared: 0.767497 and Product R squared: 0.998943) reveal that the prototype was near to the optimal regions which indicates that the prototype was liked, other factor considered is the descriptive information based on the attributes studied, all attributes except odor, flavor and texture have influence in the drivers of liking of the product ($\alpha \leq 0.05$). LSA results are in accordance to results obtained by JAR, where d value is calculated between the product and the ideal on each attribute studied, evaluating variance and probability. CATA in negative attributes was less than 35%, whereas positive attributes had more than 50%. Results reveal that the prebiotic prototype has a great opportunity to be scaled up and be sold commercially because it is accepted by consumers and also it is a prebiotic product that can increase health.

Keywords: Landscape Segmentation Analysis (LSA), Prebiotic, ready-to-eat, sensory analysis, functional food.

Comparison Between Two Types Of Seasoned Jerky Elaborated With Two Types Of Lean Meat: Rabbit And Chicken.

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Rabbit meat is classified in the lean meats group (like the chicken, turkey and fish) and it's a very nutritious food: it has a low fat content and a high content of vitamins, proteins and minerals. The objective of this project was the elaboration of a jerky-type snack with rabbit dry meat in a custom-made gas dryer. Two type of sauces were used to give a characteristic flavor to the snacks: one made with mustard and another made with paprika, the elaboration process basically consisted of three stages: marinated, pre-cooked and dried. A sensory analysis was made with the help of a trained panelists group (12 people of different ages, between 19 and 45 years) to determine the taste of the snacks, two snacks of dried chicken meat were also prepared in the same way (for comparison purposes). The panelists were asked to rate the taste of the four snacks, we used a triplicate assay and the taste evaluation scale was from 1 to 5; with the results, it was conducted an statistical analysis (consisted of an ANOVA test and an homogeneous groups test of Scheffe, both with a 95% significance, both tests were made in Statistica^{MR}); the results showed that there was not statistical differences between the taste of the snacks made from chicken meat and rabbit meat (for panelists who participated in the evaluation).

Keywords: Sensory analysis, jerky, rabbit.

Preference for Different Jamaica's (*Hibiscus Sabdariffa*, L.) Formulas Determined by the Rank-Rating Method

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Drinks obtained from jamaica's (*Hibiscus sabdariffa* L) calyces are an important source of antioxidants and are widely consumed in México. Some efforts for describing jamaica-beverage's attributes have been done but there are differences among them in the concentrations used to this purpose. Therefore, it is needed to identify the Jamaica-water concentration preferred by consumers in order to obtain a pleasant, strong enough beverage to perform sensory descriptive analysis with the beverages obtained from the calyces. In this study, the aim was to identify the calyces-sugar-water proportion most preferred by consumers for the consequent sensory descriptive analysis. Sensory evaluations were applied in two stages among 212 adult consumers in Pénjamo, Guanajuato. Eight formulas consisting in four concentrations of jamaica calyces (1, 2, 4 and 10% w/v) and two sugar concentrations (11 and 16% w/v) in water were prepared. Samples were presented at room temperature in plastic cups randomly coded and in a counterbalanced way. Subjects tasted 15 mL of each beverage, ranked the samples according with their preference and after that, rated them from the least to the most preferred in a 15-point numeric, structured scale. Kruskal-Wallis test was used for the ranking test, and one-way ANOVA was used for the rating test. Dunn's and Tukey's test were calculated for differences at 5% level. The rating data was treated as continuous and non-linear regression analysis was performed to determine the optimum calyces-sugar-water level. Two preference tests were conducted including 106 subjects each. The first preference test allowed to identify that the two most diluted-least sweet samples were positioned in the not preference area as well as rated the least [$F_{(7,840)}=29.32$; $P<0.0001$]. The second test showed that jamaica's 4 and 10% concentrations additioned with 16% sugar were the most preferred obtaining the highest ranks and rates [$F_{(5,630)}=21.83$; $P<0.0001$], but the ratings obtained by the jamaica's 4% concentration was slightly higher than the 10% concentration. This effect could be related with an u-inverse preference-jamaica's concentration curve. The results obtained in this investigation can be considered an effort to standardize jamaica's beverages concentration prepared for conducting a sensory profile.

Keywords: *Hibiscus sabdariffa*, beverages, preference, Rank-rating test

Food neophobia and general health interest and its association with food variety and a balanced diet

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Mexico has experienced a substantial change in obesity rates. One major causes are the negative changes in diet. A healthy diet consists of a variety and balanced diet. Different studies have showed that food neophobia is an important predictor of people's willingness to try variety foods, while consumers' interest about general health can influence their healthy eating. The purpose of this study was to examine the possible relationship between food neophobia and the interest in eating healthy with food-varied consumption. Participants (n=303, 18-55 years old) were from Guadalajara, Jalisco. They completed a questionnaire designed to measure their interest on healthy eating with the multiple scale labelled as 'general health interest'; their attitudes towards new food with the multiple scale of 'food neophobia' and their food intake. The impact of various socio-demographic variables on food neophobia and general health interest was examined using multiple linear regression analysis. The predictors were age, income, gender, and education. The model was significant ($F_{(4,298)} = 7.84, p < 0.001$) and explained 12% of the variance. Results of multiple linear regression analysis showed that age was positively associated with food neophobia and general health interest. Whereas, income and education were negatively associated with food neophobia. Results of the present study suggest that food neophobia and general healthy interest influences people's daily eating behavior. Persons with higher food neophobia scores consume smaller amounts of vegetables and less often fish compared with persons with lower food neophobia scores. It is also noted that, persons with lower general healthy interest scores tend to consume smaller amounts of fruits and vegetables, and more legumens compared with persons with higher general healthy interest. The findings of the present investigation indicate that food neophobia has a negative impact on people' food variety and on the consumption of recommended food.

Keywords: Food neophobia; health interest; eating behavior; Mexican consumers

Exploring the Influence of Extrinsic Attributes in a Regional Product: Case Study of Mezcal

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The selection and consumption of a food product may be affected by different extrinsic and intrinsic cues, and normally extrinsic cues are those that drive the initial product choice. In that sense, the relative importance of three extrinsic characteristics of mezcal was evaluated. The selected attributes were: alcohol content (38% V/V and 45% V/V); price (\$150.00, \$280.00 and \$548.00) and region of origin (Durango, Oaxaca and San Luis Potosí). 497 consumers from four cities in Mexico (Mexico City, the city with the highest level of mezcal consumption; Durango City, the capital of the fourth largest mezcal producer state; Guadalajara, where mezcal consumption is incipient and Oaxaca City, the capital of the largest mezcal producer state) having different levels of exposure and familiarity to mezcal assessed nine different product profiles. These profiles, obtained through an orthogonal design, combined the different levels of each considered factors and were presented in a random order. Multiple regression analysis was applied to determine the utility values for the different levels of attributes and the relative importance of these attributes had for participants. Overall, the region of origin was the most important factor, followed by price and alcohol. The Oaxacan mezcal had the highest purchase intention value meanwhile mezcal from San Luis Potosi showed the lowest scores. Four segments of consumers were found regardless of the city. The region of origin and the price were at the same level of importance in clusters 1 and 3 (50.1% of consumers), while the alcoholic content had the lower influence in the purchase intention for the participants. For the two remaining clusters, the region of origin was the most important factor followed by the price (49.9% of participants). The cluster 3 had significant higher number of women showed the strongest rejection towards the higher alcoholic content. The results of this study confirm the importance of identifying consumers segments with similar patterns of preference in order to develop oriented marketing strategies according to the characteristics of the product and the peculiarities of the target market.

Keywords: Extrinsic attributes, mezcal, consumers, utility values, relative importance.

Beef hamburger lean meat, Chia (*Salvia hispanica* L.) And Edible mushroom (*Agaricus spp*)

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The aim of this work was to develop a hamburger meat lean beef, mushrooms (*Agaricus spp*) as a meat extender and chia (*Salvia hispanica*) as a fat substitute. For the development of research an experiment design was proposed. Independent variables were amounts of lean beef, chia and mushroom, additives which the same amounts for each of the formulations, were used, with the response variable acceptance of the product, which was performed using a sensory evaluation. So it was necessary to make the selection and training of sensory evaluation panel, randomly selected 80 students from the Instituto Tecnológico Superior de Santiago Papasquiario, differentiation of flavors tests were applied, screening color and odor detection and finally the taste detection threshold, 30 panelists were selected, then they are advised on techniques for product evaluation and use of vocabulary. Sensory evaluation was applied to 8 proposed formulations, which consisted of an acceptance test (hedonic scale), with a scale of 1 to 9, where 1 means I like a lot and 9 I dislike very much, texture, color and flavor were evaluated. For results analysis was carried out a gap analysis (ANOVA) in which it was determined significant differences between formulations, after was made a Friedman test, with which it was determined which was the most widely accepted formulation for the statistical analysis program SSPS. Then the accepted formulation was developed for evaluation color odor, flavor, texture and aroma, which it was determined that what they liked most was the smell, secondly the smell, the third flavor and finally the color. Physico-chemical analysis to more acceptable formulation was made to finish.

Keywords: Sensory evaluation, hamburger, extensor, substitute.

Effect of Cattle Finishing Diet and Product Enhancement in Honduras to Improve Consumer Eating Experience of Beef Cooked to the Traditional Well-Done Degree of Doneness

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Honduran consumers traditionally prefer beef cooked to 77°C to mitigate food safety concerns in a minimally regulated meat production system. While cooking beef to a higher internal temperature does decrease the risk of foodborne illness, palatability characteristics are sacrificed. This study aimed to determine effect of enhanced steaks from different finishing diets to improve consumer palatability and perceived value. Locally available feedstuffs were used to develop seven Honduran beef finishing diets including, sugarcane (SC), dried distillers grain (DDG), palm kernel meal (PKM), palm kernel meal replication (PKMR), soybean meal (SB), soybean meal and poultry litter (SBPL) and grass finished control (CON). Striploins (n=210) were collected, and half from each treatment were enhanced (E) with water, salt and phosphate to 12% of the steak green weight, or non-enhanced (NE). Strip loins were fabricated and steaks were frozen at 21 d postmortem. Thawed steaks were cooked on clamshell grills to 77°C, portioned into uniform pieces and served warm. Untrained panelists (n=96) evaluated each sample for tenderness, juiciness, flavor and overall liking. Panelists always evaluated CON-E and CON-NE along with 6 (of the 12) other treatment samples. Willingness to pay (WTP) for each sample was rated in Honduran Lempiras, but reported as USD. Sensory data were analyzed using the GLIMMIX procedure of SAS as a split plot with diet as a whole plot fixed effect, enhancement as a subplot fixed effect, and panelists as the random effect ($\alpha=0.05$). A two-way interaction between diet and enhancement was observed for scores of all palatability traits, and WTP ($P<0.01$). For PKM, SB, and SBPL diets, consumers scored E samples greater ($P<0.05$) than NE for all traits and WTP, with the most noticeable increase from NE to E occurring for SB and SBPL. However, CON-NE were scored greater ($P<0.05$) than CON-E for all palatability traits and WTP. These results indicate that implementation of cattle finishing diets, in addition to enhancement of steaks, can improve the consumer eating experience and perceived value of Honduran beef while still achieving the preferred degree of doneness. This information can be used to further address improved food safety in value-added Honduran beef.

Keywords: Honduras, beef, consumers, grass-fed, enhancement

Changes of Odor Profile and Volatile Compounds of Fermented Sausage “Chorizo” During Ripening

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The flavor profile of fermented meat products such Chorizo results from multiple chemical and biochemical reactions that take place during the ripening stage. Most studies describe the sensory profile of the final product, with limited information related to the odor profile evolution during ripening. Therefore, the aim of this work was to explore the evolution of odor profile of homemade Chorizo during ripening (day 0, 7, 14 and 32), and to correlate with their volatile compounds. Odor profile was obtained by conventional descriptive analysis with the following strategy: 1) Selection the panelist according to their ability to discriminate differences, recognize 12 chemical compounds and threshold, 2) Generate vocabulary with different types of chorizos and select attributes to evaluate and their references, 3) Training the panelist: first recognize the different type of spices and odors characteristics, second, familiarize with simple pork meat mixture (pork-onion, pork-garlic-onion, pork-lactic acid, pork-clove) and then 4) Evaluate sample of Chorizo, the sequence for evaluation was from simple reference solutions up to complex mixtures, and finally the Chorizo sample. Volatile compounds were extracted by SPME technique using a DVB/CAR/PDMS fiber and analyzed by CG-Shimadzu 2010 and standard references. ANOVA was carried out on sensory data by each attribute, considering sample, sessions, assessor and their interactions as sources of variation and 5% significance lever was considered in the analysis and the differences were calculated using Tukey's test. Principal Component Analysis (PCA) was applied to explore the inter-relationship between variables. Thirteen odor attributes (pork meat, greasy, garlic, onion, fermented, vinegar, clove, pepper, oregano, bay leaf, cumin, smoked and chilli) were evaluated. The sample in day 0 was different ($p \leq 0.05$) with the highest intensity in descriptors chilli, onion, meat pork and greasy, and these were decreased during ripening. Chorizo in day 14 was significantly different with the highest intensity in vinegar and bay leaf odor, which were correlated ($r \geq 0.5$) with acetic acid and trans-2-hexanal, respectively. Furthermore acetic acid was correlated with fermented odor, 1-pentanol with fermented, pepper, oregano and smoked odor and clove odor with eugenol and benzaldehyde.

Keywords: Chorizo, Sensory Evaluation, Odor Profile, Volatile Compounds

Effect of Nixtamalized Maize Flour Substitution by Pinto Bean and Chickpea Flours on Sensorial and Physicochemical Properties of Tortilla Chips.

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Fried snacks maize based has a wide consumption base. However, these snacks do not satisfy to consumers seeking quality nutritional products being the legumes an alternative to this issue due to lysine and tryptophan, which complement maize amino acids. The aim of this work was to assess the effect of the substitution of chickpea flour or pinto bean flour to maize flour on sensorial and physicochemical properties of tortilla chips obtained from maize - chickpea and maize - pinto bean blends. Pinto bean and chickpea grains were soaked, dried and milled to obtain flours. Legumes and nixtamalized maize flours were characterized by proximal analysis and color. Four blends were obtained of each legume flour with maize flour by substitution in different levels, using no legume flour substitution as a control (100% Maize). Doughs were made from blends incorporating water until obtain a standard consistency. After that, doughs were laminated, cut in triangles of 6x6x6cm and baked during 5 minutes and 30 seconds at 150°C. Baked products were cooled to room temperature before frying at 180°C during 30 seconds. A 5-point hedonic satisfaction and multiple comparison tests were used to assess the level of satisfaction and flavor, color and texture changes of chickpea-maize and pinto bean - maize tortilla chips using 50 non trained panelists. Furthermore, Tortilla chips were evaluated physicochemical by proximal analysis, color, hardness, and rancidity. Data were evaluated by a completely random design of one factor using ANOVA and Dunnett test. Sensorial evaluations in tortilla chips show that flavor did not change significantly ($p < 0.05$) in any of the blends although color, texture, rancidity and proximal composition were significantly different ($p < 0.05$), In maize - chickpea blends the degree of satisfaction decreased compared to control. Partial substitution of maize flour by pinto bean or chickpea flours can be a good option to improve nutritionally tortilla chips preserving satisfaction and sensory properties.

Keywords: Maize, Pinto Bean, Chickpea, Tortilla Chips

How is Conceptualized a Regional Product in an External Market?

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In consumer test, the study and understanding of the conceptualization of a food product is important. The meaning analysis allows to know consumer perception towards a product, especially when the product has a cultural distinctive typical of the region where it is produced. Mezcal is a traditional alcoholic beverage, that in the last five years has increased its consumption has increased by 140% in some cities in Mexico. The aim of this study was to determine the definition of the term “mezcal” by consumers of an external market. In this study, 408 participants from the Metropolitan Area of Guadalajara were individually interviewed. A free association test was carried out, consumers had to indicate the first 3 words that came into their mind when the concept “mezcal” was presented. The total frequencies of the mentioned words were obtained and analyzed by multiple correspondence analysis (MCA). Words that were mentioned with a frequency of at least 10% were considered to carry out the analysis. A total of 1127 words were obtained. They were clasificated into 13 categories by means of a triangulation method. Alcohol (31%), agave (24%), drinks (20%) and tequila (19%) were significantly the most frequently mentioned. The mezcal concept’s meaning was different depending on whether the participants had already consumed mezcal or not. In addition, the youngest participants with low levels of education tended to associate the concept of mezcal with the one of the tequila and their perspectives were negative towards mezcal. In contrast, consumers with high levels of education as well as experienced consumers tended to relate the concept with symbolic and experiential aspects. The results of the present study could be used and applaied to design marketing strategies directed to increase the products’s presence in differents markets.

Keywords: Mezcal, regional product, conceptualization, word association.

Sensory Lexicon Development and Characterization for Papaya Fruit as Affected by Cultivars

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The aim of this study, was to develop a sensory lexicon for analysis of odor, flavor and texture of papaya fruits, using sensory and their correlation to instrumental measurements to characterize different cultivars of Mexican papaya fruits. Fourteen panelists were trained to evaluate sensory quality of papaya fruits. The judges were trained to identify differences between varieties of papaya and different maturity stages by Duo-trio test. For objective description of the odor and flavor of fruits, there were used 7 volatile compounds that contribute to the typical papaya aroma, (methyl butanoate, benzyl isothiocyanate, butyric acid, 3-mercapto-3-methyl-1-butan-ol, isoamyl acetate and 4-hexen-3-one) from which 10 descriptors were generated. On the other side, panelists were familiarized with different papaya cultivars to know the characteristics of broad range of papaya fruits at different ripening stages to know the features that consumers use to choose a fruit. Repeatability of the panelists were evaluated by ANOVA of intensity of physical references and intensity descriptors of odor and aroma profile of fruits. Nine descriptors of odor (mature papaya/grape, fermented/aged cheese, green papaya, onion/rue plant, banana gum and plastic/ nail polish) and four descriptors of texture (firmness, melting, juiciness and particle shape: fibrous or lumpy) were obtained. Results showed that the lexicon, was adequate to describe the differences of odor and texture characteristics among cultivars. In parallel pH, acidity titration, A_w , moisture percent, color CIEL*a*b*, total soluble solids and texture (TPA) were measured, to establish differences among cultivars ($p < 0.05$) and correlate with to sensory evaluation by principal component analysis. This methodological strategy could be the basis for the implementation of a method to the sensory and physicochemical characterization of papaya fruits.

Keywords: sensory evaluation, papaya, lexicon

Effects of Texture Modification of the Diet in the Expected Satiating Capacity and in the Total Intake of Patients with Chronic Renal Disease in Replacement Therapy in a General Hospital in Puebla, Pue.

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Chronic renal failure (CKD) is a progressive disease resulting in a loss of 50 to 70% of kidney function and promotes various disorders, specifically in the metabolism of macronutrients and alterations in the removal of waste products such as creatinine and urea. In late stages, CKD require replacement treatment including peritoneal dialysis, hemodialysis and renal transplantation. In México, CKD is in the top causes of mortality in general hospitals. Changes in hormonal secretion of leptin and ghrelin may play an important role in malnutrition, decreasing appetite of and causing early satiety. The high risk of malnutrition in CKD patients worsen with a permanent state of catabolism. Thus, the aim of the present study was to determine the effect of texture on the diet on early satiety in CKD patients on replacement therapy. CKD patients in a public hospital (40% men and 60% women) with a mean age of 46.3 ± 5.02 years old in peritoneal dialysis as replacement therapy for kidney failure were asked to test a diet with a thick puree texture and, the day after, to have a regular meal with same caloric content and nutrient distribution, both in breakfast time. Before eating either of them, patients indicated in a scale the expected satiating capacity of the food presented and after they have eaten answered how satiated they felt in a scale with similar characteristics. The real consumption of the regular diet and the diet modified in texture were measured. For statistical analysis Student's t-test was performed with Minitab® at a confidence level of 90%. In terms of the caloric, protein, carbohydrate and fat intake patients consumed significantly more with the modified diet than with the regular one ($p < 0.01$). The texture of the presented food has an impact in the expected satiating capacity but in this study there was no difference found in the expected satiating capacity or in the satiety after eating in neither of the meals offered. However, as stated before, the total of nutrients and calories intake increased with the diet with a thick puree texture which may help to prevent or treat malnutrition in CKD patients.

Keywords: diet modified in texture, expected satiating capacity, early satiety, chronic renal failure

Acceptance Level from a Cherry Drinkable Soy Yogurt Sweetened With Sucrose

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A drinkable soy yogurt, could be classified as a functional food, because of its lactic bacterial and protein soy content. It also, was proposed as an alternative fast food for Mexican woman. Thereby, the main objective for this project, was to determine the acceptance Level from a cherry drinkable soy yogurt sweetened with sucrose. A Sensory Evaluation pilot test was made with 100 consumer panelists (69 females and 31 men, 18-25 age). Consumer panelist completed Paired Comparison and Preference Tests, in order to evaluate two treatments. Treatment 1, cherry drinkable soy yogurt and Treatment 2, natural drinkable commercial yogurt, that was cherry flavored. A Randomized Complete Block Design was made using a Binomial Approximation Test from the Normal Distribution, to the Paired Comparison probe and an X^2 for the Preference Level as response variable, 95% confidence interval. Samples were identified by random 3-digit codes on plastic glasses (No. 0). For every sample change, each panelist could unclogging their mouths eating green apples. Arenosity and Liquid consistency from the treatments were measured within a Paired Comparison Test. A significant difference existed on Arenosity (p value 0.0005160, z value = -3.47), hence that, the alternative Hypothesis was accepted. Thus, it has been suggested that the natural drinkable commercial yogurt that was cherry flavored, remained with an arenosity sensation. No significant difference, were observed for Liquid consistency variable (p value 0.5716, z value = 0.5656), so the null hypothesis for this variable were equal perceived in both treatments for the consumers. No significant difference was observed on the Preference Tests (p value 0.18122), so it proposed that, both treatments were equal accepted for the consumers. Then, it has been concluded that cherry drinkable soy yogurt had had the same acceptance level than the commercial yogurt that was flavored.

Keywords: Soy, yogurt, Acceptance Level, arenosity.

Improvement in protein and fiber and sensory study of fried tortilla made from unconventional ingredients

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Because of the importance of seeking alternative sources of ingredients in the development of new products, tortilla chips in this research were obtained from corn, cassava (*Manihot esculenta*) and Chaya sheet (*Cnidocolus aconitifolius*). The main objective was to evaluate the effect of concentration chaya leaf on protein content, fiber content and level of satisfaction. Four treatments with four repetitions were analyzed using a completely randomized design. a sensory test of pleasantness was applied to a total of 100 untrained consumers. The results were interpreted with an ANOVA ($p = 0.05$) and DMS ($\alpha = 0.05$) test. In tortilla chips with 2.5% and 7.5% of Chaya (T3 and T4) higher protein content (7.13 and 7.39%) and fiber (2.66 and 2.84%) with no significant difference was obtained, which is important because the majority of existing chips on the market do not provide enough of these nutrients, however, sensory test indicated that the totopo with 2.5% obtained the best level of appreciation among consumers which was rated "like a lot". According to the results, it is feasible to enrich tortilla chips with a vegetable source such as cassava flour Chaya and to provide protein and fiber in the daily dietary intake, without affecting its sensory attribute.

Keywords: *Manihot Esculenta*, *Cnidocolus aconitifolius*, fried tortilla



VIII. GENERAL FOOD MICROBIOLOGY

Hygienic quality of raw goat's milk and artisanal cheese Miravalles, Oriental, Puebla, Mexico

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In developing countries, goat milk plays an important role in human nutrition. Some benefits in the human are the effect in physiological functions and the nutrition in children and people late in years. Nowadays pathogenic microorganisms' presence in raw milk of goat and by-products; like cheese, represent a great concern for consumers. The majority of the sprouts of intoxication; attributed to the consumption of dairy products, is due to the contamination in the phases of milking, storage, transportation and processing. In this study, the bacteriological quality of milk and goat cheese were analyzed by quantifying the presence of aerobic mesophilic bacteria, total coliforms, fecal coliforms, *S. aureus*, as well as the presence of *L. monocytogenes* and *Salmonella*. Microbiological analysis of goat's milk and cheese were done according to the Mexican Official Standards (NOM). The results showed that 50% of the samples did not comply with the Mexican Official Standard (NOM), NOM-243-SSA1-2010, for variables Fecal Coliform Bacteria (BCF) and Total coliform bacteria (TCB), however, *L. monocytogenes* and *Salmonella* presence was not detected in any of the samples. Some differences were observed in the sanitary quality of milk and cheese due to the number of goats kept per producer and the handling system (stabling and herding). The sanitary quality of raw milk and cheese was better when producers handled fewer goats and applied grazing farming system.

Keywords: microbiology, goat cheese, pathogenic microorganisms

Antimycotoxigenic and Antifungal Activity of *Eucalyptus globulus* and *Thymus capitatus* Essential Oils

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Essential oils (EO) of eucalyptus (*Eucalyptus globulus* L.) (EOE) and thymus (*Thymus capitatus* L.) (EOT) were evaluated for their efficacy to control *Aspergillus parasiticus* and *Fusarium moniliforme* growth and their ability to inhibit mycotoxin production. Data from kinetics radial growth was used to obtain the half maximal inhibitory concentration (IC₅₀). The IC₅₀ was used to evaluate spore germination kinetic and mycotoxin production. Also, spore viability was evaluated by the MTT assay. All EO had an effect on the radial growth of both species. After 96 h of incubation, EOT at concentrations of 1000 and 2500 µL L⁻¹ totally inhibited the growth of *F. moniliforme* and *A. parasiticus*, respectively. The IC₅₀ of EOE and EOT significantly reduced spore germination of *A. parasiticus*. Inhibition of spore germination of *F. moniliforme* was 84.6 and 30.6% when exposed to EOE and EOT, respectively. EOT and EOE reduced aflatoxin (4%) and fumonisin (31%) production, respectively. Spore viability was affected when oils concentration increased, being the EOT the one that reduced proliferation of both fungi. Our findings suggest that EO affect *F. moniliforme* and *A. parasiticus* development and mycotoxin production.

Keywords: essential oils, mycotoxin production, spore viability, mold inhibition

Role of Growth Conditions in Adhesion and Invasion Efficiency of Tropical River Water-Isolated *Salmonella* Oranienburg and Saintpaul

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Salmonella species are often present in a diverse range of environmental sources, such as soil, sewage effluent and water, where they can survive for long periods until they reach a definitive host. In these environments, bacteria are deprived of nutrients, and in order to survive and resist to environmental factors, they need to repress genes that jeopardize bacterial virulence, invasion ability and other transmission related genes. Despite some serotypes are well adapted to the environment and have been responsible of global clinical outbreaks, the study of their virulence profile is limited. In this study, we compared the effect of the conditions for bacterial growth in the pathogenicity of two closely related environmental serotypes isolated from tropical river water, *Salmonella enterica* serovar Oranienburg and Saintpaul. To this end, these serotypes were grown in enriched media (laboratory) or river water, and adhesion, invasion and cell viability assays were performed in HEp-2 epithelial cells. Data showed that river water growth conditions affected the adhesion capability of *S. Saintpaul*, with a reduction of 75% compared to bacteria grown in enriched media, while the invasion efficiency was maintained in similar levels between bacteria grown in both conditions. Furthermore, even when adhesion of *S. Oranienburg* to HEp-2 cells was independent on the growth condition, the invasion efficiency was reduced 80% when bacteria were grown in river water. In addition, these reduced *S. Oranienburg* invasion efficiency was significantly lower than *S. Saintpaul* ($p < 0.05$). Likewise, river water conditions induced a significant reduction in adhesion ($p < 0.001$) and invasion efficiency in the clinical *S. Typhimurium* used as control. Cell viability of infected HEp-2 cells was significant decreased (~15%) in all treatments compared to noninfected cells ($p < 0.011$). No differences in cell viability levels were observed between treatments. Finally, *in silico* analysis of *S. Oranienburg* and Saintpaul genomes displayed similar pathogenicity gene profiles that included genes involved in adhesion, invasion and bacterial survival. These data demonstrate that growth environment plays an important role in the virulence behavior of *Salmonella* environmental serotypes and expand the knowledge about the interactions of these serotypes with epithelial cells.

Keywords: *Salmonella*, pathogenicity, invasion, growth condition, environment

Determination of the Presence of *Salmonella* spp in Mixtures of Onion and Coriander Used as Seasonings for Different Kinds of Tacos Sold by Roadside Stands.

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The objective of this work was to determine the presence or absence of *Salmonella* spp in samples of onion and coriander mixtures that come with different kinds of tacos that roadside stands sell in the east side of the city Torreón, Coahuila. A total of 32 samples of the onion-coriander mixture were collected from the places mentioned above, not changing the way street vendors manipulate them. The technique used corresponds to the one proposed in the standard NOM-114-SSA1-1994. For the pre-enrichment, 10 g of the sample was immersed in 90 mL of peptone water 1.0% and then incubated at 35 ± 2 °C for 24 h. The samples enrichment was made in Selenite-cystine and tetrathionate broths with 1.0 mL of the pre-enrichment broth, then incubated at 35 ± 2 °C for 24 h. The development phase was made inoculating them with the enrichment broths, Petri dishes with the following microbiological cultures: *Salmonella-Shigella*, Bismuth sulfite, Brilliant green and XLD. Petri dishes were incubated at 35 ± 2 °C for 24 h. At the end, colonies with *Salmonella* characteristics were taken from the original group of samples, and the corresponding biochemical tests were performed for their preliminary identification. From the 32 total samples 11 showed preliminary characteristics for *Salmonella*. These 11 samples were processed using the automated equipment WalkAway 961006, showing 7 samples resulting positive for *Salmonella enteritidis* (21.87%) from the total quantity. Nowadays street food is much consumed; the onion-coriander mixture usually comes with this kind of products. The presence of *Salmonella* in some of the samples reaffirms the necessity of a better sanitary control from authorities in the selling and making of these food products along with a better enforcement of GMP.

Keywords: ETA's, *Salmonella* sp, GMP.

Determination of Density of Total Coliforms, Fecal Coliforms, *E. coli* and Associated Flora in Flavored Water of The City of Torreon. Mex.

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The objective of this work was to determine the total density of total coliforms, fecal coliforms and *E. coli* using the technique of NMP and associated flora in samples of flavored water offered by street vendor. Methodology. 30 samples were taken at random from 100 ml each of flavored water of different flavor sold in the center of Torreon, Coahuila. The methodology proposed in the CCAYAC-M-004/8 standard of the Ministry of Health for drinking water and ice by determining the NMP was used. For total coliforms to 5 tubes with sodium lauryl sulfate broth was added 20 mL of the test sample and incubated at 35°C for 24 to 48 hours. Of the positive tubes with gas, the same number of tubes were inoculated with bright green bile broth and incubated at 35°C for 24 to 48 hours, for fecal coliforms. Positive tubes CF to test *E. coli*, the same number of tubes with EC broth and incubated at 44.5°C for 24 to 48 hours were inoculated. The confirmatory test for *E. coli* was done on agar EMB confirmed *E. coli* with biochemical tests. The accompanying flora was determined with the positive growth of a tube for CT McConkey agar and bacteria were identified by biochemical tests. The descriptive statistical analysis was performed nonparametric. The NMP for CT was 30 samples; >8 (66.66%); 8 (13.35%); 4.6 (10%); <1.1 (6.66%); 0 (3.35%). CF: >8 (46.66%); 8 (10%); 4.46 (16.66%); 2.6 (6.66%); <1.1 (10%) and 0 (10%). 36.66% confirmed for *E. coli*. The associated flora in a 97.07% corresponded to the group of coliforms. Flavored water of City of Torreon Coah., shows contamination with coliforms that proves them to be a potential source of ETA's. Which makes necessary an in-depth the sources of contamination of these products.

Keywords: coliforms, *Escherichia coli*, Associated Flora

Growth and Fermentative Profile of Acid Lactic Bacteria Isolated of Adobera Cheese

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The adobera cheese is manufactured and produced in Jalisco Mexico, this cheese has unique sensory properties, probably due to the presence of certain bacteria. This cheese is makes by artisans, creating a variety of microorganisms that developing properties in the product. The aim of this work was to isolate and identify the presence of lactic acid bacteria in adobera cheese for determine her application in foods. Their growth was determined using MRS agar, incubated anaerobically at 37 or 44 ° C, biochemical tests were performed to determine their morphology. The pH and acidity were determined to know their ability fermentation using the pH-meter and acidity by titration, finally DNA extraction and PCR were performed, using the 16S rDNA gene sequencing. The results showed the presence of 21 lactic acid bacteria, their morphology was in form of cocos or diplococos. Catalase test and oxidase were negative. The growth curves showed that only one microorganism grows at 44 ° C, the others at 37 ° C. All bacteria obtain their maximum growth at 10 h after incubation, the fermentation profile was low (1 % lactic acid) after 24 h. The strains were identified as *Lactococcus* and *Enterococcus*. Therefore, these bacteria could be used to develop sensory characteristics in products as yogurt or generate a microbial symbiosis for the development of functional foods.

Keywords: adobera cheese, lactic acid bacteria, growth, fermentative profile.

Antifungal Activity in Gaseous Phase of Mexican Oregano (*Lippia berlandieri* Schauer), Thyme (*Thymus vulgaris*), and Mustard (*Brassica nigra*) Essential Oils

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The antimicrobial efficacy of essential oils (EOs) when applied in gaseous phase depends on the volatility of the compounds present in the EO and their corresponding antimicrobial activities. The antifungal activity in gaseous contact of EOs from Mexican oregano (*Lippia berlandieri* Schauer), thyme (*Thymus vulgaris*), and mustard (*Brassica nigra*) against several fungal species was studied. Chemical composition of EOs was analyzed by gas chromatography coupled to mass spectrometry (GC-MS). The minimum inhibitory concentration (MIC) for each essential oil was determined by the inverted-dish technique. To determine the activity of tested EOs against *Aspergillus fumigatus* (ATCC 1022), *Aspergillus nomius* (NRRL 13137), *Eupenicillium hirayamae* (NRRL 3587 and 3118), *Penicillium viridicatum* (NRRL 5571), and *Candida albicans*, selected concentrations (1, 0.5, 0.25, 0.125, 0.063, 0.031, or 0.016 μL of EO/mL of air) were evaluated. Sabouraud agar plates were inoculated with 5 μL of the spore suspension, filter paper was taped to the lid of the Petri dish, and corresponding volume of the EO was poured. Inoculated plates were incubated for 5 days at 26°C and observed daily for mold growth. Tested EOs displayed significant ($p < 0.05$) antifungal effects against evaluated molds. MICs depend on the tested EOs as well on studied molds, and varied from 1 $\mu\text{L}/\text{mL}$ of air for Mexican oregano EO against *A. nomius* and *P. viridicatum* to 0.016 $\mu\text{L}/\text{mL}$ of air for mustard EO against *C. albicans*. Mustard EO was effective mainly due to the presence of allyl isothiocyanate (98.4%); thyme EO, due to the presence of *p*-cymene (19.8%), linalool (13.6%), and thymol (12.1%); while compounds primarily responsible for the antimicrobial effect of Mexican oregano EO were *p*-cymene (35.5%) and carvacrol (26.9%). Tested EOs were effective antifungal agents, being mustard EO significantly ($p < 0.05$) better (lower MICs). Evaluated molds exhibited different sensitivity to tested EOs in vapor phase, *A. nomius* and *P. viridicatum* being the most resistant. Carvacrol, thymol, and allyl isothiocyanate are highly volatile and therefore high activity is expected when used in the gaseous phase. Studied EOs contain several highly volatile compounds with strong inhibitory effects, so they could be considered a good alternative to traditional antifungals.

Keywords: essential oils, antifungal, mustard, oregano, thyme

Vapor Phase Antibacterial Activity Evaluation of Allspice (*Pimenta dioica*), Thyme (*Thymus vulgaris*), and Rosemary (*Rosmarinus officinalis*) Essential Oils Against Pathogenic Bacteria at Selected pHs.

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Chemically synthesized preservatives have been used for many years by the food industry. However, demand for more natural products by consumers has increased, being essential oils (EOs) obtained from herbs and spices, an alternative. There are few studies regarding the use of EOs as antimicrobials applied in vapor phase; hence the purpose of this work was to evaluate the vapor phase antibacterial activity of allspice (*Pimenta dioica*), thyme (*Thymus vulgaris*), or rosemary (*Rosmarinus officinalis*) EOs against *Salmonella enterica* serovar Typhimurium or *Listeria monocytogenes* in media formulated with selected pHs. The minimum inhibitory concentration (MIC) of each tested EO was determined at different pHs (5.0, 5.5, or 6.0) in culture media by the inverted Petri dish technique after incubation at 35°C for 24 h. The lowest MIC against *L. monocytogenes* was 0.70 mL of thyme EO/L_{air} for every tested pH, while the highest MIC for the same bacteria was 2.40 mL of allspice EO/L_{air} for pH 6.0. In the case of *S. enterica*, the lowest MIC was 0.13 mL of thyme EO/L_{air} (on media with pH 5.0 or 5.5) and the highest was 8.99 mL of rosemary EO/L_{air} for pH 6.0. In most of the studied cases, *L. monocytogenes* was less resistant to tested EOs than *S. enterica*. It has been reported that Gram-negative bacteria, are more resistant than Gram-positive bacteria to EOs applied (in liquid phase) by direct contact. It was also observed, in almost every evaluated case, that when the pH of the culture medium increased, the MIC of the EOs also increased against both microorganisms. EOs in vapor phase achieved desired effects at much lower concentrations than in liquid phase, this could be utilized to favorably impact their sensory influence on foods treated with them in vapor phase.

Keywords: Antibacterial activity, allspice, thyme, rosemary, essential oils

Antimicrobial Effect of Mustard Essential Oil in Vapor Phase through Biopolymer Films

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Smart packages are systems that help to maintain and even improve a food product by releasing substances to the package headspace. These systems help to extend food shelf life by assuring its safety and quality. The design of smart packages requires an active substance capable of being contained inside a matrix and liberated over time. There is always interest in finding innovative ways to inhibit microbial growth; one option is to use antimicrobial food packages in order to provide product safety, freshness, and quality. Furthermore, the use of antimicrobial packages that modify food package internal atmosphere is more beneficial than the direct addition of antimicrobial agents onto foods. Some spices and their essential oils (EOs) are very effective inhibiting microbial growth. One of these EOs is mustard essential oil, which primarily contains the active compound allyl isothiocyanate (AITC) that has been proved as a potent antimicrobial in vapor phase. One of the main problems of using AITC as antimicrobial agent is that is not compatible with traditional synthetic polymers used in packaging films. An alternative explored in this work is to use mixtures of biopolymers such as alginate, chitosan, and carboximethyl cellulose as matrices to incorporate AITC. These biopolymers are capable to form films for food applications. Permeability of biopolymer films to mustard EO in vapor phase was evaluated by pouring a known quantity of EO into containers sealed with the studied films. The system was then placed into a hermetic vessel of 1L with a Petri dish plate inoculated with *Aspergillus flavus* or *Penicillium expansum*. Mold growth was evaluated during 15 days at room temperature. After 15 days, molds did not grow thus were placed in regular atmosphere for another 5 days. Mustard EO exhibited a strong fungicide power against the tested strains; studied films displayed low permeabilities to AITC without affecting its antimicrobial efficacy. These results suggest that biopolymer films can be used as matrices in one of the layers of a smart package.

Keywords: biopolymer films, active packaging, allyl isothiocyanate, mustard

Comparison of Antifungal Activity of Orange Peel Essential Oil and its Two Main Components in Spore Germination of *Aspergillus niger*

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Fungal growth is initiated by germination of spores; therefore, its prevention could stop food spoilage. The antifungal properties of citrus essential oil (EO) are well documented; however, it is unknown which components of this EO are responsible for such effects. The aim of this study was to compare the effect of *Citrus sinensis* var. Valencia peel EO and its two major components (limonene or citral) in the spore germination of *Aspergillus niger*. Orange peel EO was obtained by microwave assisted extraction, analyzed by means of GC-MS. The obtained EO, limonene, or citral were applied at different concentrations (0 to 20000 ppm) evaluating spore germination and mycelial growth of *A. niger*, by optical density (OD) determination of inoculated media during 10 days of incubation and fungal biomass, respectively. Main compounds identified in the obtained orange peel EO were: limonene, citral, 1-r- α -pinene, and linalool; limonene represented 93.41% of the EO. During the experiments a linear decrease in OD was observed as a function of increasing EO, limonene, or citral concentrations, which represent a decrease in biomass production and therefore spore germination. Inhibition of *A. niger* mycelial growth was obtained with every tested compound. Minimal inhibitory concentrations (MICs) of orange peel EO, limonene, and citral for inhibiting *A. niger* spore germination were 310, 18000, and 150 ppm, respectively. Although limonene is the major compound of orange peel EO it cannot be considered as strong inhibitor of the studied mold since large concentrations are needed to observe inhibitory results. On the other hand, citral and obtained orange peel EO exhibited strong antifungal effects. According to our results, the antifungal effect of orange peel EO is due to a synergistic effect of its distinctive constituents.

Keywords: *Aspergillus niger*, orange essential oil, antifungal, citral, limonene

Evaluation of antibacterial effect, antioxidant activity and polyphenols content in nine cultivars of cactus pear (*Opuntia* spp.) and their by-products.

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Nopal cactus (*Opuntia* spp.) is an important resource of semi-arid zones of the world, where fruits and stems are used as food or forage, depending on the variety or ripeness of the cladode. *Opuntia* genus has a good capacity of adaptation, and comprises a large number of species with variable phytochemical composition. About 20% of the cladodes are by-products (modified leaves or thorns) that are usually discarded. To evaluate the antioxidant and antibacterial potential of 9 nopal cultivars and their by-products. Cladodes and by-products from 9 nopal cultivars were washed, dried and macerated in ethanol, evaporated and the extract resuspended in water. The antimicrobial activity against *V. cholerae* and *C. perfringens* was determined. Preliminary analyses were conducted by the well diffusion method. Minimal bactericidal concentrations (MBCs) were determined using the broth microdilution method. Quantification of total phenols and flavonoids, and antioxidant capacity, as TEAC and inhibition percentage of DPPH radical, were performed by spectrophotometric methods. All extracts showed antioxidant and antibacterial activity. Extracts of cladodes and by-products showed similar MBC (around 7.5 mg/ml) for *C. perfringens* and (4.0 mg/ml) for *V. cholerae*. The cladode by-products showed higher antioxidant capacity (DPPH and TEAC tests) when compared with cladodes. High concentrations of phenols and flavonoids were also found in the by-products analyzed (ranges from 91.23 to 853.78 mg GAE/g DW and from 17.10 to 39.42 mg QE/g W). This study demonstrated the antimicrobial activity of nopal cactus byproducts with a higher content of phenols and flavonoids, and an increased antioxidant activity compared with cladodes.

Keywords: *Opuntia* spp., by-products, antibacterial, antioxidant, polyphenols.

Physicochemical Characterization and Identification of Native Lactic Acid Bacteria in Chihuahua Artisanal Cheese Produced in the Region.

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Delicias is the most important region of the state of Chihuahua with regard to bovine milk production, where one part of produced milk is destined for Chihuahua cheese production. The geographical location and subtropical climate of Delicias promotes the generation of specific microflora in milk, for instance lactic acid bacteria (LAB). The aim of this study was to characterize the physicochemical composition and identification of native lactic acid bacteria in artisanal cheese produced in the region. The cheese was made at an artisan cheese factory located around Delicias on each season of the year and was vacuum-packed and stored at 4°C during 15 days. Cheeses produced in the four dates were analyzed in days 1, 3, 5, 7, 10 and 15 of ripening. A total of 18 samples were analyzed for each season. All samples were analyzed in triplicate. The variables analyzed were total solids, fat, proteins, pH and titratable acidity. The lactobacillus were isolated in MRS medium. The biochemical identification test were analyzed with the commercial kits API 50CH BD. The temperature characteristic of each season exert certain influence over the physicochemical composition of cheese. Raw milk Chihuahua cheese manufactured during all seasons showed a predominant isolated of *Lactococcus lactis* and *Lactobacillus paracasei*, according to the carbohydrates fermentation pattern, while the rest appertain to *Lactobacillus pentosus*, *Lactobacillus brevis*, *Lactobacillus fermentum*, *Lactobacillus plantarum* and *Leuconostoc mesenteroides* depending on the date of the producing.

Keywords: Artisanal Chihuahua Cheese, Lactic Acid Bacteria, Raw Milk.

Efficacy of *Citrus* byproducts as antioxidants and against adherence and invasion of *Campylobacter jejuni* in HeLa cells

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Campylobacter jejuni is one of the most important foodborne pathogens in the world. Adherence and invasion are key processes during the development of infection. Considering the increasing incidence of antibiotic resistance, it is crucial that new strategies be developed to control this pathogen. In this study, we evaluated the use of three citrus byproducts, *Citrus limon*, *Citrus aurantium*, and *Citrus medica*, to prevent adherence and invasion of *C. jejuni* in HeLa cells. The effects of these extracts on expression levels of genes involved in adherence and invasion processes (*cadF* and *ciaB*) were examined. Furthermore, we determined the antioxidant activities and the contents of phenolics and flavonoids in these extracts. *Citrus* byproduct extracts were added to cultures of *C. jejuni* and determined the adherence/invasion ratio to HeLa cells, and the relative expression of adhesion/invasion genes (*cadF* and *ciaB* respectively, and the housekeeping gene *glyA*) were measured by real time qRT-PCR. Antioxidant activity assays were performed by spectrophotometric methods. Total contents of phenolic and flavonoid compounds, DPPH radical scavenging activity, and the Trolox-equivalent antioxidant capacity of dried *Citrus* byproduct extracts were studied. In general, byproduct extracts affected the adherence to and invasion of HeLa cells ($p \leq 0.05$), as well as the expression levels of *cadF* and *ciaB*, depending on the tested extract or strain. Among the extracts, *C. aurantium* contained the highest levels of phenolic compounds.

Keywords: *Campylobacter jejuni*, *Citrus* by-products, HeLa cells, polyphenols.

Physicochemical, rheological, thermal and gas permeability characterization of Chía (*Salvia hispánica*) edible coating over meat

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In recent years it has been investigated intensively in the field of edible films and coatings, efforts continue due to growing demand from consumers to purchase better food quality, healthy, and food safety issues. All this requires that scientist help to protect and ensure the health of consumers, offering new alternatives to help establish new conservation alternatives with free food pathogens. Furthermore, Edible films can significantly help in reducing bad environmental consequences of packaging, and protection, extended shelf life and freshness of food. This research aimed to develop edible films from *Salvia hispánica* mucilage . It was evaluated by performing the characterization of the behavior of various factors such as physical (solubility, color, thickness), chemical (composition, A_w , FTIR), thermal (crystallization, melt, glass transition temperature T_g), rheology (viscosity), mechanical (maximum stress, strain, modulus of elasticity) barrier properties to gases (CO_2 and O_2) and water vapor permeability. Furthermore the edible films that shows the highest quality was applied in pork carcasses. As result, flexible films with good mechanical strength, with low viscosity of the solutions forming the films obtained showed a A_w that is not conducive to growth of microorganisms at 65 days of analysis with 3 log reduction time. The films are thermally stable in a temperature range of 0 ° C to 100 ° C and with acceptable permeability. It was observed that most of the analyzed properties of the films as the rheological, mechanical, A_w , thickness, color, solubility and barrier gas, were affected by the concentration of the polymer used. Besides, the film showing the best properties for use as a barrier coating is the film made from *Salvia hispánica* 35% glycerol, 1% and 0.2% $CaCl_2$ as it presented the best values or maximum stress resistance (14.6796 N / mm²) and good permeability, in addition to all the features mentioned above.

Key words: chia, eddible coating, characterization

Enhanced Poultry Carcass Neutralization of Carcass-Applied Antimicrobials for Determination of *Salmonella* Survival during Chilling

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Chemical sanitizers such as peroxyacetic acid (PAA) and cetyl pyridinium chloride (CPC) are commonly applied to poultry carcasses or parts to reduce pathogenic microorganisms including *Salmonella* and *Campylobacter* spp.. Recently there has been increased concern expressed regarding the risk of chemical residue carryover that may result in failure to detect pathogens surviving antimicrobial treatment of poultry carcasses or parts during routine testing. Chemical neutralizers may be used to counteract the activity of food sanitizers, thus allowing pathogen detection from foods. In this study, the abilities of sanitizer-specific neutralizers applied at differing concentrations to CPC- or PAA-treated *Salmonella* in liquid medium were tested to determine minimum neutralizer concentrations necessary to allow pathogen survival. Three *S. enterica* serovars (Typhimurium, Kentucky, Heidelberg) were individually inoculated to a target of $\sim 5.0 \log_{10}$ CFU/ml in double strength tryptic soy broth (2xTSB) and then immediately exposed to CPC at 0.1, 0.2, 0.4, 0.6, or 0.8% (w/v; final concentration), or PAA at 0.0125, 0.025, 0.05, 0.1 or 0.2% (0.2% = 2,000 ppm; final concentration). Following antimicrobial addition, sanitizer-specific neutralizers were added at different concentrations. For CPC, combination of lecithin and Tween 20 was added in buffered peptone water (BPW) at 2X, 1X, 0.5X, 0.25X, or 0.125X their standard concentrations in Dey-Engley (D/E) Neutralizing Buffer. For PAA, disodium phosphate (Na_2HPO_4) and potassium monophosphate (KPO_4) were added at 3X, 2X, 1X, 0.5X, and 0.25X their standard concentrations in BPW. Sodium thiosulfate was also added at 1.8%, 1.2%, 0.6%, 0.3%, and 0.15% (w/v) to neutralize peroxy-radicals. Following addition of sanitizer neutralizers, test tubes were incubated for 24 hr at 35°C and then inspected for turbidity. For all *Salmonella* isolates, higher concentrations of sanitizers required higher concentrations of neutralizers to counteract sanitizer antimicrobial activity. At 0.8% CPC, 1X neutralizer additions were required to observe growth for *Salmonella* isolates, whereas for PAA the addition of neutralizers to at least 2X their concentrations in BPW was required to allow *Salmonella* survival. The recovery of foodborne microbial pathogens may be enhanced by utilization of sanitizer neutralizers during the testing of foods for pathogenic microorganisms.

Keywords: *Salmonella*, poultry sanitizers, neutralizers, poultry microbiology

Study of Dynamics and Biodiversity of Yeast during Cocoa Process in Mexico.

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Cocoa pulp is a rich substrate for microbial growth. Yeast growth and metabolic activities are essential for a successful fermentation. They also have specific influences on chocolate flavor and could prevent ochratoxin A production by fungi inhibition. Given the importance of yeast at sensorial and safety quality level, the aim of this work was to study the dynamic of yeast at a molecular level (PCR-DGGE) and by classical microbiology at different stages of cocoa processing in two farms (A and B) in Tabasco- Mexico during 2013. Yeast DNA fingerprints obtained by amplification of 26S rDNA coupled to DGGE (PCR-DGGE) were analyzed by multivariate analysis comparing microbial dynamics at different stages of cocoa production. Neither of the two farms (A or B) showed a dominant microbial group/species at any stage. However, one species was detected through all the process in both farms. The highest number of species (15-20) was observed at 21 and 30 days of storage in farm A. In contrast in farm B, the highest number of species (10) was found at the surface of the pod. Moreover, a low number of species was detected in both farms at the beginning of the drying step, which could be related with the change of conditions from fermentation to drying. In farm B, a wash step before drying could reduce the number of species. Yeast counts were performed by plate counting on Malt Extract Agar (MEA). In farm A, total available count values were between 2 and 5.5 log UFC/g through all the process, while in farm B values were between 1 and 6.5 log UFC/g. This could be due to the difference in the process and raw materials used. In both farms, yeast DNA was detected through all the process since harvest until storage and they showed different dynamics even when they come from the same region. Cocoa process in Mexico shows a very heterogeneous yeast presence at all stages depending on conditions, which was carried out. The variations were observed both in total yeast cell counts and by DGGE profiling method, showing they might play an important participation in all the stages of cocoa process, not only during fermentation.

Key words: Cocoa, fermentation, microbial ecology DGGE, dynamic, yeast.

Beneficial Potential of Lactic Acid Bacteria Isolated from Milk Production Environment

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Lactic acid bacteria isolated from milk production environment were assessed for their beneficial potential. Samples of raw milk, swab from cows and goat saliva and vaginal mucosa, ruminal boluses, water and silage were collected from goat and cow dairy farms located in Minas Gerais state, Brazil. Based on a first screening for pH and bile salts, 82 of 500 isolates were selected for further analysis. Isolates were subjected to rep-PCR and RAPD PCR, and 15 were selected for 16s rRNA PCR and sequencing for identification: *Lactobacillus* (n = 11, being named as *L. acidophilus* MVA3, *L. casei* MRUV1, *L. casei* MRUV6, *L. casei* MSI1, *L. casei* MSI5, *L. fermentum* SIVGL1, *L. harbinensis* MSI3, *L. harbinensis* MSIV2, *L. nagelli* MSIV4, *L. plantarum* MLE5 and *L. plantarum* MSI2), *Pediococcus* (n = 2, *P. acidilactici* MSI7 and *P. pentosaceus* MLEV8) and *Weissella* (n = 2, *W. paramesenteroides* MRUV3 and *W. paramesenteroides* MSAV5). The strains confirmed their resistance at low pH (2.0, 2.5 and 3.0) and at different bile salts concentrations (0.5 and 3.0%), and all tested strains presented positive results for leucine arylamidase, acid phosphatase and naphthol phosphohydrolase (APIZYM). Based on the results for simulation of gastrointestinal conditions, all strains presented survival rates higher than 91% after gastric conditions and higher than 46% after intestinal conditions. Also, the 15 selected strains were able to auto-aggregate (higher than 50%), co-aggregate with target organisms (higher than 54 % with *Listeria monocytogenes* Scott A, higher than 46 % with *Enterococcus faecalis* ATCC 19443 and higher than 33 % with *L. sakei* ATCC 15521), and presented high cell surface hydrophobicity (higher than 96 %). Thirteen of 15 selected isolates presented positive results for *EFTu* and 9 strains for *map* genes by PCR (adhesion). Strong β -galactosidase enzymatic activity was recorded in 13 of the 15 tested strains and all strains presented similar results for lactose (minimum of 7.62 ± 0.13 CFU/mL) and glucose (minimum of 7.59 ± 0.04 CFU/mL) assimilation. Strong bile salts deconjugation was determined for all 15 strains. Based on the results, the beneficial potential of the selected strains was characterized allowing consider them as good candidates as probiotic cultures.

Acknowledgments: FAPEMIG, CAPES, CNPq

Keywords: Beneficial potential, lactic acid bacteria, milk production system.

Hygiene in the Pork Production Chain: From Farm to Fork

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Based on “Farm to Fork” concept, the adoption of good manufacturing practices during all steps of food production is the key for obtaining end-products with high quality and safety. For meat production, such as pork, the monitoring of such indicators allows the identification of key contamination points during production, slaughtering and processing, leading to corrective procedures avoiding problems in end-products. Hygiene indicator microorganisms were assessed in different steps of a pork production chain in Minas Gerais State, Brazil. Five lots of pigs were sampled in different steps of the chain production, covering samples from finishing barns (n = 10), slaughtering (before bleeding = 50, after buckling = 50, after evisceration = 50, after final washing = 50), processing (knives, tables, hands of the employees = 90) and end-products (n = 35). All samples were diluted in NaCl 0.85% and plated on Petrifilm™ AC (for mesophilic aerobes), Petrifilm™ EB (for Enterobacteriaceae), and Petrifilm™ EC (for coliforms and *Escherichia coli*; for these groups, four pig lots were assessed). The obtained results were expressed as log CFU/cm² or g. As expected, finishing barns samples presented high levels of contamination by mesophilic aerobes (2 samples with counts higher than 6 log CFU/cm²), Enterobacteriaceae (2 samples with counts higher than 5 log CFU/cm²), coliforms and *E. coli* (3 samples with counts higher than 4 log CFU/cm²). In contrast, all samples collected from slaughtering, processing and end products presented counts lower than 3 log CFU/cm² for all indicators, except for one carcass after buckling that presented mesophilic aerobes and Enterobacteriaceae counts higher than 6 log CFU/cm². One sampled hand of employee that presented mesophilic aerobes among 4 and 5 log CFU/cm², and one sausage sample that presented mesophilic aerobes counts higher than 5 log CFU/cm². Despite being present at high levels in the initial step of the pork production chain, in pig farms, the results indicate a decrease in the contamination by hygiene indicator microorganisms during slaughtering and processing, leading to end products with high hygienic quality and indicating proper good manufacturing practices.

Acknowledgments: FAPEMIG, CAPES, CNPq

Key words: pork chain production, hygiene indicator microorganisms, farm to fork

Multilocus Sequence Typing and Antimicrobial Resistance Characterization of *Salmonella* Isolates from Mesenteric Lymph Nodes of Swine.

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The presence of *Salmonella* in the mesenteric lymph nodes of pigs can be associated with the excretion of the pathogen in the pre-slaughter and possible contamination of the final product and the industrial environment. The inappropriate use of antibiotics in swine production selected resistant strains to several compounds. Genotypic characterization of the isolates with Multilocus Sequence Typing (MLST) can provide valuable epidemiological and evolutionary information for understanding the pathogen cycle. This study evaluated 250 animals of 25 different batches processed in four slaughterhouses in São Paulo state - Brazil for the presence of *Salmonella* in mesenteric lymph nodes, and characterized the resistance profile for the main antibiotics and the sequence type (ST) with MLST. The pathogen was present in 36.4% of samples. Of the 91 isolates, 90 were serotyped, and the main serovars found were *S. Typhimurium* (n = 23), *S. 1.4,5,12:i-* (n = 17) *S. Infantis* (n = 12) and *S. Havana* (n = 11). Serovars, *S. Panama*, *S. Derby*, *S. Bovismorbificans*, *S. Coeln* and *S. Newport* were also isolated. The antibiotics with less efficacy were streptomycin and tetracycline (68.1% resistant) ampicillin and sulphonamides (62.6%), chloramphenicol (56.0%), trimethoprim-sulfamethoxazole (41.8%), and nalidixic acid (40.7%). The most effective were cephalothin and aztreonam, (both with 3.3% resistant) and ceftriaxone and cefepime (both with 7.7%). Multidrug-resistant strains (MDR) accounted for 70.3% of the isolates. Eleven strains were submitted to MLST: Five *S. Typhimurium*, all belonging to the ST 19, three *S.1.4,5,12:i-* two belonging to ST 19 and one ST 32, two *S. Infantis*, both belonging to the ST 32 and one *S. Derby*, belonging to ST 40. The high prevalence of the pathogen in the analyzed animals, with high rates of antibiotics resistance and belonging to genetic groups that are often associated with outbreaks and disease in humans, reinforces the idea that the production chain of pork is a potential source of contamination in salmonellosis cases. With the necessity of effective preventive measures for pathogen control and decrease the risk of foodborne diseases transmission.

Keywords: pork, Multidrug-resistant, epidemiology, serovars

Pathotypes *E.coli* characterization and virulence profile of the STEC strains isolated from Beef Cattle in São Paulo - Brazil

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Beef can be an important vehicle of various pathogens to humans. One of the most expressive in the last years is Shiga toxin-producing *Escherichia coli* (STEC), which was related to several outbreaks worldwide. Usually the infection is associated to diarrhea in humans, and can evolve to Haemolytic Uremic Syndrome – HUS mainly in the risk group (children, elderly and immunocompromised). In this study, were evaluated 88 cattle farms and a total of 431 animals from São Paulo State – Brazil for the presence of different pathotypes of diarrheagenic *E. coli* in fecal samples. STEC was present in 116 (26,9%) of the animals, being 111 (25,8%) STEC *eae*- and 5 (1,1%) STEC *eae*+. EPEC pathotype was detected in 20 (4,6%) samples and the other diarrheagenic *E. coli* pathotypes were not identified. The percentage of each isolated pathotype was statistically different ($p < 0.05$). One STEC strain from each animal was selected, (95 strains) for further characterization. All STEC harbored *stx2*, while 28 (29,5%) contained *stx1*. The adhesin-encoding genes *iha* and *sa* were found in 93,7% (89/95) and 66,3% (63/95) of the isolates, respectively. *EspP*, gene which encodes a protease related with intestinal colonization, was detected in 61,1% (58/95) and *ehxA* hemolysin was present in 54,7% (52/95). The *subAB*, *nleE* and *nleB* genes were also detected in lower rates. STEC are widespread in cattle herds of São Paulo, and harbor virulence markers that are associated with STEC infection produced in humans. The surveillance of this pathogen must be intensive, and the importance of inspection and good manufacture practices in the slaughterhouses are evident.

Keywords: STEC, cattle, virulence profile, pathotypes

Application of Hot Water and Calcium Chloride to Inhibit *Colletotrichum gloeosporioides* Development and to Preserve Postharvest Quality of Papaya

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Anthracnose caused by *Colletotrichum gloeosporioides* is the major postharvest disease of papaya, which provokes a decrease in the quality. Anthracnose is mainly controlled with chemical fungicides; however, currently it is seeking to develop effective antifungal treatments to replace synthetic chemicals because health-related concerns. Among various non-chemical alternatives, hot water immersion treatment and calcium chloride have been used to control postharvest diseases and to maintain the fruit quality. For this reason, the objective of this study was to evaluate the use of hot water combined with calcium chloride as an alternative to chemical fungicides in anthracnose control keeping the postharvest quality of papaya. Fruits were washed and inoculated by immersion in a spore suspension (1×10^5 spores/mL) for 3 minutes. After that, fruits were divided in four groups, one of them did not receive a treatment and was used as control, other group was immersed in hot water (HW) (48°C, 20 minutes), the third group was immersed in a calcium chloride solution (Ca) (1% w/v, 20 minutes) at room temperature, and the fourth group was immersed in hot water containing calcium chloride (HW-Ca) under the same conditions. Later, fruits were stored during 20 days at 12°C. *In vitro* (mycelial growth and conidial germination) and *in vivo* (anthracnose incidence and severity) fungicidal activity of HW and Ca as well as postharvest quality parameters (color, firmness, soluble solids content, and titratable acidity) were evaluated against *C. gloeosporioides*. Treatments were arranged in a completely randomized design. Data were analyzed through multiple analyses of variance using Statgraphics Plus 5.1 and the means were compared using Fisher's least significant difference (LSD) test ($p < 0.05$). Inhibition of mycelial growth and conidial germination was statistically higher by HW-Ca than control and Ca treatments. *In vivo* studies showed that HW-Ca delayed the onset of anthracnose symptoms respect to control and slowed down the anthracnose development. HW-Ca also maintained papaya postharvest quality by keeping color, and higher firmness, soluble solids content and titratable acidity values during the storage. In general, HW-Ca was effective to inhibit *C. gloeosporioides* development and to maintain the quality during storage of papaya.

Keywords: anthracnose, papaya, hot water, calcium

A Simple Low Cost Method for the Screening of Microbial Enzymes Excretion on Agar Petri Plates

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The selection of strains with high production of hydrolytic enzymes is essential for the development of bioprocesses. The aim of this work was the assessment proteases, lipases and amylases production of 17 fungal strains isolated from the food industry by-products. The strains were coded as: SK1 and SK2 (grapefruit peel); Q1, Q2, and Q4 Q3O (cheese); ACB, ACD and ACR (olive); PE (olive crust); P1, P2, P4, P5, P6, P7 and PR (pomegranate shell). Cultures in agar Petri dishes supplemented with skim milk (protease), olive oil (lipase) and starch (amylase) were prepared and incubated at 30 °C (48 h). Radial growth and substrate hydrolysis diameter (mm) were recorder. The PZ index, defined as the ratio between the diameter of substrate hydrolysis (DSH) and radial growth diameter (RGD) was calculated. The PZ index allows to identify the excretion strains capacity of at least one of the tested enzymes. The selection of the strains was evaluated under a completely randomized design to estimate differences between treatments (strains) with respect to the response variable (PZ). When necessary, a comparison of means by Tukey test ($p \leq 0.05$) was performed. The results showed significant differences between strains for each assessed enzyme excretion. Highest proteolytic activity (2.59), lipolytic (4.32) and amylolytic (3.78) PZ values were reached by Q1, P2 and P4 strains respectively. The differences on the nature of enzymes excretion from the different strains are mainly attributed to the substrate from each strain was isolated. The use of agar plates selectively supplemented the quick, easy and low cost technique that allows the identification of enzymes excretion from microbial strains. Additionally, the statistical analysis of PZ values gives a close look of the extent of enzyme excretion by the different strains. By means of the technic presented, 17 microbial strains were characterized by its different enzymes excretion capacity. The strains will be used in further studies in bioprocesses for the production of enzymes of industrial interest.

Keywords: microbial enzymes, enzyme identification, PZ index, preselection bioassay

Characterization of Silks from Different Mexican Races of Autochthonous Corn and Evaluation of its Effect on the Growth of Selected Microorganisms.

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In the Mexican traditional herbal medicine, it is common the use of corn for different pathologies, including urinary and stomach infections. The aim of this research was to characterize the composition for the maydis stigmas (proximal analysis), and the extract of stigmas (total sugars, reducing sugars, total polyphenols, total flavonoids and total anthocyanin content). Additionally, it was testing the effect of the silk's extract (from different Mexican corn races like Gordo, Cónico and Cristalino de Chihuahua) on the growth of select microorganisms. The bacteria used in this study were: *Proteus mirabilis*, *Lactococcus lactis*, *Lactobacillus casei*, *Lactobacillus acidophilus*, *Escherichia coli*, *Enterococcus faecalis* and *Kluyveromyces marxianus*). From the main results, it was observed that stigmas from corn race RC-red, present the most amounts of total polyphenols, flavonoids, and anthocyanin content. About the extracts of corn races RG-white and RC-red present, the most amounts of total sugars and the corn races RG-white and RC-white/blue present the highest levels of reducing sugars. At quantifying phenolic compounds in extracts, the corn races RG-white, RC-red and RC-dark red had the highest amount of total polyphenols, and the corn race RC- red had the highest amounts of flavonoids and anthocyanin. Regarding the growth of microorganisms, the results showed that aqueous extracts of corns from RC-dark red, RC-white and blue and RCr-yellow increase the lag phase of *Proteus mirabilis* strain 7002 ATCC; whereas *Enterococcus faecalis* decreased its growth rate with the presence of all the aqueous extracts used. In contrast, *Kluyveromyces marxianus* increased its growth rate with all the used aqueous extracts except with the extract of corn race RC-red. *Escherichia coli* decreased its change in optical density with corn race RG-white extract like *Enterococcus faecalis* decreases its change in optical density with all the aqueous extracts used except with the extract of corn race RC-red. This research demonstrated that only some of the extracts of the different races of Mexican autochthonous corn might modify the growth of selected microorganisms. However, they did not have antimicrobial activity in the case of pathogens, or prebiotic activity with nonpathogenic microorganisms.

Keywords: corn silk, extract, autochthonous corn, prebiotic

Recovery of Presumptive Shiga toxin-producing *Escherichia coli* from Chicken Carcasses from Retail Markets in Culiacan, Sinaloa, Mexico

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Shiga toxin-producing *Escherichia coli* (STEC) divides in *E. coli* O157 and non-O157. Both groups are zoonotic enteric pathogens associated with human gastroenteritis worldwide, ranging from diarrhea to life-threatening diseases such as hemorrhagic colitis and hemolytic uremic syndrome. *E. coli* O157 and non-O157 can be isolated from raw poultry representing a high risk to public health. The aim of the present study were to develop and optimize and isolation and enrichment procedure for the recovery of STEC O157 and non-O157 from chicken carcasses. Thirty whole chicken carcasses were purchased from various local retailers. The liquid from each package was collected and enriched in a two-step enrichment in tryptic soy broth with an incubation for 2 hours at 25 °C and then 8 hours at 42°C. The enrichments were then subjected to an immunomagnetic separation with anti-O157 beads, were plated directly on CHROMagar O157 (C-O157) selective medium and were further incubated for 18-24 hours at 37°C. Our preliminary results indicated that a total of 141 presumptive STEC isolates were recovered on C-O157 selective medium from all tested chicken carcasses samples. The presumptive STEC colonies had distinctive colors that were suspected of being STEC O157 and nonO157, the colony color appearance consisted of pink; blue with white perimeter; blue with pink perimeter; blue, white perimeter, blue halo; turquoise; bluish turquoise, swarmy; pink with blue center. Our findings indicate that the use of a two-step enrichment, followed by immunomagnetic separation, effectively recovered presumptive STEC isolates from chicken carcasses from retail markets in Culiacan, Sinaloa. Futher research might help to determine the prevalence of STEC O157 and non-O157 among, and can help to develop strategies to prevent contamination of these pathogens in food.

Keywords: STEC O157 and non-O157, poultry, public health risk

Analysis of Yeast communities associated with an Artisanal Mezcal Fermentation By Culture-dependent and Independent methods

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Mezcal is the second most important alcoholic beverage in Mexico, and Durango has designation of origin for its production. Market growth demands better control of the process to ensure consistent quality, so it is essential to know the yeasts present during fermentation, primarily responsible for the sensory quality of the product. When analyzing complex microbial environments such as a spontaneous fermentation, culture-dependent and culture-independent molecular methods have advantages and disadvantages, so several authors recommend comparing both. The aim of this study was to detect and identify yeasts in Mezcal artisanal fermentation at Durango State combining culture-dependent (CDA) and independent (CIA) analysis. To achieve this, a sampling during a production process in Nombre de Dios, Durango was conducted. A representative isolation was performed using the Harrison discs technic with subsequent extraction of DNA from isolated yeasts and from samples taken directly from the system. The CDA was performed by RFLP of amplified fragments using ITS1/ITS4 primers, CIA by DGGE of the amplified region using NL1/LS2 primers at previously reported conditions. Both analyzes indicate a similar species proportion and a sequence that matches with the observed in wines and other Mezcal producing regions of the country, with *Saccharomyces cerevisiae* as the dominant specie towards the end of fermentation. The AD allowed to observe greater diversity, composed for at least 8 different species in the initial must and 3 in the residual must. Mainspecies encountered were *S. cerevisiae*, *Torulaspota delbrueckii*, *Pichia kluyvery* and *Kluyveromyces marxianus*; while the AI allowed to observe only four species bringing a general image of the evolution of the microbiota present in the system in a much smaller analysis time. Both analysis indicate that *S. cerevisie*, *T. delbrueckii* and *K. marxianus* are present during the whole process increasing in proportion, while other species reduce towards the fermentation. In conclusion, even though is less precise the AI by DGGE could be useful as a monitoring tool during Mezcal production process because it provides an overview of the yeasts present in the system in a shorter period of time than AD by RFLP.

Inhibition of *Listeria monocytogenes* by a *Lactococcus lactis* subsp. *lactis*(*nisZ*)in Brain Heart Infusion and Milk

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Several bacterial genera found in raw milk are used in cheese production, especially *Lactococcus*. Some *L. lactis* strains can produce nisin, a bacteriocin capable of inhibit bacteria, including the foodborne pathogen *Listeria monocytogenes*. Different variations of nisin have been described, where nisin Z, where histidine residue on position 27 is changed by asparagine; it is associated their presence in the producer strains to *nisZ*. The use of bacteriocin-producing bacteria in food depends on their inhibition capacity in the food, and is influenced by several factors such as incubation temperature, pH and food components. This study aimed to demonstrate the inhibition capacity of a *nisZ L. lactis* over *L. monocytogenes*. BHI and sterile skim milk were inoculated with *L. monocytogenes* ScottA and *nisZ L. lactis* (both around 7 log CFU/ml), incubated for 24 h at 25°C and 37°C. Individual *L. monocytogenes* growth in BHI and skim milk were used as controls. Every 3 h, aliquots were obtained and plated for enumeration of populations (ALOA for *L. monocytogenes*, and MRS agar for *L. lactis*). Bacteriocin production was analyzed by the agar-spot semi-quantitative assay (using as target to *L. monocytogenes* ScottA). Despite the negative results for production of inhibitory substances in BHI medium, reduction of the population of *L. monocytogenes* was observed at both temperatures, when compared to control. The production of inhibitory substances by *L. lactis* in milk started at 3 h for both temperatures, (400 AU/ml). The production peak was 800 AU/mL, at 12 and 15 h, at 37 °C and 25 °C, respectively. Despite the production of inhibitory substances, at 25°C there was no reduction of *L. monocytogenes* population compared to the control. In milk maintained at 37°C, was not possible make *L. monocytogenes* quantitation after 21 h incubation due to bacteria growth inhibition. The results obtained showing inhibitory potential of the *nisZ L. lactis* strain over *L. monocytogenes* can be influenced by culture conditions, manifesting the importance of assessing such interactions, for massive application of bacteriocinogenic cultures as biopreservatives in foods.

Acknowledgments: CNPq, FAPEMIG, CAPES

Keywords: nisin, *Lactococcus lactis*, *Listeria monocytogenes*, milk, interaction

Effects of Ozone and Other Agents in the Disinfection, Polyphenols and Antioxidant Activity of Strawberries and Coriander

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Due to their aroma, flavor, medical properties and antioxidants, strawberries and coriander are frequently consumed in Mexico. Their popularity makes it crucial to find a way to disinfect them properly. This paper assesses the microorganism elimination, total phenolic content (TPC) and total antioxidant capacity in strawberries and coriander with the use of ozone produced by electrolysis (OPE) and three other commercially available disinfection treatments. The OPE in a medium scale ($7.75 \times 10^{-7} \text{ mol min}^{-1}$) was obtained by modifying the methodology published by Ibañez G.J. The remaining three treatments were a domestic ozone generator (DOG) with a rate of $6.25 \times 10^{-5} \text{ mol min}^{-1}$, a disinfectant containing 10% chlorine dioxide, and another one with 0.082% ionized silver. After disinfection treatments, colony forming units (CFU) countings were performed in order to determine the effectiveness of microorganism removal. The TPC and antioxidant capacity were assessed in wet basis using hydro-methanolic extract solutions of 80%. The TPC was determined according to the Folin-Ciocalteu procedure and antioxidant capacity by FRAP and ABTS assays. The results obtained of the TPC equivalent to gallic acid (GAE) are between the $1.75\text{-}0.81 \pm 0.23 \text{ mg GAE g}^{-1}$ interval, while the antioxidant capacity values equivalent to Trolox (TE) are between the $12.97\text{-}2.59 \pm 1.13 \text{ } \mu\text{mol TE g}^{-1}$ interval using ABTS assay, and between $4.94\text{-}1.85 \pm 0.69 \text{ } \mu\text{mol TE g}^{-1}$ interval using FRAP assay. Both in the TPC and antioxidant capacity determination, non-statistically different values ($p < 0.05$) were obtained when the control and the treatments were compared, which suggest that none of the treatments affect said properties. In the case of the CFU count in the coriander, there is no statistically significant difference between any of the treatments. However, when applied to strawberries, the chlorine dioxide and DOG were 19% more effective in microorganism removal than OPE and the disinfectant based on ionized silver. In conclusion, ozone produced by electrolysis may be used as an alternative and/or complementary disinfection treatment, since it reduces in 61% and 80.7% the number of CFU in strawberries and coriander, respectively, while TPC and antioxidant activity in both cases remain constant.

Keywords: Ozone, antioxidant, polyphenols, CFU, disinfection

Microbiological Profile and Incidence of *Salmonella* Spp and *Listeria monocytogenes* in Ranchero Cheese (Fresh Cheese)

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Ranchero cheese is a highly consumed fresh cheese by Mexican population. Due to its artisanal production and public markets sale, it could represent microbial risks for the consumer. The aim of this work is to evaluate microbial quality of commercial ranchero cheese from supermarkets and public markets, including the presence of *Salmonella* and *Listeria monocytogenes*. From public markets and supermarkets of Queretaro City (Mexico), 150 samples of ranchero cheese were collected. Lactic acid bacteria (LAB), molds and yeasts, Enterobacteriaceae, total and fecal coliforms and *E. coli* were quantified; and *Salmonella* and *L. monocytogenes* were investigated according to the Bacteriological Analytical Manual (FDA). Water activity (A_w), pH, titratable acidity and NaCl content of cheese samples were measured according to AOAC methods. Ranchero cheese from public supermarkets^a and markets^b, showed a similar ($p > 0.05$) concentration of LAB (6.69^a and 6.78^b Log CFU/g) In contrast, the levels of molds (1.0^a and 2.0^b Log CFU/g), yeasts (3.63^a and 4.05^b Log CFU/g), Enterobacteriaceae (2.32^a and 5.85^b Log CFU/g), total coliforms (1.95^a and 3.77^b Log CFU/g), fecal coliforms (1.95^a and 2.26^b Log CFU/g) and *E. coli* (1.95^a and 2.10^b Log CFU/g) showed significant differences between cheese obtained from public markets and supermarkets ($p < 0.05$). *Salmonella* and *L. monocytogenes* were detected in 14 samples (9.33%), and 3 samples (2%), respectively. Physical and chemical characteristics of ranchero cheese showed a wide dispersion, values for pH (4.87-6.87), A_w (0.813-0.999), lactic acid % (0.08-0.52), NaCl % (0.53-4.25). *Salmonella* and *L. monocytogenes* presence in a ready-to-eat food (ranchero cheese) reveals deficient hygienic practices during its production chain, representing a microbial risk for the consumer.

Keywords: Ranchero cheese, *Salmonella*, *Listeria monocytogenes*

Effect of pH on the Release of the Purified Bacteriocin from *Pediococcus acidilactici* ITV26 Loaded into Liposomes.

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Bacteriocin produced by *Pediococcus acidilactici* ITV26, has a potent antilisterial activity. However, the activity of this bacteriocin is affected by several factors, such as inactivation by proteolytic enzymes or by additives, linking or interaction with food components, limited solubility and high pH. Hence, an alternative to protect it is encapsulation into liposomes. The aim of this research was to obtain liposomes loaded with the purified bacteriocin of *P. acidilactici* ITV26 through microfluidization and to evaluate the effect of pH on the kinetics of release of the bacteriocin. In addition, the obtained liposomes were characterized in terms of particle size, polydispersity and zeta potential. The bacteriocin was produced from a fresh culture of *P. acidilactici* ITV26 incubated at 37 °C for 18 h. The bacteriocin was purified by the adsorption-desorption method with 200 mM NaCl solution, then lyophilized and stored at -20 °C. Liposomes were prepared by using a rotor-stator (Ultra Turrax T25), and subsequently a microfluidizer equipment (Microfluidics M-110P) with 3 to 5% (w/w) of phosphatidylcholine from soybean (PC), at pressures of 500 and 1000 bar using two cycles. The obtained liposomes were characterized in terms of particle size, polydispersity and zeta potential. Release kinetics were studied by incubating the encapsulated bacteriocin at pH 4, 5, 6 and 6.8, at several time intervals for 120 h at 20 °C. Results showed that bacteriocin from *P. acidilactici* ITV26 is a peptide of 4,610 Da having 20,333 Activity Units/mL. Otherwise, the particle size of the emulsion obtained with the rotor-stator was reduced by 62% using microfluidizer equipment. Nanoencapsulation with PC by using microfluidization allowed obtaining liposomes of about 128 nm with no significant difference ($p < 0.05$) between cycles. However, with 5% PC and 2 cycles of microfluidization allowed to achieve 89% encapsulation efficiency. The bacteriocin was stable, and had a slow and controlled release during 120 h in all the studied pH, decreasing pH modifies the ionic interactions involved in the stability of liposomes, therefore, at pH 4 has a better release of the purified bacteriocin.

Keywords: bacteriocin, microfluidization, liposomes, *Pediococcus acidilactici* ITV26

Effect of Habanero Chili Extract on the Survival of Lactic Acid Bacteria and *Staphylococcus aureus*

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Lactic acid bacteria (LAB) are used in the food industry in the production of fermented products. *Staphylococcus aureus* is a pathogenic bacteria that should be absent in our food products. Previous work has shown that pimiento and guajillo peppers inhibited *Staphylococcus aureus*. The objective of this work was to evaluate the impact of habanero chili extract on the viability of LAB and *Staphylococcus aureus*. The habanero chili extract was prepared using isopropanol which was subsequently eliminated by evaporation under vacuum. The capsaicinoids concentration in the extract was determined by HPLC-RP. Concentrations of 10, 20 30 and 50% of extract were tested against *Leuconostoc citreum*, *Lactobacillus casei* Shirota and *Staphylococcus aureus*. Bacteria concentration was reading at 0.5 McFarland nephelometer and inoculated at 1% (v/v) in broth mixed with the habanero chili extract. Viability was monitored by optical density and plate count for 24 h at 37 °C for *Lactobacillus casei* Shirota and *Staphylococcus aureus*, and at 30 °C for *Leuconostoc citreum*. A positive control of each bacteria was run in each case. *Staphylococcus aureus* was inactivated by the addition of 30% of extract showing a significant decrease ($p \leq 0.05$) in its viability after 8 h of incubation, reaching its complete inhibition at 12 h. On the contrary, *Lactobacillus casei* Shirota reached its maximum growth with 30% extract. *Leuconostoc citreum* was the most tolerant bacteria; at the same concentration of 50% its viability remained constant until 24 h; showing a bacteriostatic effect. *Lactobacillus casei* Shirota and *Leuconostoc citreum* were able to tolerate 30% of extract, and the same concentration inactivates *Staphylococcus aureus*. It is concluded that these lactic acid bacteria can tolerate high concentration of chili extract and this effect is important on food products that contain habanero chili.

Keywords: *Capsicum*, Capsaicinoids, Habanero chili, Lactic acid bacteria

Mexican Unpasteurized Fresh Cheeses Are Contaminated With Non-O157 Shiga Toxin Producing *Escherichia coli* And Potential Uropathogenic *E. coli* Strains

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Foodborne diseases encompass a wide spectrum of illnesses that are the result of the ingestion of foodstuffs contaminated with microorganisms or chemicals. From 1998 to 2011 in the United States, a total of 90 outbreaks due to cheese consumption were reported, 38 were caused by cheese made from unpasteurised milk of which 40% were linked with soft cheeses imported from Mexico. Fresh cheeses are a main garnish of Mexican food and 88% of these, are made from unpasteurized cow milk. A total of 52 fresh unpasteurized cheeses, of 5 different types, were purchased from a variety of suppliers from Tabasco, Mexico. By most probable number method, 67% and 63% of samples were positive for faecal coliforms and *E. coli*, respectively; revealing their low microbiological quality. General hygienic conditions of traditional cheese manufacturers were poor. All *E. coli* isolates were analyzing for the presence of 26 virulence genes, using five multiplex PCR; two for the identification of diarrheagenic *E. coli* groups (DEC), one for DEC toxins and two for uropathogenic *E. coli* (UPEC) virulence genes. 9 (17%) samples were contaminated with diarrheagenic *E. coli* strains; 8 harbored non-O157 Shiga toxin producing *E. coli* (STEC) and one sample simultaneously had STEC and diffusely adherent *E. coli* strains. All STEC strains carried the *stx1* gene. Potential uropathogenic *E. coli* (UPEC) strains were isolated from 15 (29%) samples; the most frequent gene combination was *fimA-agn43*. Two samples were contaminated with *Salmonella*. Unpasteurized fresh cheeses produced in some regions of Mexico are in general of poor microbiological quality and frequently harbor foodborne pathogens. National food safety authorities should consider their consumption a public health risk. Good hand milking practices and hygienic manufacturing procedures may have a major effect on improving the microbiological quality of these food items.

Keywords: Fresh cheeses; *E. coli* genes; non-O157 STEC; UPEC

Isolation and Identification Microbial Flora from *Melipona beecheii* Honey

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The honey is a sweet complex substance produced by the bees from the nectars and other sources, which has been consumed by the people since ancient times as food, and it has been employed in traditional medicine, for the treatment of several affections. It is mainly composed of carbohydrates and, to a lower degree, of other substances like organic acids, amino acids, proteins, minerals, vitamins, flavonoids, pigments, enzymes, and other phytochemicals. Furthermore, researchers have demonstrated that the honey has microorganisms, which come from several sources such as air, soil, digestive tract of bees, pollen and nectar. They also have suggested that these endogenous microorganisms of the honey perform several functions like the maturation through the fermentation of carbohydrates and the dehydration, just like the addition of some compounds that make a positive effect in the treatment of several affections. Additionally, previous studies have demonstrated the presence of lactobacillus strains in honey. Due to this, the purpose of the current study is the isolation and identification of the microaerophilic and anaerobic microorganisms of the *Melipona beecheii* honey, using biochemical tests to find strains with potential probiotic capabilities, also to generate knowledge about endogenous microorganisms of the *Melipona beecheii* honey, which are not identified yet. The isolation of the microorganisms was carried out through serial dilutions, using microaerophilic and anaerobic conditions, and employing two kinds of media, Luria-Agar and Mueller Hinton. The strains were purified and then they were valued by macroscopy morphology, cellular morphology by Gram stain, their production of endospores, and catalase and oxidase test. We obtained 16 microbial strains, 7 in anaerobic conditions and 9 in microaerophilic conditions. Most of them were classified as Gram positive rods, producing endospores, catalase-positive and oxidase-negative. With the information generated, the strains were grouped in the genera *Bacillus*, *Lactobacillus*, *Actinomyces*, *Enterobacter*, *Clostridium*, *Enterococcus*, *Paenibacillus*, *Aerococcus* y *Lactococcus*.

Keywords: Bacteria, Melipona Honey and *Bacillus*

***Melipona beecheii* honey and its phenolic and protein extracts have antimicrobial activity against *Listeria monocytogenes*, a foodborne pathogen.**

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Listeriosis is a serious, invasive disease that primarily affects pregnant women, neonates and immunocompromised adults. This disease has a high mortality rate (20-30%), and its complications could cause meningitis, septicemia and abortions. *Listeria monocytogenes* is the bacterial agent of this infection, and is primarily transmitted to humans through contaminated foods. The main problem today is that the microorganisms have acquired resistance to several antibiotics. A potential alternative to control antibiotic resistant pathogens is honey. In Mayan culture, the uses of *Melipona* honey produced by stingless bee species are diverse; it is mainly used to treat disorders of the respiratory, digestive, circulatory and immune systems. Previously, studies have shown that the *Melipona* honey is able to inhibit the growth of important pathogens such as *Escherichia coli* and *Staphylococcus aureus*. In this sense, *L. monocytogenes* ATCC 15313 was the strain used in the experiments. The phenolic extracts (PhE) from *Melipona* honey were obtained using Amberlite XAD-2 column. Also, protein extracts (PE) were obtained employing phosphate buffer. The antimicrobial activity and minimum inhibitory concentration (MIC) of *Melipona* honey, PhE and PE were determined by the disk diffusion and microdilution method. Correspondingly, primers were designed and tested to detect housekeeping and virulence genes of *L. monocytogenes*. Our results showed that *Melipona* honey, PhE and PE can inhibit the growth of *L. monocytogenes* with concentrations above of 40%, 620 µg and 100 µg, respectively. The MICs of *Melipona* honey, PhE and PE against *L. monocytogenes* were 23%, 591µg/ml GAE and 85 µg/ml, respectively. cDNA were amplified from RNA to detect ActA, InlA, InlC and Hly genes which are involved with the pathogenicity of *Listeria monocytogenes*. These results could be useful to determine the effect of *Melipona* honey and its components on expression of virulence genes of *L. monocytogenes*. *M. beecheii* honey, its phenolic and protein extracts could be used as a natural alternative against infections caused by *Listeria monocytogenes* because it showed high bacterial activity against the pathogen. Furthermore, honey and its compounds also have a great advantage, since its intake does not cause side effects in humans.

Keywords: listeriosis, honey, pathogenicity

Biofilm-Forming Ability by Lactic Acid Bacteria Isolated From Meat Industries

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Biofilms on inert food contact surfaces could lead to food contamination by undesirable microorganisms, resulting in food spoilage or transmission of disease. The carnic products are the most susceptible to this type of contamination. Some spoilage are *Pseudomonas aeruginosa*, *Moraxella*, *Alcaligenes*, *Streptococcus* spp, *Leuconostoc* spp, *Bacillus* spp, *Micrococcus* spp and *Lactobacillus* spp associated with meat processing. Biofilm has become a problem in food industries as it renders its inhabitants resistant to antimicrobial agents and cleaning. The objective of this work was the formation of biofilms could be a potential source of contamination with spoilage in industries meat processing. The biofilm formation assays that were realized consisted in to incorporate aliquot 50 μ L of a three different strains of Lactic Acid Bacteria (LAB) (1.1×10^5 – 8.5×10^7 UFC/mL) in MRS broth and were added stainless steel coupons (AI SI 304) of 250 mm and 0.5 mm surfaces. A negative control with no inoculum was included in all assays. After 24 h of incubation at 37 °C and 7 days / 25 °C, coupons were removed and washed with 1 mL PBS (7 mM Na₂HPO₄, 3 mM NaH₂PO₄, 130 mM NaCl pH 7.4) for 10 s to eliminate non-adhered cells. Coupons were stained with 0.01 % of acridine orange solution for 2 min, rinsed with sterile distilled water and observed three coupons of each model with a Nikon Eclipse E200 epifluorescence microscope. The number of adhering cells of LAB on the surface of the coupons increased as a function of contact time (7 days) and temperature (25°C). Other important factor is the ability of LAB to produce extracellular adhesive material that helps the cells to adhere to the surface. The study demonstrated that the lactic acid bacteria could adhere and survive in food contact surface and even increase the populations as time progressed and low temperature.

Keywords: Biofilms, Lactic Acid Bacteria, surfaces

Antimycotoxigenic and Antifungal Activity of *Eucalyptus globulus* and *Thymus capitatus* Essential Oils

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Essential oils (EO) of eucalyptus (*Eucalyptus globulus* L.) (EOE) and thymus (*Thymus capitatus* L.) (EOT) were evaluated for their efficacy to control *Aspergillus parasiticus* and *Fusarium moniliforme* growth and their ability to inhibit mycotoxin production. Data from kinetics radial growth was used to obtain the half-maximal inhibitory concentration (IC₅₀). The IC₅₀ was used to evaluate spore germination kinetic and mycotoxin production. In addition, spore viability was evaluated by the MTT assay. All EO had an effect on the radial growth of both species. After 96 h of incubation, EOT at concentrations of 1000 and 2500 µL L⁻¹ totally inhibited the growth of *F. moniliforme* and *A. parasiticus*, respectively. The IC₅₀ of EOE and EOT significantly reduced spore germination of *A. parasiticus*. Inhibition of spore germination of *F. moniliforme* was 84.6 and 30.6% when exposed to EOE and EOT, respectively. EOT and EOE reduced aflatoxin (4%) and fumonisin (31%) production, respectively. Spore viability was affected when oils concentration increased, being the EOT the one that reduced proliferation of both fungi. Our findings suggest that EO affect *F. moniliforme* and *A. parasiticus* development and mycotoxin production.

Keywords: essential oils, mycotoxin production, spore viability, mold inhibition

Evaluation of CLA Production by Lactic Acid Bacteria Isolated from Artisanal Mexican Fresco Cheese

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The artisanal cheeses, in most cases, are produced with unpasteurized milk under semi-rustic conditions without addition of starter cultures. Therefore, the autochthonous microbiota contained in the cheeses contributes to the development of the typical features of the cheeses. Particularly, lactic acid bacteria (LAB) play an essential role in the developing of specific flavor, texture and aroma. Beyond such conventional role, some LAB have been looked up as “cell factories” for production of functional biomolecules such as conjugated linoleic acid (CLA), a biologically beneficial functional lipid with different health benefits (e.g., anticarcinogenic, anti-obesity, immunomodulatory, antioxidant). Due to such benefits are dependent on the CLA isomers, and that CLA isomer formation is strain-dependent, bacteria selection must take into account CLA production conditions and the type of isomer formed. Hence, the aim of this study was to assess the ability of eight LAB strains isolated from artisanal fresco cheese from Veracruz, México, to produce CLA by fermentation carried out either in MRS broth or low-fat milk [10% (w/v)] added with 0.5 mg/L or 1 mg/mL of linoleic acid (LA). Additionally, the effect of co-culture on CLA production was assessed. Gas chromatography was used for CLA quantitation. Results showed that *L. plantarum* SP-50, was the strains with highest CLA production in MRS broth (9.29 mg/mL) and in low-fat milk added with 1 mg/mL of LA (3.56 mg/mL) after 48 h of incubation at 37 °C. Viability of the producing strains was not affected by the addition of free LA. Besides, interactions between bacteria (co-culture) did not increase significantly the amount of CLA produced, compared to single cultures. Our results suggest that *L. plantarum* SP-50 have biotechnological potential as adjunct or starter culture for preparation of fermented dairy products enriched with CLA.

Keywords: linoleic acid, lactic acid bacteria, conjugated linoleic acid, *Lactobacillus plantarum*.

In Vitro Test For Parasitism Of *Lecanicillium lecanii* (Zimmermann) Zare & W. Gams On *Hemileia vastatrix* Berkeley & Broome, Causal Agent Of Rust On Coffee Leaves

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Leaf rust caused by *Hemileia vastatrix* Berk. And Br. is a disease that attacks coffee crops, decreasing their yields. While chemical fungicides have been effective to keep the disease under control, they introduce dangers to human health and to the environment. Naturally occurring hyperparasitic fungi do not present the same risk, and may be more sustainable. The entomopathogenic fungi *Lecanicillium lecanii* has been shown to have an antigenic effect on the rust. The objective was to evaluate the parasitic capacity of twelve strains of *L. lecanii* *In vitro* on *H. vastatrix*. The percentage of *H. vastatrix* uredospore germination was determined as well as the *L. lecanii* conidia for the following strains: EH-348(0), EH-457(0), EH-457(5), EH-458(0), EH-458(2), EH-459(0), EH-460(0), EH-572(0), EH-572(7), EH-627, EH-630 y EH-633, and also the chitinolytic activity of four *L. lecanii* strains that were selected by an enzymatic index. (The chitinolytic activity was expressed as the ratio between colony diameters of the halo caused by substrate degradation). Results showed that uredospore germination decreased significantly ($p \leq 0.05$) in the presence of conidia of the twelve strains of *L. lecanii* compared to the control group. In ten strains of *L. lecanii* the conidial germination percentage in the presence of uredospores increased compared to the control group. This suggests that the reduction in the uredospore germination percentage is related to the presence of conidia, since *L. lecanii* has been linked to *H. vastatrix* uredospore lesions and to a decrease in its function. The index of chitinolytic activity in *L. lecanii* strains EH-459(0), EH-458(2), EH-572(0) y EH-630 had values of 3.56, 3.04, 3.13 and 2.69 respectively. The experiments that we conducted demonstrated that *H. vastatrix* germination was significantly inhibited by the twelve *L. lecanii* strains evaluated, making it an alternative for biological control of rust. Pathogenicity is a complex process in which the presence, timing and regulation of many factors, as well as their interactions are probably involved and they have to be considerate to select the best biocontrol strains.

Keywords: *Lecanicillium lecanii*, rust, *Hemileia vastatrix*, biological control, chitinolytic Activity

Occurrence of Non-tuberculous Mycobacterial in Unpasteurized Milk and Dairy Products and that have the Capacity to Produce Biofilms

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Non-tuberculous mycobacterial (NTM) are opportunistic pathogens that can be recovered from water, soil and food. Biofilm formation is the best strategy for the survival of these microorganisms in the environment, conferring them high resistance to disinfectants and antimicrobial drugs, making NTM infections difficult to eradicate. The aims of this study were to evaluate the occurrence of NTM in unpasteurized milk and dairy products as well as to evaluate the capacity of NTM strains to produce biofilms. From October-2013 to September-2015 a total of 120 samples were collected; 24 samples of unpasteurized milk, from three different dairy farms of the State of Mexico; 72 cheese samples and 24 cream samples collected from three markets at the Mexico City “Delegación Gustavo A. Madero”. An aliquot of 100 μ L of each diluted food was placed on Middlebrook 7H10 agar supplemented with PANTA and cycloheximide. Then Acid-fast bacilli strains that grew on this agar were characterized by two specific PCR, one for *Mycobacterium* genus and the other for *M. tuberculosis* complex. Mycobacterial species identification were done by three methods: PRA technique, sequencing of the *rpoB* gene and sequencing of the 16S rRNA hypervariable region V2. Biofilm formation was evaluated by placing the strains in 24-well polystyrene plates coated with two different mediums (7H9 and M63), and then biofilm formation was quantified using the crystal violet technique (*M. smegmatis* mc²155 was used as positive control). NTM species were recovered from 11 samples (9.1%): three (12.5%) from unpasteurized milk samples, five (20.8%) from cream samples and three (4%) from cheese samples. Of some samples, more than one *Mycobacterium* specie was isolated. *M. chelonae* and *M. abscessus* were recovered together from 3 samples, *M. fortuitum* from 3, *M. porcinum* from 3, *M. abscessus* from 1 (alone), and 1 from *M. rhodesiae*. All 14 mycobacterial strains were able to form a biofilm structure in both tested media, but was significant less ($p < 0.05$) than the biofilm produced by the positive control. Mycobacterial strains were isolated from unpasteurized milk and dairy products that have the capacity to produce biofilm structures.

Keywords: Unpasteurized milk, Dairy products, Non-tuberculous Mycobacterial, Biofilm.

Fungal β -glucosidase production on tarbush foliage solid-state fermentation

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There are resources from semidesertic areas that can be employed to produce metabolites or high added-value compounds. *Flourensia cernua* (tarbush) is a plant widely available in this region which foliage can be biotransformed for biotechnological obtention of the desired compounds. This research work carried out a solid-state fungal culture for β -glucosidase production using leaves of tarbush inoculated with *Aspergillus niger* GH1. The experiments were made under a Box-Behnken design to obtain the most adequate conditions for β -glucosidase production. To each treatment, a specific condition was applied, which involved three levels of the factors evaluated which were pH, water content and inoculum size. The culture was performed at 30 °C for 36 hours. As a result, compared to a control treatment of 486 U/L, the highest enzymatic activity was 1446 U/L. This demonstrates a clear effect of factor manipulation in increasing enzyme production under the established conditions. Also it is shown that the fungal strain is able to degrade tarbush compounds to produce an enzyme of great interest for agroindustry.

Keywords: β -glucosidasa, fermentación sólida, *F. cernua*, *Aspergillus*.

Viability of Yeast Isolated From Guajillo Pepper Brine Fermentation Under Gastrointestinal Conditions by Laser Scanning Confocal Microscopy

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Mexico is the principal consumer of *Capsicum* varieties in the world. Peppers can be consumed fresh, on sauces or brine. In previous results we identified the presence of yeasts in the guajillo pepper brine fermentation: *Pichia kudriavzevii*, *Wickerhamomyces anomalus*, *Hanseniapora opuntiae* and *Candida glabrata*. The objective of this work was to analyze the presence of yeasts in the guajillo pepper fermentation and its capacity to survive in gastrointestinal conditions. First, we optimized the spontaneous guajillo pepper (*Capsicum annuum* L.) brine fermentation measured by the ethanol production through a factorial design 32 and response surface methodology. Ethanol content was analyzed by CG-HS. Later, each yeast was cultivated in YPD media at 37°C and 150 rpm for 8 h. After, the cultures were centrifuged, washed with PBS and then they were exposed to gastrointestinal conditions for 6 hours, using pepsine, bile salts and pancreatine. Initial population was adjusted at 107 CFU/mL. Cultures were incubated with 0.26 g/L pepsine and pH 2 at 37°C for 1 h, following by addition of 1.95 g/L pancreatine and 3 g/L bile salts and incubated for 5 h. Yeasts viability was determined by confocal laser scanning microscopy (CLSM). Yeasts cultures were washed with PBS and fluorochromes were added. Diacetate fluorescein was used to distinguish living yeast cells (which are unstained), from dead cells, which propidium iodide. Statistical and image analysis was performed using the software STATGRAPHICS® Centurion XVI and Image J, respectively. Results on CLSM showed than initial viability of *Hanseniapora opuntiae* was 84% and after exposure to gastrointestinal conditions, it decreased at 65%. Initial viability of *Pichia kudriavzevii* and *Wickerhamomyces anomalus* was similar, 98%, however after incubation for 6 h, viability decreased 12 and 4%, respectively. Initial viability of *Candida glabrata* was 99% and after exposure to gastrointestinal conditions, it decreased 8%. In conclusion, some yeasts can growth during guajillo pepper fermentation, which have capacity to resist gastrointestinal conditions. This is one of the characteristics to considered with probiotic potential.

Keywords: viability, guajillo, yeasts, CLSM.

***Enterococcus faecium* Kinetic Study Asylee Cream Cheese Chiapas State**

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For hundreds years the lactic acid bacteria (LAB) have played an important role in obtaining and producing most of the fermented foods. LAB are of interest in the food industry to induce favorable organoleptic and structural characteristics. The purpose of this study was to evaluate the kinetics of *Enterococcus faecium* growth isolated of cream cheese to study their behavior in MRS medium *in vitro*. Growth kinetics were conducted evaluating three concentrations of MRS broth (40, 55 and 65 g/L) and three growth temperatures (25, 30 and 35 °C) at 150 rpm and pH 7.0, performing nine treatments. A laboratory level, Erlenmeyer flasks were assessed growth rate, generation time, biomass and CFU/mL. For the statistical study was performed ANOVA completely randomized using the Minitab 17. For the growth kinetics were used the Sigma Plot 12. In the methodology were carried fermentations at lab level, they were conducted in 250 mL Erlenmeyer flasks containing 100 mL of broth MRS (40, 55 and 65 g/L), they were incubated in a shaker (THERMOSCIENTIFIC MAXQ 4000) at a speed of 150 rpm. Fermentations were performed at 25, 30 and 35 °C. The biomass was determined by absorbance at 600 nm D.O. The quantification of viable cells was performed using decimal dilutions, which 10 µL of sample was inoculated in MRS agar. Generation times and the growth rate were calculated using the methodology proposed by Jury-Gamez *et al* in 2014. The results showed a growth in an order of 1×10^6 CFU/mL of *Enterococcus faecium*, obtaining μ values of 0.0667 h^{-1} at 25 °C and 65 g/L, 0.0819 h^{-1} at 30 °C and 65 g/L and 0.0841 h^{-1} at 35 °C and 65 g/L, with generation times of 10.39 hours at 25 °C and 65 g/L, 8.46 hours at 30 °C and 65 g/L and 8.24 hours at 35 °C and 65 g/L, obtaining biomass final concentration of 4.2785 g/L, 6.3575 g/L and 6.1208 g/L respectively. Statistical results did not show significant differences at 30 and 35 °C in growth rates and the generation time at these concentrations.

Keywords: *E. faecium*, kinetic growth, MRS media

Isolation and Characterization of Compounds with *In Vitro* Antibacterial Activity from Hydrosol of Oregano (*Lippia palmeri*) and Morphometric Changes on *Listeria monocytogenes*

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The risk for foodborne disease increases every year and thus the interest in discovering new natural antimicrobials. Studies of aromatic plants have increased due to the use of essential oils (EO), which improve the taste of food and increase its shelf life due to their antimicrobial activity. However, reports on the study of their aromatic waters or hydrosols (HS) are still limited. In order to evaluate the antibacterial activity of oregano (*Lippia palmeri*), EO and HS were obtained by the hydro distillation method. The fractionation was performed by open column chromatography. The *in vitro* antibacterial activity of oregano HS and its fractions, against the bacterial pathogen *L. monocytogenes* (ATCC 4766), was performed by using the disk diffusion method. The inhibitory concentration (IC₅₀) was estimated using the survival PROBIT analysis, (Ampicillin was used as a control); statistical significance was considered as $p < 0.05$. For cell diameter measurement, membrane damage estimation, and oxidative stress evaluation, epifluorescence microscopy was used. Chemical characterization of the major compounds present in oregano HS was performed by UV-Vis, fluorescence, IR, and ¹H-NMR. HS showed inhibition of *L. monocytogenes* (IC₅₀ = 224 µL/mL). From FA1 and FA2 obtained, FA1 had a higher antibacterial activity (IC₅₀ = 125 mg/mL) ($\alpha = 0.005$). Rosmarinic acid and a phthalate derivative were identified. The HS, a by-product of the essential oils extraction, showed bioactivity against *L. monocytogenes*; therefore, concentrated HS would likely be a candidate for its use as an active ingredient in sanitizing food and areas in contact with them.

Keywords: *Lamiaceae*; aromatic leaves; bioactive compounds

Distribution of Ethanol-Resistant Lactic Acid Bacteria Present in Wineries of Querétaro, México

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Wine quality is strongly affected by autochthonous microorganisms present in the field and/or in cellar equipment, especially those able to grow in wine. Some lactic acid bacteria (LAB) species have been associated to wine spoilage and biogenic amines production, while others can improve wine taste by malolactic fermentation. In the emerging wine region of Querétaro, México the LAB species present, their reservoirs and their possible wine quality impact are unknown. To identify ethanol-resistant LAB species from strategic materials of wineries established in Queretaro, LAB were isolated using three culture media, from must, wine and barrel/filters samples collected in four wineries of Querétaro. Tolerance to ethanol (10-13%) was assessed in a synthetic wine media containing SO₂ (300 mgL⁻¹) and a pH of 3.5, using a Bioscreen© (72 h, 30 °C), Those LAB strains resistant to at least 10% ethanol were identified using species-specific primers in a Multiplex-PCR. From 61 samples, 822 LAB isolates were recovered, from which only 14% (119) were resistant to 10% ethanol. Five different species were identified in these isolates: *Oenococcus oeni* and *Lactobacillus plantarum*, which can be used as starter cultures, and *Pediococcus parvulus*, *Lactobacillus hilgardii* and *Lactobacillus brevis*, which have been associated with wine spoilage and biogenic amines production. The highest diversity of LAB species was found in wine samples, while barrels were perceived as hazardous microbial reservoirs. With 13% ethanol, almost all species (excepting *O. oeni*) decreased the number of resistant isolates in about 50%, being spoilage species (*Lactobacillus*. spp. and *P. parvulus*) the most affected ones. Results obtained in this study lead to develop strategies to control spoilage microorganisms and obtain possible autochthonous starter cultures in order to improve the quality of the local wines.

Keywords: autochthonous cultures, winemaking, lactic bacteria

Antifungal Activity of Compounds of the 2-(Anilino) 1,4-Naphthoquinone and its Incorporation in an Edible Film

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Naphthoquinones are natural pigments present in higher plants, traditionally were used by their dyeing properties and are currently important biological activities have been attributed as antiparasitic, antibacterial, anticancer agents, antifungals, among others of great importance. The aim of this work was to obtain compounds of the 2- (anilino) -1,4-naphthoquinone with antifungal activity and could be incorporated into edible shell. 3 compounds (3a, 3b and 3c) were obtained by the addition reaction by 1,4-Michael type ring anilines to 1,4-naphthoquinone. Ultrasound-assisted synthesis (SAU) and Microwave assisted synthesis (SAM) as alternative activation sources were used. The results indicated that the SAU promotes the reaction and provides the best yields (47-96%). Subsequently antifungal activity against phytopathogenic fungi (*Alternaria alternata*, *Fusarium oxysporum*, *Colletotrichum gloeosporoides*, *Penicillium expansum*, *Botrytis cinerea*, *Aspergillus fumigatus*, *Mucor* and *Rhizopus stolonifer sp*) was evaluated by the method of poisoned medium at different concentrations (1000-62.5 ppm). The percentage of inhibition was determine; with the data, an ANOVA was done, followed by a means comparison test by Tukey with a significance level of 95%. All analysis were done using the statistical program Statgraphics Version 5; It was the best inhibited phytopathogenic *A. alternata* (MIC₅₀ = 2.1X10¹ mg / L). Finally the compounds were added as antifungal agents (500 ppm) to an edible shell produced from pectin (1.093%), candelilla wax (0.165%), glycerol (0.328%) and were characterized in part by measuring parameters of thickness, permeability water vapor, solubility and transparency. The results of this research show that it is possible to incorporate naphthoquinone derivative compounds with antifungal based pectin and Candelilla wax for generating grocery covered with colors characteristic activity.

Keywords: naphthoquinones, antifungal, covers edible

Pigment production by *Janthinobacterium lividum* using different culture media

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Pigments are molecules that impart color to materials by the optical effect of the refraction of sunlight and they are of great importance for various industries such as food, pharmaceutical and textile. Traditionally natural sources of pigments are plants and insect tissues; however, those processes have some disadvantages such as low production yields, generation of wastes during the extraction process, low thermal stability, etc. Owing to those characteristics, pigments synthesized by microbial pathway is an interesting alternative. The aim of this work was to analyze the effect of the nutritional factors on the biosynthesis of microbial violacein in submerged culture. Experiments were conducted in different steps such as i) analysis of the effect of culture medium composition, ii) description of the production kinetics, and iii) analysis of the impact of low cost carbon and nitrogen source on the violacein production. The strain used was *Janthinobacterium lividum* CECT946. All experiments were carried out at temperature of 21 °C and 150 rpm of agitation. Pigment production and bacterial growth were quantified spectrophotometrically at 570 and 660 nm respectively. According to the results, it was observed that *Janthinobacterium lividum* strain was able to produce violacein and grow in different culture media tested. The maximum levels of violacein produced were obtained in the modified soy broth medium (3.779 ± 0.52 UA_{570nm}). It was observed that the maximum production of violacein was reached at 57-62 hours of fermentation. In addition, it was observed that with the use of molasses and sodium glutamate, as sources of carbon and nitrogen respectively, the violacein levels were similar to control medium. However, from an industrial perspective, the use of these by-products can substantially reduce production costs of violacein. The results of this study indicated that the strain *Janthinobacterium lividum* strain was able to grow and produce pigment in different media. The use of inexpensive carbon and nitrogen source is a promising alternative to use in the production of microbial pigments.

Keywords: Pigment, agro-industrial waste, violacein, *Janthinobacterium lividum*

Rapid Identification Method for the Detection of Microbial Hydrolases on Agar Plates with Selective Enzymes Inductors

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The isolation, selection, characterization and identification of microbial strains is crucial for industrial enzymes production. The aim of this study was to identify the tannases, ellagitannases, pectinases and cellulases excretion capacity from 17 strains isolated from food industry by-products. The strains coded as SK1 and SK2 (grapefruit peel); Q1, Q2, and Q4 Q3O (cheese); ACB, ACD and ACR (olive); PE (olive crus); P1, P2, P4, P5, P6, P7 and PR (pomegranate shell). Agar plates added with selective substrates were prepared to induce tannase (tannic acid), ellagitannase (punicalagin), pectinase (pectin) and cellulose (carboxymethylcellulose) production. The strains were inoculated to the center of the plate and incubated for 48 h (30 °C) for pectinase and cellulases test and 72 h for tannases and ellagitannases. Radial growth diameter (RGD) and radial substrate hydrolysis diameter (RSHD) were recorded, then power index ($PZ = RGD/RSHD$) was calculated. The enzyme expression identification was assessed following a completely randomized design to estimate differences between treatments (strains) with respect to the response variable (PZ). When necessary, a test comparison of means by Tukey ($p \leq 0.05$) was performed. It was observed that the strains P6 ($PZ = 2.28$), ACR 8 ($PZ = 2.36$), SK2 ($PZ = 4.65$), P6 ($PZ = 4.73$) strains produced higher titers ($p \leq 0.05$) of ellagitannases, tannases, pectinases and cellulases respectively. The agar plate bioassay is a feasible methodology for the easy, fast and low cost system to characterize the enzymatic activity based on microbial ability to hydrolyze the specific substrates tested. The strains characterized for its enzymatic activity will be used in further studies for production of enzymes with high industrial interest.

Keywords: Bioassay, potency index, hydrolases, ellagitannases, pectinases.

Growth of lactic acid bacteria in the presence of sweeteners and an emulsifier

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The objective was to evaluate the effect of the addition of non-caloric sweeteners and an emulsifier in the growth of 9 strains of lactic acid bacteria. To do so, microorganisms belonging to the genera *Lactobacillus* and *Pediococcus* were grown in broth Man, Rogosa and Sharpe (MRS) to which was added, individually, 4 sweeteners equivalent to daily estimated intake in mg/kg (13.3 aspartame, 1.3 Stevia, Acesulfame K 0.69 and 1.6 sucralose) and the emulsifier Tween 80 1%. The experiment was performed in a Bioscreen equipment, at 37°C using microtiter plates with 340 µL of MRS broth, 10 µL of solution of the test compound and 50 µL of microorganism suspension previously cultivated in MRS broth at 37°C, washed and resuspended in saline solution (0.85%), so that the cultivation initiated with approximately 500 cells as inoculum. Each experiment was done in triplicate by measuring the absorbance to reach stationary phase. The results were processed to obtain the growth curves and the specific growth rate (μ) was calculated. It was found, that the effect of the compounds tested was differential, depending on the type of additive (sweetener or emulsifier) and each strain responds differently to the presence of these; *Pediococcus acidilactici* and *Lactobacillus rhamnosus* ATCC 7469 were not affected. The specific growth rate of *Lactobacillus plantarum* increased in about 70% when grown with stevia, acesulfame K and sucralose, while *Lactobacillus brevis* was the most affected bacteria by the emulsifier Tween 80, as its specific growth rate decreased by 40%. The lag phase showed an increase, in most cases, with the addition of the mentioned compounds. It can be concluded that for most microorganisms tested, there was an effect of sweeteners and emulsifier on the growth rate, although not necessarily negatively. A specific sweetener does not have the same impact on the kinetic parameters of the different strains.

Keywords: emulsifier, sweetener, lactic acid bacteria

Identification of *Brucella* spp from Water by Xanthogenate-Sodium Dodecyl Sulfate Nucleic Acid Isolation

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Brucellosis is a zoonotic infection, prevalent worldwide mainly in endemic developing countries, is most frequently associated with the consumption of contaminated dairy foods, contact with infected animals and laboratory exposure. Due to the complexity of the modern commercial food chain and the wide geographical distribution of food products, contamination with *Brucella* is a economic, environmental, and health problem. Several vectors for disease transmission play an important role, such as, water, which could be contaminated by bacteria from infected animals downloads. To identify *Brucella* spp it is necessary simple, fast and economic methods. The objective of this work was to isolate nucleic acids from water by Xanthogenate-Sodium Dodecyl Sulfate (X-S) method and identify the presence of *Brucella*. DNA extraction was performed from drinking, lake water and five samples of 200 mL of distilled water inoculated to obtain reading to OD 600 of 0.002 to 0.78. The UFC/ml were determinated (NOM-092-SSA1-1994). Two hundred ml were filtered (0.22- μ m). The filter was incubated in 1.0 ml of buffer (1% potassium ethyl xanthogenate, 100 mM Tris-HCl (pH 7.4), 20mM EDTA (pH 8.0), 1% sodium dodecyl sulfate, 800 mM ammonium acetate) at 70 °C/2 hours. The lysate was placed on ice/30 min, centrifuged at 12,000 rpm/15 min, 750 μ L of supernatant were mixed with isopropanol and was incubated at room temperature/10 min, and the precipitated DNA was washed with 70% ethanol and resuspended in water. Genomic DNA was analyzed by PCR to identify *Brucella* spp. Nucleic acid were isolated by X-S method in all samples analyzed, except to drinking water. Relation 260/280 was from 1.6 to 1.8, DNA obtained was used successfully to amplify by PCR a fragment of 450 pb corresponding to bp26 gen presents in *B. melitensis* M16. The X-S method to isolate nucleic acid is of great utility because of is economic, rapid, efficient, no need mechanical cell breakage, enzyme digestion, hot phenol. DNA obtained was useful to realize PCR assays, this method could contribute to identification of pathogenic bacteria causing of zoonoses associated with water like possible vector for disease transmission.

Keywords: *Brucella* spp., DNA, isolation, PCR

Presence and Survival of Pathogenic Bacteria in Atole Agrio From Villahermosa, Tabasco

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Atole agrio is a fermented non-alcoholic beverage elaborated with young non nixtamalized maize and consumed in the southeast region of Mexico (Tabasco, Chiapas and Veracruz). The preparation process is carried out in the household and in small-scale. Maize is ground, a dough is made and shaped into balls with part of the maize (solid fermentation), water is added to the other part (liquid fermentation). The microbiota of this product has been described previously, despite the presence of lactic acid bacteria, enterobacteria grow and persist in the product. Because of this and of the poor hygienic conditions in which it is elaborated, it is necessary to evaluate the presence of pathogenic organisms. The aim of this work was to isolate *Salmonella* spp. *E. coli* and *Bacillus* spp. from raw materials and from the stages of elaboration of atole agrio from Villahermosa, Tabasco and to evaluate their survival during fermentation. Official methods were used to isolate pathogenic bacteria and phenotypic and genotypic tests were used to identify them. Survival of pathogenic strains of *Salmonella*, *E. coli* and *Bacillus* in atole agrio was tested. Despite of the lack of hygiene during atole agrio elaboration, *Salmonella* spp. was not detected. Challenge experiments showed elimination of inoculated *S. Typhimurium* in 24h fermentation samples, after 4 hours of incubation. *E. coli* was not isolated from raw material but it was present in several stages of solid and liquid fermentation. *Bacillus anthracis*, *B. thuringiensis*, *B. cereus* and *B. megaterium* were isolated from liquid and solid fermentation.

Keywords: maize fermentations, atole agrio, enterobacteria

TEMPO[®] is a Good Tool for Quality Indicators Analysis in Poultry Products

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Assessing microbiological quality indicators is a useful tool for food companies, as it allows the monitoring of process and products. However, conventional methods considered official in many countries are laborious and the time-to-results is too long. Moreover, they are subjected to errors and lack traceability. Alternative automated methods may be used to facilitate the workflow and optimize the time-to-release results and decisions. The TEMPO[®] system is a solution for enumeration of microorganisms in food providing a fully automated process, fast and safety results. The purpose of this study was to compare the performance of TEMPO[®] system with two other methods for poultry products. 215 poultry product samples were grouped in 8 categories: (1) raw meat, (2) seasoned raw meat, (3) hot dogs, (4) fully or partially cooked products, (5) condiments, (6) prepared but not "ready-to-eat" dishes/snacks, (7) mechanically separated meat, (8) cured and cooked-pasteurized products. TEMPO[®] was compared to Petrifilm[™] for mesophilic aerobic count, *Enterobacteriaceae*, *E. coli* and yeast/molds. TEMPO[®] was compared to traditional method for *Staphylococcus* (ISO6888-2), *Bacillus cereus* (ISO7932:2004) and acid lactic bacteria (ISO15214), totalizing 681 tests. Results were transformed in log₁₀ and sorted by below/above of range and within the range. Counts with <1 log₁₀ difference between the methods were considered as equivalents. There was no statistical significant difference (p<0,05) between the results. The agreement was 96,0% between TEMPO[®] and Traditional method and 94,0% between TEMPO and Petrifilm[™]. However when analyzed by parameters, the agreement was 100,0% for *Bacillus cereus* (26/26), 100% for yeast/molds (26/26), 97,0% for *Staphylococcus* (193/200), 96,0% for *Escherichia coli* (163/170), 92,0% for mesophilic aerobic count (158/171), 87,0% for *Enterobacteriaceae* (26/30), 93,0% for acid lactic bacteria (54/58). TEMPO[®] showed better performance for condiment analysis. TEMPO[®] is a practical and reliable alternative method for quality indicators enumeration. It provides significant benefits to food companies since it saves time-to-result allowing decisions makers to take fast corrective actions. It also contributes to reduce media and consumable costs, standardize processes and reduce errors. Moreover, the system ensures traceability and connectivity, promoting workflow optimization, increasing lab productivity and liberating staff for other value-added tasks.

Keywords: TEMPO[®] system, Quality indicators, Poultry products

TEMPO[®] Usefulness in Fruit Puree Analysis

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Consumption of fruit products is increasing as consumers strive to eat healthier diets. In order to attend this growing demand, food companies have developed several fruit-based products. Controlling the microbiological quality of these products is of utmost importance to producers and consumers. Traditional methods are laborious, time consuming, and the time-to-results (TTR) is long. Alternative automated methods can be useful to facilitate the workflow, improving the productivity and allowing fast results and decisions. The TEMPO[®] system is an automated solution for enumeration of microorganisms in food providing a fully automated process, fast and trustable results. The purpose of this study was to compare the TEMPO[®] system and traditional methods performances for fruit products. 60 samples of fruit products (Purefruit Chile) were analyzed including different puree flavors such as apple, apple-cinnamon, apple-strawberry, butternut squash, banana-peach-mango, green bean-pear, sweet potato-apple, sweet potato-apple-carrot-cinnamon, oatmeal with cinnamon, blackberry puree. Apple fiber was also analyzed. The performance of TEMPO[®] and traditional methods (BAM) were compared for mesophilic aerobic count, total coliforms, *E. coli* and yeast/molds parameters totalizing 240 tests. For comparative purposes the results were log₁₀ transformed. For the same sample, results obtained by the two methods with absolute differences not exceeding one log, were considered as concordant. Although the samples being colored there was interference with TEMPO[®] cards for only three matrices: blackberry and the two apple fibers. The agreement between TEMPO[®] and traditional methods was 91,7%. However, when analyzing by parameters, the agreement varied from 98,3% for yeasts & molds, 91,6% for *E. coli*, 90% for total coliforms, and 86,7% for mesophilic aerobic count. A non-traditional method showing agreement $\geq 85\%$ is usually, considered as a good alternative to traditional methods. The study showed that the automated system is suitable for quality indicator analysis of fruit products being an alternative method for fruit product companies. TEMPO[®] is an easy to perform, fast and reliable system that allows the reduction of TTR and product turnaround time. It also reduces hands-on staff time and costs, increasing efficiency. Additionally the system enables a better use of lab space, workflow optimization and full traceability of results.

Keywords: TEMPO[®] system, Fruit quality, Rapid methods

Comparative Study between Conventional and Freeze Drying methods to preserve the Antibacterial and Antifungal Activities of Garlic Powder (*Allium sativum* L).

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The study of natural plant products as a mean to prevent various diseases is currently gaining popularity. Garlic is one of the most extensively researched products due to the high content of bioactive compounds; these compounds are known to possess beneficial health effects. The main physiological effects of garlic are based on their antimicrobial, anticancer, antioxidant, antidiabetic, hepatoprotective characteristics, as well as potentially in preventing cardiovascular diseases. The aim of this study was to evaluate the preservation of the antimicrobial and antifungal activities by comparing the freeze-drying technique to the traditional drying in order to obtain better grade functional food ingredients. Garlic bulbs were obtained from a farm located in Galeana, N.L.; bulbs were subjected to conventional drying (48h, 85°C) and freeze-drying (48h, -52°C a 45 torr) prior to grounding. Afterwards, antimicrobial and antifungal activities were evaluated against 3 important pathogens (*Escherichia coli* ATCC 25922, *Staphylococcus aureus* ATCC 19184, *Salmonella typhimurium* ATCC 14028) and one yeast (*Candida albicans* ATCC 2019) by agar disk diffusion method. A suspension of the previously prepared microorganism (10^8 cfu/mL) was spread over Mueller–Hinton agar plates; the same technique was used to evaluate the antifungal activity. Subsequently, 10 μ L of each sample was discharged in sterile filter papers (6 mm diameter), these were placed on the inoculated agar plates and incubated at 37 °C for 24 h. Kanamycin (10 mg/mL) and Amphotericin B (10 mg/mL) were used as a positive controls. Garlic essential oil was used as an additional negative control. All tests were performed in triplicate and the mean diameter of the inhibition zone halos were calculated. Results indicated significant differences ($p \leq 0.05$) between samples evaluated, freeze drying garlic powder exhibited very high activity against *C. albicans* (16.31 ± 0.39 mm), high activity against *S. aureus* (13.23 ± 0.12 mm); however, no activity against *E. coli* and *S. typhimurium* were found. Regarding the conventionally dried garlic powder, no antimicrobial activity was found. Finally, freeze-drying processing is recommended as an alternative and more efficient technique in order to better preserve the antimicrobial properties of a garlic powder and provide an opportunity for adding value in local crops.

Keywords: garlic, freeze-dried, antimicrobial activity

Antagonistic Activity *In Vitro* of Killer Yeasts against *Alternaria* Spp.

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A total of 24 yeast strains with killer phenotype (several species) belonging to the plant pathology laboratory culture collection (UANL) were analyzed *in vitro* to detect antagonistic activity against ten strains of *Alternaria* spp., considered as the causal agent of the "black spot" disease in solanaceous and "early blight" disease in potato and tomato crops. Fungal isolates were obtained from infected plant samples by transferring mycelium from the host directly into Petri dishes with PDA and identified according to their morphological characteristics. The yeast and fungi strains to be tested were respectively grown on PDA for 48h at 25-27°C and for 5-6 days at 30 °C. To evaluate the antagonistic activity against *Alternaria* spp. each fungus was inoculated in the center of the Petri dish containing PDA pH 4.5 with two parallel smears of every strain of the killer yeast tested, respectively. Four replicas for each yeast strain were performed. The incubation period was 8 days at 28 °C and radial growth reduction was calculated in relation to growth of the control as follows: %R = 100- (PY/PC*100). The results showed that six yeast strains produced a significant mycelial growth reduction of *Alternaria* spp. ($\geq 40\%$) in five or more strains of *Alternaria*; belonging to the genus *Pichia guilliermondii*, *Wickerhamomyces anómala* and *Pichia kluyveri* which were identified using molecular methods (three strains have not been identified). *P. kluyveri* (1153) showed the highest biocontrol *in vitro* activity with more than 50% mycelial growth reduction in the ten strains of *Alternaria* isolated. The yeast strains denominated as 1025, VG036, VG032, AT3 and FCB9 only demonstrated a significant inhibition activity in 5-6 strains of *Alternaria*., *P. guilliermondii* has been widely reported as a biocontrol agent against *Penicillium*, *R. nigricans* and *C. capsici* while *P. kluyveri* studies in this area are limited. In this study we demonstrated that some killer yeasts provide excellent control against *Alternaria* spp. so we recommend *in vivo* assays using *P. kluyveri* in order to obtain a viable alternative to the currently use of fungicides and chemical agents.

Keywords: *Alternaria* spp., biocontrol, killer yeasts.

Antagonistic Yeast Killer Activity Against Fungi Of The Genus *Penicillium*

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A battery of 50 yeast isolates obtained from diverse natural sources was evaluated in order to detect the killer activity, testing each isolate against the other 49. 24 killer yeast were detected, which were assayed qualitatively against 10 isolates of *Penicillium*, by placing yeasts grooves suspension onto PDA pH 4.5 plates containing a concentration of 10^5 conidia/mL. Plates were incubated at 25°C for 5 days. Killer yeasts that inhibited 5 or more mold isolates were selected to establish the percentage of radial growth in *Penicillium*. The yeast and fungi strains to be tested were respectively grown on PDA for 48h at 25-27°C for 3-5 days at 30 °C. In this case it was used 4 plates per fungi and yeast, PDA plates were inoculated with the molds at the center, flanked by 2 smears of each yeast, incubated at 25°C by 10 days. After incubation, colonial diameters were measured in two axis, including the control, to calculate the radial growth reduction in terms of percentage. The radial growth reduction was calculated in relation to growth of the control as follows: $\%R = 100 - (PY/PC * 100)$. The mean reduction resulted in a range of 12 to 19% with yeasts 1268 and 1144 being the most effective. Isolates Fit-5 and Fit-1 were the most resistant and susceptible isolates respectively. This shows the potential of killer yeast as biological control agents during postharvest.

Keywords: *Penicillium*, Biological control, killer yeast.

Evaluation of Physico-Chemical and Microbiological Quality of Sheep Meat in the Central Highlands of the State Of México.

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In order to develop a microbiological baseline of sheep meat production at the Highlands of the State of Mexico, the aim of the current research was to evaluate their physico-chemical and microbiological quality from slaughterhouses. Carcasses, utensils and workers' hands samples were taken according to Standard NCh-ISO 17025 Official, 2005 and European Union Council and Parliament Regulations. For physico-chemical characteristics initial pH and temperature (45 min), ultimate pH and temperature (24 h), temperature, objective color, and tenderness were evaluated. The microbiological quality was analyzed by Mesophilic Aerobic, Total Coliforms and Fecal Coliforms values. In the variables initial pH, ultimate pH and temperature, lightness (L*), redness (a*), yellowness (b*), and tenderness significant differences among abattoirs were found ($p \leq 0.05$). Most of the slaughterhouses were close to the Superior Limit Permitted (MLP) for Mesophilic Aerobic values (3,59 log₁₀ UFC/mL) on sheep carcasses. Even though there were no fecal coliforms found on sheep carcasses, they have been found on knives, tables and workers' hands in most of the slaughterhouses. In conclusion, physico-chemical characteristics were acceptable. However, because of the high sheep meat production in the Central Highlands of the State of Mexico and its microbiological characteristics it has been concluded that is required a shared responsibility among productive sector and from the government in order to regulate that production.

Keywords: Meat quality, microbiological quality, slaughterhouses, sheep carcasses.

Study of the Natural Microflora of artisanal Ranchero Cheese with Special Interest in *Lactococcus* Strains

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The aim of this work was to study the microflora of Artisanal Ranchero cheese, as a first step towards the development of a starter culture, that would allow the produce of a safer and more uniform cheese from pasteurized milk. Ten artisanal Ranchero cheese samples (500g) made with raw milk were obtained from local producers. Aerobic mesophilic and psychrophilic flora, total coliforms, moulds, yeast and lactic acid bacteria (LAB; *Lactococcus*, *Streptococcus* mesophilic and thermophilic, *Lactobacillus*, *Enterococcus*, *Leuconostoc*) were investigated. Microbial counts were analyzed with statistical package SAS (versión 9) using ANOVA with a significance of $P < 0.05$. For the genomic identification of 19 *Lactococcus* isolates was performed by sequencing of 16S rDNA gene. Mesophilic aerobic bacteria count ranged from 9.04 ± 0.01 to 6.95 ± 0.01 . Coliforms had values from 7.15 ± 0.03 to 4.109 ± 0.02 and moulds and yeast from 6.69 ± 0.01 to 2.00 ± 0.00 . LAB ranged from 8.49 ± 0.08 to 2.00 ± 0.00 \log_{10} CFU/g. Mean counts for the ten samples were relative uniform for *Enterococcus* and *Leuconostoc*, 6.30 ± 1.33 and 5.45 ± 1.47 \log_{10} CFU/g, respectively ($P > 0.05$). *Lactococcus* was the most representative group (8.14 ± 0.22 \log_{10} CFU/g) followed by mesophilic *Streptococcus* (7.79 ± 0.65 \log_{10} CFU/g), thermophilic *Streptococcus* (7.65 ± 0.71 \log_{10} CFU/g), *Lactobacillus* (7.65 ± 0.55 \log_{10} CFU/g) and *Staphylococcus* (7.32 ± 0.73 \log_{10} CFU/g). Of the 320 isolates, 45 (14.06%) were lost during the subculture process, 103 (32.18%) could not be classified as LAB, and 172 were identified as LAB. Of these, 73 (42.5%) were *Lactococcus*, 72 (41.8%) *Enterococcus*, 14 (8.1%) *Lactobacillus*, 6 (3.5%) mesophilic *Streptococcus*, 4 (2.3%) *Leuconostoc*, and 3 (1.7%) thermophilic *Streptococcus*. Nineteen isolates were randomly chosen from the *Lactococcus*, 13 isolates exhibited 100% homology with *Lactococcus lactis* subsp. *lactis*, whereas 5 others showed 99% homology with *Lactococcus garvieae* and one had 95% homology with *Lactococcus garvieae*. Results suggest that an adequate starter for the production of artisanal ranchero cheese from pasteurized milk may be made up *Lc. lactis* spp. *lactis*.

Keywords: artisanal ranchero cheese, microflora, *Lactococcus*

Phytochemical screening and antimicrobial activity of *Croton incanus*

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Croton incanus is a plant species that is distributed in Northern and Central Mexico. *C. incanus* is used in traditional medicine as auxiliary for colic infantile, anemia and in the recovery of diseases. Despite its benefits, not there are studies scientific about its content phenolic and activity antibacterial. Therefore, the objective of the present work was to determine plant phytochemical profile as well as evaluate its activity antibacterial against bacteria of importance in food science. The dried leaves of *C. incanus* were crushed to less than 1 mm particle size The extraction was made by maceration for 2 hours at 600 rpm. The extract was concentrated to not more than 50°C, and I store under refrigeration until use. It prepared a solution of the extract to 2000 ppm and is carried out a screening phytochemical. Finally, the antibacterial activity test was performed using the microdilution method on the NCCSL plate using strains of *Escherichia coli* and *Staphylococcus aureus*. Concentrations of 0.43 to 1000 ppm was used. The phytochemical screening revealed the presence of flavonoids, alkaloids, Sesquiterpene lactones, coumarins and lactones in ethanolic extract of *C. incanus*. As for the antibacterial activity of the extract, it obtained inhibition percentages of 61 % and 49 % against *E. coli* and *S. aureus* respectively. Both percentages of inhibition occurred at concentrations of 1000 ppm. Another study with a different species revealed that 2000 ppm was obtained 100% inhibition, this is consistent with the results obtained in this work since the summary shows a dose-dependent behavior for antibacterial activity. *Croton* ethanolic extract *incanus* present antibacterial activity, however, this was not 100% what you have a perspective to assess the summary to higher concentrations as well as also to separate the compounds found and assess them separately and thus know which of them is attributed to the effect.

Keywords: antibacterial activity, phytochemical screening, *Croton incanus*

Analysis and Effects of Habanero Chili Extract on Pathogenic Microorganisms in Food

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One of the main concerns in food industry is maintaining food preservation and safety, due to the presence of pathogens and spoilers that can affect it. The aim of this project was to test habanero chili (*Capsicum chinense*; HC) as food preserver, and bacteriostatic additive. Therefore its possibility to become an alternative organic option to common added preservatives in food industry, i.e. sodium benzoate. Antibioqram test by the Kirby-Bauer's diffusion on *Salmonella spp.*, *Escherichia coli*, *Staphylococcus aureus*, and *Bacillus spp.*, with two replicates were conducted using habanero extract (HEX). The results showed inhibition of all strains at high concentration levels of Hex (80% and 100% (p/p)). This was not observed at lower concentrations. The greatest bacteriostatic effect occurred with *Salmonella spp.* with an average of 31.6 mm as inhibition area (100% p/p); this pathogen has been considered to be the second cause of foodborne illnesses worldwide. Biochemical analysis of the effect produced by HEX suggest that membrane synthesis was affected by structural alterations and therefore, allowed and increase of membrane permeability (which fosters cell-lysis), and enzymatic inhibition, among others. It was concluded that inhibition was due to the combination of compounds contained in HEX, therefore we hypothesize that growth-inhibition of HC is larger in Gram-negative bacteria. More experiments must be conducted in order to achieve complete knowledge of kinetic and biochemistry action of HEX, in order to determine its efficiency as food preservative.

Keywords: habanero extract, inhibition, food microorganisms

Antagonistic Activity of Killer Yeast against Fungi of the Genus *Aspergillus* section *Nigri*.

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A battery of 50 yeast strains was evaluated for the killer phenotype, testing them against each other in every combination possible. Strains LALVIN and ATCC 26609 were the positive and negative controls, respectively. For every assay, yeasts were grown for 48h while the *Aspergilli* were grown for 5 days. Killer phenotype detection assays were performed in YEPD-MB agar inoculated with a lawn of 1×10^6 cels/ml of the potentially susceptible strain. Then a smear of the potentially killer strain was inoculated on the surface along with both control strains. The presence of an inhibition zone was the indicator of a killer phenotype. A total of 25 killer strains were found, which were tested afterwards against 10 strains of *Aspergillus* section *Nigri*, by striking them onto plates with a suspension of 10^5 cels/ml in PDA. All plates were incubated for 5 days at 25°C. The yeast strains that exhibited an inhibition zone around them against 5 or more *Aspergilli* were considered as antagonists and thus selected for the next assay. In order to evaluate the radial growth reduction of the *Aspergillus* strain caused by the yeasts, PDA plates were point inoculated with each *Aspergillus* strain and flanked by smears of each yeast on both sides. After 5 days of incubation, the radial growth was measured and compared to that of the control plate, which was inoculated only with the *Aspergillus* strain. The range of radial reduction was 32 – 47%, with the yeast strain 1025 being the most effective. The *Aspergillus* strains M5 and 048 were the most and least susceptible, respectively. The experimental design was completely random, with 2 replicates and 2 repetitions for every assay. These partial results show the potential of killer yeasts in the biological control of food spoilage molds, which could also produce mycotoxins, which could ensure a better food quality and reduce economic losses.

Keywords: fungus, biocontrol, post

Evaluation of a Rapid Technique for the Enumeration of Coliforms in Two Dairy Matrices

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The objective of this study was evaluate the performance of the 3M™ Petrifilm™ Rapid Coliform Count (RCC) Plate in yogurt and sour cream when compared to the traditional method (Violet Red Bile Agar (VRBA) utilizing a paired design. Thirty 10 g samples of yogurt and sour cream were inoculated with one mL of raw milk containing 22-23 coliforms/mL (n=60). An additional 30 samples of uninoculated sour cream were used as a control. Samples were diluted and homogenized with 90 mL of Butterfield's Phosphate-Buffered Dilution Water. One mL of the suspension was plated to rehydratable film media or VRBA with an overlay. Samples were incubated at 35°C. Enumeration of 3M Petrifilm RCC Plates was done at 8, 12, 14 (presumptive) and 24 h (confirmed). VRBA plates were enumerated after 24 h of incubation. Results were compared using a paired-t test. The recovery of coliforms from yogurt utilizing VRBA plates incubated for 24 h was not significantly different from the early presumptive positive recovery obtained with 3M Petrifilm RCC Plates enumerated after 8, 12 and 14 h of incubation($p>0.05$); coliform recovery is statistically superior using the dry film media incubated 24 h when compare with VRBA. Similarly the recovery of coliforms from sour cream was not significantly different between VRBA and 3M Petrifilm RCC Plate enumerated after 12, 14 and 24 h of incubation; enumeration of 3M Petrifilm RCC Plate enumerated 8 h provides lower recovery than VBRA ($p<0.05$). The 30 sour cream samples used as control did not yield any colonies with both methods. Utilization of 3M Petrifilm Rapid Coliform Count Plate for yogurt and sour cream provide fast, accurate, early detection of coliforms that is statistically equivalent to the traditional agar method.

Keywords: Coliforms, Yogurt, Cream, Dairy, Petrifilm

Antimicrobial Activity of Extracts from *Agave lechuguilla* Torrey against Bovine Mastitis Etiological Agents

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Agave lechuguilla TORREY belongs to the family *Agavaceae*, which in Mexico reaches its highest level of species diversity and Durango is among the richest States of Mexico in species of *Agave*, with 24 to 29. *Agave* and other genera of *Agavaceae* are rich in secondary metabolites, mainly saponins but until further research has been conducted, there are at present no data about the evaluation of the biological activity (antibacterial activity) and phytochemical profile of *A. lechuguilla* TORREY. In this study the foliar tissue, cogollo and pineapple extracts of *A. lechuguilla* were assessed to determine the antibacterial activity for control of diverse etiological agents of bacterial bovine mastitis and also analyze the antioxidant capacity to preserve foods. Preliminary phytochemical screening included the determination of unsaturated compounds, phenolic compounds, carbohydrates, coumarins, alkaloids, sterols and triptens. The modified well-diffusion method was used to assess antibacterial activity of extracts against bacteria cultivated overnight at 37 °C in Luria broth (Difco), and 100 µl (1×10^9 cell/ml) of each isolate were mixed with 15 ml of TSB with warm soft agar 0.7% (w/v) and plated. Wells, 8 mm in diameter, were dug into the agar and kept for 2 h at 37°C. Then, 100 µl of each extract. The antioxidant capacity was determined by Radical Scavenging Capacity Using DPPH Method DPPH in % Inhibition. The results of arbitrary units (mm^2) for bacterial inhibition were *Staphylococcus aureus* (ATCC 25923), *Streptococcus agalactiae*, *Streptococcus uberis*, *Escherichia coli* (ATCC 25922), *Serratia marcescens* NIMA, *Klebsiella pneumoniae* (ATCC 10031). The antioxidant capacity of the aqueous and alcoholic extract of foliar tissue were 21% and 33 % respectively and for pineapple of the aqueous and alcoholic extracts corresponded 12% and 43% in the preliminary analysis results. The results showed that the extracts had differences in the antimicrobial patterns against important mastitis causing bacteria, and the aqueous extract of *A. lechuguilla* TORREY could be the most useful as an alternative method to control bovine mastitis.

Keywords: *Agave lechuguilla*, antibacterial, antioxidant, mastitis.



IX. FOOD SAFETY

Agave Fructans (*Agave tequilana*, Weber) as Dietary Supplement in Laying Hens and their Effect on the Levels of Polyamines in Excreta

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Fructans conformed by fructose units may be obtained from *Agave tequilana* spp and can be added to an extensive variety of dietary products since it offers both technological and nutritional benefits, such as stress suppressor. The polyamines Putrescine, Spermidine and Spermine are positively charged ubiquitous molecules of low molecular weight and basic by their amino groups. The polyamines are considered necessary for homeostasis, division and cell differentiation, they are involved in multiple metabolic pathways and molecular processes such as replication, transcription and translation, and these molecules are considered survival and development indispensable. Retroconversion of bioactive polyamines Spermine and Spermidine respectively, they becomes to Putrescine, which in turn is excreted. To this aim 100 hy-line w-36 pullets were randomly divided into three experimental groups. Two pullets groups were treated by adding 0.1% and 0.2% agave inulin in feed. The test lasted up to 30 posture weeks. Treatments were categorized as control without agave inulin addition. Polyamine (putrescine, spermidine and spermine) levels in feces were used as stress indicators. Polyamine levels in feces were determined by RP- HPLC to evaluate the effect of agave inulin supplementation. The values of putrescine found in feces decreased in comparison with the control group, ($p < 0.05$), demonstrating that agave inulin can be a useful alternative as feed additive.

Microbiological Analysis of Açai Pulp Marketed in Coari-AM/Brazil

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Sanitary hygienic conditions of açai pulp are worrying because its processing is usually performed informally, without the care and expertise to prevent contamination. This study aimed to examine the microbiological quality of açai pulp, the water used in the washing of the fruit and an intervention to improve the microbiological quality of the pulp. Samples were collected in five craft processing units in Coari-AM and analyzed according to the parameters required by ANVISA (National Agency for Sanitary Vigilance) for thermotolerant coliforms counts and presence/absence of *Salmonella spp* for pulp and *Escherichia coli* in water. After the analyzes results, four treatments were performed with chlorine solution (HClO two tablespoons for each 1L of water) to identify the most efficient way to obtain a final product with quality: 1) Açai pulp extraction in the traditional process (control); 2) Only the fruit treated with the chlorine solution for 10 minutes; 3) Only the equipment (batter) sanitized with chlorine solution; 4) The fruits treated for 5 minutes and the equipment sanitized with chlorine solution. At the end of each treatment, açai pulp samples were collected for subsequent microbiological testing. From the data obtained, Good Practice Guidelines were developed. As a result of the samples without intervention, *Salmonella spp.* presence was found in 80% and thermotolerant coliforms at 45°C above parameters required by ANVISA in all samples. Concerning water, the results were all negative for *Escherichia coli* and in the four treatments tested for *Salmonella spp*, the result was positive only in the first one. Thermotolerant coliforms results were: Treatment 1: 6×10^4 CFU/g pulp, a greater number than the one allowed by the Agency; Treatment 2: 1×10^3 CFU/g pulp; Treatment 3: $2,2 \times 10^2$ UFC/g pulp; Treatment 4: 1×10^2 CFU/g pulp, leaving this last sample within the permitted limits by the Brazilian law. We conclude that the samples extracted in the traditional way were classified as unfit for human consumption and that the sources of contamination are the fruits and the equipment. So, it is recommended to apply the treatment 4 to obtain a product of acceptable microbiological quality.

Keywords: Microbiology analysis; Açai pulp; thermotolerant coliforms

Food Safety Management Systems for the Food Service Industry

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Abstract: Due to the changing and evolving environment, a perfect storm is starting to brew that could push the food service even further into the spotlight when there are food safety issues. As more and more emphasis is placed on stronger food safety systems across all of the food channels, more is going to need to be done at the food service level to meet the same type of standards that have been set at the manufacturing level. This has potential to be a monumental burden on an industry where 55 percent are defined as independent restaurateurs. As such these types of restaurants will not have the resources or the expertise to create and implement a comprehensive food safety management system at the same level as the large national and multi-national organizations and can be at an acute disadvantage when the time comes that regulations are created to drive more food safety awareness at the unit level. This presentation will discuss the issues the food service industry will face as the need to create a more proactive food safety system is needed to help protect their brand and customers.

Safety Aspects of Bacteriocinogenic *Enterococcus faecium* Strains Isolated From Smoked Salmon

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Enterococcus faecium is a wide spread bacterium in the fermented food products and its potential in producing bacteriocins represents an important opportunity for exploration it as tools for food biopreservation. However, safety of *Enterococcus faecium* strains is a very controversial subject related to the fact that some of the strains belonging to the genus *Enterococcus* can be opportunistic pathogens. In this, safety assessment for presence of virulence and antibiotic resistance genes in LAB is an important task to be evaluated in order to be selecting these strains as commercial beneficial cultures. The aim of this study was to explore safety aspects of bacteriocinogenic *Enterococcus faecium* ET05, ET12 and ET88 based on presence and expression of genes related to the virulence factors, production of biogenic amines and antibiotic resistance. *Enterococcus faecium* ET05, ET12 and ET88 were isolated from smoked salmon, identified based on their biochemical and genetic characteristics including PCR with species-specific primers, and characterized as bacteriocin producers against some food spoilage microorganisms and food borne pathogens. The strains were subjected to molecular and phenotypical tests to assess the presence of more than 50 genes related to virulence factors, production of biogenic amines and antibiotic resistance. *Enterococcus faecium* ET05, ET12 and ET88 produce class IIa bacteriocins with 3.5-3.7 kDa, respectively, with bactericidal activity against *Staphylococcus* spp., *Enterococcus* spp. and *Listeria* spp., including *Listeria monocytogenes* from various serological groups. *Enterococcus faecium* ET05, ET12 and ET88 presented also low virulence profile, indicated by the presence of few genes related to antibiotic resistance and surface proteins, based on genetic and physiological tests. Besides all beneficial properties studied for various LAB, most considered as GRAS, a special attention need to be pay on the possible presence of virulence factors, production of biogenic amines and antibiotic resistance. Horizontal gene transfer of virulence factors between pathogenic and LAB, including probiotics is a highly possible scenario in case of uncontrolled application of probiotics or starter cultures.

Acknowledgments: CNPq, CAPES, FAPEMIG and FAPESP

Keywords: *Enterococcus faecium*, bacteriocin, virulence factors

***Lactobacillus plantarum* ST8Sh - Safety Aspects for Application of the Strain and Produced Bacteriocin**

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Lactobacillus plantarum ST8Sh was isolated from Bulgarian salami and been identified based on his biochemical and genetic features including PCR with Species-specific primers and 16S rRNA sequencing. This strain produces class IIa bacteriocin (5.0 kDa), active against different species from genera *Enterobacter*, *Enterococcus*, *Lactobacillus*, *Pseudomonas*, *Streptococcus* and *Staphylococcus* and including more than 80 different *Listeria monocytogenes* strains from various serological groups. Based on the PCR analysis, *Lactobacillus plantarum* ST8Sh was hosting gene related to the production of variant of plantaricin 423, a bacteriocin from pediocin PA-1 family. Expressed bacteriocin produced by *Lactobacillus plantarum* ST8Sh have been partially purified by ammonium sulphate precipitation and hydrophobic chromatography on SepPakC₁₈ column. Semi-purified bacteriocin was presenting a very high activity against *Listeria monocytogenes* and *Enterococcus faecalis*. However, when semi-purified bacteriocin ST8Sh (fractions 60% and 80% iso-propanol in 25mM phosphate buffer, pH 6.50) at 25 µg/ml protein concentration have been tested for cytotoxicity, high cytotoxicity have been recorded on human hepatocytes cells (Huh7.5) reducing the cell viability by approximately 80% however. When this same fraction was tested at a lower concentration (5 µg/ml) no cell cytotoxicity was observed. Regarding the 80% iso-propanol fraction, cell viability was not reduced in both tested concentrations (25 µg/ml and 5 µg/ml). Total DNA extracted from *Lactobacillus plantarum* ST8Sh have been screened for presence of more than 50 genes related to production of biogenic amines (histidine decarboxylase, tyrosine decarboxylase and ornithine decarboxylase), virulence factors (sex pheromones, gelatinase, cytolysin, hyaluronidase, aggregation substance, enterococcal surface protein, endocarditis antigen, adhesion of collagen, integration factors) and antibiotic resistance (vancomycin, tetracycline, erythromycin, gentamicin, chloramphenicol, bacitracin). *Lactobacillus plantarum* ST8Sh showed a low presence of virulence genes. Only 13 genes were detected (related to sex pheromones, aggregation substance, adhesion of collagen, tetracycline, gentamicin, chloramphenicol, erythromycin, but not to vancomycin and bacitracin) and may be considered as safe for application in fermented food products.

Acknowledgments: CNPq, CAPES, FAPEMIG and FAPESP

Keywords: *Lactobacillus plantarum*, bacteriocin, virulence factors, cytotoxicity

***Lactobacillus plantarum* ST16Pa as Probiotic or Bio-Protective Culture?**

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Lactobacillus plantarum ST16Pa was isolated previously from papaya and been identified based on his biochemical and genetic features including PCR with Species-specific primers and 16S rRNA sequencing. It has been shown that this strain produces bacteriocin (6.5 kDa), active against different species from genera *Enterobacter*, *Enterococcus*, *Lactobacillus*, *Pseudomonas*, *Streptococcus* and *Staphylococcus* and different strains of *Listeria* spp. In adding up *Lactobacillus plantarum* ST16Pa based on the genetic and physiological tests presented a potential to be consider as a probiotic candidate. Based on the PCR analysis, *Lactobacillus plantarum* ST16Pa was harbouring genes related to the production of nisin and enterocin P, however, no evidences for presence of pediocin PA-1, plantaricin S, plantaricin W, plantaricin NC8, enterocin A, enterocin B or enterocin L50B have been obtained. Taking in consideration the molecular size (6.5 kDa as determined by tricin-SDS-PAGE) of the expressed bacteriocin, most probably *Lactobacillus plantarum* ST16Pa express bacteriocin different from nisin or enterocin P. A future study on purification, mass spectrometry and amino-acid sequence will need to be performed in order to clarify this hypothesis. Produced by *Lactobacillus plantarum* ST16Pa bacteriocin has been partially purified by ammonium sulphate precipitation and hydrophobic chromatography on SepPakC₁₈ column. Semi-purified bacteriocin was presenting a remarkable activity against *Listeria monocytogenes* (102400 AU/ml), *Pseudomonas aeruginosa* (25600 AU/ml) and *Enterococcus faecalis* (102400 AU/ml). However, when semi-purified bacteriocin have been tested for cytotoxicity, CC₅₀ > 1600 µg/ml have been recorded (CC₅₀: Compound concentration required to reduce cell viability, using stationary-phase monolayers of Vero cells, by 50 % after 24 h of incubation at 37°C). In addition, *Lactobacillus plantarum* ST16Pa generated positive PCR results on the DNA level for *gelE* (gelatinase), *hyl* (hyaluronidase), *asa1* (aggregation substance), *ace* (adhesion of collagen) and *tdc* (tyrosine decarboxylase), a considered as high virulence profile when been examined for presence of virulence factors.

Acknowledgments: CNPq, CAPES, FAPEMIG and FAPESP

Keywords: *Lactobacillus plantarum*, bacteriocin, virulence factors, cytotoxicity

Preliminary evaluation of the prevalence and causes of gastrointestinal diseases in Mexico

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The main of this research were evaluated the prevalence and the causes of gastrointestinal diseases (GD) in México. This study was done by online survey. It was divided in 4 sections: 1) Personal data, 2) GD information, 3) Environmental information and 4) Socio-economic information (AMAI 8x7). The distribution of the survey was carried out by social networks. The data obtained was evaluated by EpiDat3.1 program using descriptive and contingency analysis. 529 people were evaluated. The range of age of the respondents was between 16 to 72 years old and they were from 27 of the 32 Mexico's states. The prevalence of GD in the last year was of 78.83%. The 24.95% suffer them once a year and 70.14% more than once a year, being gastritis (n=219), colitis (n=165) and gastroenteritis (n= 72) the most common; also the principal symptoms were stomachache (n=438) and diarrhea (n=216). The duration of the illness was among one day (40.83%), and two to three days (42.16%), affecting to the 35.16% in the development of their personal activities. The main causes associated with these diseases were: 1) the consumption of food (n= 386), principally the consumed in the street (46.88% of the people eat once a week on it) and 2) stress (n=332). Meat (n=200), dairy (n=173) and meat (n=157) products were the most related to GD by the consumers. Most of the factors evaluated (personal characteristics, the practice of hygienic measures, the environmental conditions and the socioeconomic level) didn't have a significant relationship ($P < 0.05$) with the prevalence of GD in the last year., only the sex ($P=0.0400$), the presence of residual water in the locality ($P=0.0346$), the cleanliness of the kitchen ($P=0.0175$) and the change frequency of scouring pad ($P= 0.0054$). The frequency of street food consumption and cleanness of the refrigerator didn't have a significant difference; however show an important tendency. In conclusion, due to the high prevalence of GD, it's necessary to analyze the risk of all the factors related with these diseases to prioritize them, regardless of didn't have a significant effect, because it can contribute to increase the risk.

Keywords: gastrointestinal diseases, prevalence, causes

Molecular Detection of “Hly A” Gene in *Escherichia coli* Strains Recovered From Raw “Machito” Baby Goat in Monterrey, N.L., México Using PCR.

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The food originated from animals play a very important role in foodborne illness and *Escherichia coli* is one of the emergent bacteria more researched by his wide range of serotypes or pathogenically varieties, its 150 serotypes of produce Verotoxynes and the hemorrhagical bowel and kidney diseases. Countless are the baby goat prepared dishes and one of those is the baby goat “machito”. The nature and form of the preparation is based on baby goat intestines and the natural presence of *Escherichia coli* O157:H7 in samples of feces clinically healthy makes us think that the baby goat machitos may have been contaminated. This disease causes at least 20000 cases of bloody diarrhea stool and more than 200 deaths a year in the U.S., 97 samples of baby goat machito were collected on points of sale and flea markets, then they were bacteriologically analyzed by homogenization on EC broth and incubated at 37°C for 18 hours then the samples are planted on Fluorocult, MacConkey-Sorbitol, and EMB agar, then incubated at 37°C for 24 hours, and the based on results biochemical identification tests were realized. 500 µl were collected of the EC broth and tangible colonies of the O157:H7 serotype inoculated on nutritional broth to extract DNA and the PCR was elaborated using hemolysin alpha *hlyA* igniters. A sample was tested positive by a band amplifying of approximately 361 bp equivalent at 1.03%. This shows the presence of the enterohemorrhagycall serotype in baby goat machito in Monterrey.

In Vitro Reduced Availability of Aflatoxin B1 and Acrylamide by Bonding Interactions with Teichoic Acids from *Lactobacillus* Strains

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Several studies have evidenced the ability of some lactic acid bacteria to bind dietary carcinogens, including aflatoxin B1 (AFB1) and acrylamide (AA). Cell wall teichoic acids (TAs) appear to be components of the bacterial that might participate in binding; however, the exact mechanisms are not clear. The aims of this work were to assess the ability of fourteen *Lactobacillus* strains to bind either AFB1 or AA, and to determine the possible molecular bonding interactions among toxins and constituents of TAs. Physical binding was assessed in aqueous solution, and the components of TAs were determined by evaluation of hydrolysis products of TAs. Binding was strain- and toxin-specific dependent. All AFB1-bacterium interactions were partly reversible, while AA-bacterium appeared to be irreversible. TAs from the evaluated strains consisted of poly (ribitol phosphate) polymers decorated with glucose, D-alanine and/or glycerol molecules, thus four simplified structures were proposed. Based on compositional analysis it was hypothesized that hydroxyl groups of AFB1 as well as carbonyl oxygens of both AFB1 and AA, might be involved in interactions between both toxins and the hydroxyl groups of either glucose or glycerol in TAs. The results of this work support the suggestion that specific *Lactobacillus* strains can reduce the bioavailability of dietary carcinogens, and provide for the first time new insights on teichoic acid structure relationships on toxin binding ability.

Keywords: Aflatoxin B1, Acrylamide, Binding, Teichoic acid.

Physicochemical, Microbiological and Sensory Analysis of Combined Effect of Chitosan and Freezing in preservation of fresh cut mango

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Mango is an important nutrimental and economical fruit in Mexico. Due to its high content of vitamin A and C, sugars and sensorial attributes mango is well accepted around the world. In the other hand chitosan the deacetylated form of chitin, is a linear biopolymer obtained from crustacean shells that possess antimicrobial activity due to its polyelectrolyte behavior. The tendency of the use of natural compounds as food preservatives has conducted to the search of different natural preservation methods that combined with physical technologies can improved food safety without losing sensory and physicochemical characteristics. The main objective of this work was to evaluate the application of chitosan and freezing in the physicochemical, microbiological and sensory analysis of fresh cut mango. *In vitro* Chitosan antimicrobial activity was determined evaluating Minimum Inhibitory Concentration using low, medium and high chitosan molecular weight against *E. coli*, *S. aureus* and *S. thiphymurium*. Mango was obtained from a local market, disinfected, peel and cut and use immediately. Experiments *in vivo* were conducted with the selected chitosan concentration and citric acid solution as comparative method, liquid nitrogen was used to freeze the materials. pH, Brix°, Color and WA were evaluated as physicochemical analysis, total coliforms and mesophylls counts were determined as microbiological analysis and sensory determinations were performed using a semi-trained panel, where color, general appearance, aroma and flavor were evaluated with an acceptance test in mango determinations. Results indicate that all chitosan evaluated presented antimicrobial activity against the 3 pathogenic bacteria evaluated, but high molecular weight chitosan presented the major antimicrobial effect, 1% chitosan concentration was selected as sensorial concentration accepted by the panel without affecting mango attributes. During storage acid citric treatments presented low counts of total mesophylls and coliforms, nevertheless chitosan treatments did not presented any coliforms count until the end of the experiments. Sensorial analysis indicated that there was not significant differences between the control and chitosan treatments in color, general appearance and aroma after unfreezing the product. The study of natural additives as chitosan to food preservation and its acceptance for the consumers is of interest to develop new natural preservation techniques.

Keywords: chitosan, mango preservation, freezing technologies

Antimicrobial effect of *Moringa oleifera* Lam and *Oxalis tuberosa* against *Listeria monocytogenes* and *Escherichia coli*

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The main of this study was evaluated the antimicrobial activity of *Moringa oleifera* and *Oxalis tuberosa* against *Listeria monocytogenes* and *Escherichia coli*. Four extracts were elaborated: *M. oleifera* fresh leaves water extract (WM) and 70% acetonic extract (AM), and *O. tuberosa* flour water extract (WO) and 70% ethanolic extract (EO). The antimicrobial activity was determined by MIC and MBC employed nutritive broth (NB) and inoculated with ~ 5 Log CFU/mL. Also were evaluated the behavior of a high concentration (~ 8 LogCFU/mL) and low concentration (~ 3 LogCFU/mL) of *L. monocytogenes* and *E. coli* in NB with 250 mg/mL of AM, WO and EO after 24h of incubation at 30°C. Finally, was determined the reduction of ~ 8 LogCFU/mL of *L. monocytogenes* and *E. coli* when were in contact with 250 mg/mL of AM, WO and EO after 15 and 30 min. The MIC of AO, WO, WM and AM for *L. monocytogenes* were: 150, 125, 350 and 125 mg/mL; and for *E. coli* were 175, 150, 350 and 250 mg/mL. The MBC of AO, WO and AM for the two microorganisms were 250, 200 and 200 mg/mL. The behavior of the microorganisms in NB with the extracts depended of the initial concentration. In both cases, when the mediums were inoculated with the low concentration did not find microorganisms after the incubation. However, when were inoculated with the high concentration, only NB with WO showed an important and significant ($P < 0.05$) reduction, obtained a final concentration of 4.60 and 5.08 Log CFU/mL for *E. coli* and *L. monocytogenes*. On the other hand, the reductions on *E. coli* after the exposure to the control (water), EO, WO and AM were: 0.24 and 0.59, 0.85 and 0.93, 0.84 and 0.95, and 1.45 and 2.89 Log CFU/mL after 15 and 30 min. For *L. monocytogenes* the reductions were 0.14 and 0.14, 0.88 and 0.92, 1.00 and, 1.99 and 1.90 LogCFU/mL. All the treatments had significant differences ($P < 0.05$) in comparison with the control, being the AM treatment which obtained the highest reduction. In conclusion, the WO is a potential antimicrobial to be employed as food additive and the AM as disinfectant.

Keywords: *Moringa oleifera* Lam, *Oxalis tuberosa*, extracts, antimicrobial effect

Assessing Food Safety Messages Impacting Foodservice Workers' Handling of Leafy Greens in Facilities Serving the Elderly.

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With an aging population, increasing prevalence of illness caused by contaminated leafy greens, as well as diversity within retail foodservice workforces, the effectiveness of training materials specific to fresh produce using visual, minimal-text messages on hourly employees' handling practices was assessed. The purpose of the study was to evaluate impact of developed minimal-text posters in different foodservice operations (2 long term care, 2 hospitals, 2 assisted living, 2 restaurants) serving older Americans through microbiological screenings and observations of employees. Screening for *Listeria monocytogenes* used PCR, and *E.coli* O157 and *Staphylococcus aureus* used ELISA techniques. Enumeration for aerobic plate counts (APC), coliforms, and fecal coliform (FC) counts used petrifilm. Compliance with safe food handling behaviors was evaluated based on United States Food and Drug Administration Food Code 2009. Observational data were analyzed using SPSS 21.0 ($P < 0.05$). Based on findings from initial microbial analysis and observations, 9 minimal-text posters were developed to convey identified messages, and then sent to foodservices for posting. Posters in English, Spanish, and Mandarin Chinese were created. After intervention, microbial analysis and observations were again conducted one month and three months later to assess short and longer-term compliance. All food samples were negative for bacteria. APC and coliform counts were not significantly different before and after intervention ($P < 0.05$). FC counts in leafy green samples from hospitals and restaurants were significantly lower after intervention ($P < 0.0004$) while APC, coliform, and FC counts were lower at preparation and service after ($P > 0.05$). APC (2.75 ± 2.8 log CFU) and coliform (1.9 ± 1.8 log CFU) on surfaces exceeded acceptable levels for food contact surfaces. Forty-five of 127 (35.4%) observed food handling behaviors (e.g. gloves changed as needed) improved after food safety posters were displayed in facilities with increased rates of compliance at either one month or three months post-intervention. Safe produce handling posters were helpful in changing observed food handling behaviors, thus mitigating risks of food borne illness for an at-risk population. Visual, minimal-text messaging can be a useful communication tool with diverse workforces; further interventions targeting cleaning and sanitizing of food contact surfaces are needed.

Keywords: produce safety, training, diversity, visual-based messages

Bacteriocinogenic *Lactobacillus curvatus* Strains Isolated from Calabresa, a Brazilian Non Fermented Sausage

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Lactobacillus curvatus NPAC512 have been isolated from Brazilian non fermented sausage calabresa, and been identified based on biochemical tests and 16S rRNA sequencing. Bacteriocin produced by *Lactobacillus curvatus* NPAC512 inhibited the growth of a number of *Enterococcus* spp. and *Listeria* spp. In addition, *Lactobacillus curvatus* NPAC512 presented a good potential of bio-protective culture and technological properties based on the genetic and physiological tests. The peptide is inactivated by proteolytic enzymes, but not when treated with α -amylase, Tween-80, NaCl and EDTA. No change in activity was recorded after 2h at pH values between 2.0 and 12.0, and after treatment at 100°C for 120 min or 121°C for 20 min. The mode of activity against *Listeria monocytogenes* 72 and *Listeria monocytogenes* 508 and *Enterococcus faecium* ATCC 19943 is bactericidal, resulting in cell lyses. The highest level of activity (25 600 AU/ml) was recorded when cells were grown at 37°C, 30°C or 25°C in MRS broth (pH 6.5) even in the early exponential growth phase. Peptide NPAC512 adsorbs at low levels to producer cells. Effect of the medium components on the bacterial growth of *Lactobacillus curvatus* NPAC512 and expressed bacteriocin been evaluated. *Lactobacillus curvatus* NPAC512 was subjected to molecular and phenotypical tests to assess the presence of more than 50 genes related to virulence factors, production of biogenic amines and antibiotic resistance. *Lactobacillus curvatus* NPAC512 presented low virulence profile, indicated by the presence of few genes related to antibiotic resistance and surface proteins, based on genetic and physiological tests. Besides all beneficial properties, including production of antimicrobial peptides and potential probiotic properties, studied for various LAB with well established GRAS status, a special attention need to be pay on the possible presence of virulence factors, production of biogenic amines and antibiotic resistance. Safety assessment of the LAB needs to be carefully studied in order to be suggested for an industrial application as probiotic or starter cultures.

Keywords: *Lactobacillus curvatus*, bacteriocin, virulence factors

Beneficial Properties and Safety of Bacteriocinogenic Strains Isolated From Brazilian Artisanal Raw Milk Cheese

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Current lifestyle has made consumers more concerned about a balanced diet, health and well-being. In this sense, probiotics may develop several positive effects consumer's health, encouraging researches in this field. Thereby, the aim of this study was evaluate the beneficial/probiotic potential and safety of bacteriocinogenic *Enterococcus hirae* ST57ACC and *Pediococcus pentosaceus* ST65ACC, isolated from artisanal raw milk cheese. Survival to simulated gastrointestinal conditions, auto-aggregation and co-aggregation, survival in the presence of antibiotics and commercial drugs, study of β -galactosidase production, virulence factors and biogenic amine production was performed, including search for antimicrobial resistance, virulence and biogenic amine encoding genes. The strains survived in the presence of simulated gastrointestinal conditions, showing 79.1% and 82.2% of survival rates for *E. hirae* ST57ACC and *P. pentosaceus* ST65ACC, respectively; while hydrophobicity of cells varied among 41.0% and 46.5%. *P. pentosaceus* ST65ACC presented high levels of auto and co-aggregation with *Listeria monocytogenes*, demonstrating that close interactions between these strains may facilitates elimination of such pathogen. *E. hirae* ST57ACC have also presented good values of auto and co-aggregation, but lower than those obtained from *P. pentosaceus* ST65ACC. Both strains presented low resistance to several antibiotics and survived in the presence of some commercial drugs, being only affected by anti-inflammatories containing diclofenac potassium as active substance. *E. hirae* ST57ACC presented β -galactosidase activity, which is interesting to help consumers suffering of lactose intolerance. Genetic evaluation demonstrated that these strains carry some antimicrobial resistance genes, but all of them are related to intrinsic resistance, which represents low risks for horizontal gene transfer. Moreover, both strains have not presented biogenic amines production, neither genes related to this trait. Regarding to virulence genes, *fsrA* was detected in *E. hirae* ST57ACC, but phenotypic production of virulence factors was not observed. The expression of such gene is related to presence of gene *gelE* and complete *fsr* operon, which were not detected. In conclusion, both strains presented higher functional properties, making them potential candidates for application as probiotic strains.

Keywords: *Enterococcus hirae*, *Pediococcus pentosaceus*, bacteriocin, virulence factors

Ozone Efficiency for the Inactivation of *Cryptosporidium parvum* Oocysts in Wastewater

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In Mexico, the agriculture is one of the most water-demanding productive activities, which involves the use of 41% of surface water and 21% of groundwater. Water scarcity has an enormous impact on food production; therefore an alternative to solve this problem has been searched for. Many farmers in water scarce developing countries could irrigate with wastewater as an alternative to solve this issue; however this water might be contaminated with highly resistant microorganisms such as protozoans, being a potential risk for human health if used for agricultural purposes. In this study, we investigated the occurrence of *Cryptosporidium* spp in a WWTP located in Sinaloa over a 5-month period during 2015. After chlorination, effluent wastewater samples were collected fortnightly, and processed according to the 1623 EPA method for determining the protozoan oocysts concentration. In addition, in-lab evaluation of the ozone efficacy on inactivation (viability/infectivity) of *Cryptosporidium parvum* oocysts suspended into clarified wastewater was performed. The ozone concentrations applied to the clarified water were 0.1, 0.8 and 1.3 mgL⁻¹ of ozone during 5 min contact time. Viability and infectivity were measured by inoculating ozone-treated oocysts in CD-1 mice and using vital dyes. The oocysts concentration ranged from 163.9 to 850 oocysts per 100 L, from which 50 % of the samples contained viable oocysts. The efficiency results showed a reduction in oocysts viability of 73.33, 85.00 and 99.4 %, while the infectivity assay showed a reduction of 0.8, 1.36 and 2 log₁₀ for each concentration, respectively. Our results demonstrated that the chlorination systems of the WWTP do not ensure water free of oocysts and therefore the reuse of this water for agricultural purposes represent a potential health risk. Likewise, based on the in-lab evaluation it is shown that ozone represents an effective disinfection alternative for the inactivation of *C. parvum* in wastewater.

Keywords: Ozone, *Cryptosporidium parvum*, wastewater

Antimicrobial Activity of *Baccharis glutinosa* and *Jacquinia macrocarpa* Plant Fractions

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The aim of this work was to evaluate the antimicrobial activity of plant fractions obtained from *Baccharis glutinosa* and *Jacquinia macrocarpa* against two fungi (*Botrytis cinerea* and *Alternaria alternata*), three Gram-negative (*Salmonella enterica*, *Escherichia coli*, and *Shigella sonnei*), and three Gram-positive bacteria (*Enterococcus faecalis*, *Staphylococcus aureus*, and *Bacillus subtilis*). The fractions were obtained by solvent partition from *B. glutinosa* (BgF) and *J. macrocarpa* (JmF) methanolic extracts. The percentage of radial growth inhibition was determined in Petri dishes containing 5 mg mL⁻¹ of each plant fraction dissolved in potato dextrose agar. The minimum inhibitory concentration of 50 % (MIC₅₀) and 90 % (MIC₉₀) of bacterial growth caused by BgF and JmF was determined by the microbroth dilution method. The total polyphenols content was quantified using the Folin-Ciocalteu reagent, and antioxidant activity was evaluated using the DPPH radical and ABTS radical cation methods. All analyses were carried out in triplicates and multiple comparison of means was performed by the Tukey test ($P \leq 0.05$). BgF was able to inhibit 100 % of radial growth of *B. cinerea* and 87.5 % of *A. alternata*, whereas JmF caused 41.8 % of radial growth inhibition of *B. cinerea* and 65.8 % of *A. alternata*. On the other hand, it was observed that both plant fractions were able to inhibit to all bacteria; however, all bacteria were more sensitive ($P < 0.05$) to BgF than to JmF, except *E. faecalis*, which was highly inhibited by JmF. High inhibitory activity of *B. subtilis* and *S. aureus* caused by BgF was observed. The total polyphenols contents, as well as antioxidant activity values, were higher ($P < 0.05$) in BgF than those observed in JmF, which are in coincidence with the higher antifungal activity observed in BgF. These antifungal fractions might have a potential use in food preservation.

Keywords: Antifungal activity, antibacterial activity, polyphenols content, antioxidant activity

Preliminary Characterization, Antioxidant Activity and Microbiota of Mexican Propolis

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Propolis is a resinous substance collected by bees from sources such as plant exudates. Five Mexican propolis samples were obtained from the following states: Jalisco (1), Querétaro (2), Tamaulipas (3), Veracruz (4) and Zacatecas (5). These samples were weighted, labeled and frozen at -20°C until use. Initial characterization included: color identification using the panthone software, wax determination using methanol wash [96%], protein content determination using Kjeldahl method and mineral content using X-ray fluorescence (XRF). For the antioxidant activity, an ethanolic extract of propolis was prepared and transferred to an amber vials and stored at room temperature for later use to measure polyphenol content with microplate Folin-Ciocalteu protocol using gallic acid (0.4-11mg/mL) as control. Antioxidant activity of ethanoic extract was determined by 1,1-diphenil-2-picrilhydrazil (DPPH) method. All analyses were done in triplicates. For the microbiota determination, DNA was extracted according to the plant extraction protocol (with minor modifications) using Wizard purification system (Promega). DNA was used for 16s rDNA amplification and massive sequencing with Illumina MiSeq. Propolis colors varied from yellow to dark brown. The wax content ranged from 13 to 33%, while protein values ranged from 12 to 18%. Elemental composition showed different presence of minerals but overall we find SiO₂, S, Cl, K₂O, CaO, Ti, Mn, Fe, Cu, Zn, Rb, Sr, Zr, Mo, Ag and Au in the samples. Total content of polyphenols ranged from 28 to 147% and antioxidant activity varied from 0.8 to 49%, compared to galic acid. According to microbiota analyses, our propolis samples contained up to 23 different classes of bacteria. This findings present evidence of the high diversity present in natural propolis. Most prominent class was alphaproteobacteria, Bacilli, Actinobacteria and the less represented was Armatimonadia, Opitutae and Nitrospira. Overall, the results of our study revealed wide variations between the different parameter measured highlighting the inherent diversity of sources from which propolis is collected. Importantly, this is the first report of microbiota in propolis samples, a traditional remedy well known for its antimicrobial properties.

This research was funded by PRODEP 18724 and SEP-CONACYT (CB 257171).

Keywords: propolis, protein, polyphenols, antioxidant, microbiota

Efficacy of Commercial Hand Soaps to Remove *Escherichia coli* and *Enterococcus faecalis* of Soiled Hands.

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It has been demonstrated that contaminated hands are among the main sources for transmission of foodborne pathogens. In the agricultural environment, hands could become easily contaminated during work activities caused in many cases, by poor hygiene practices. To evaluate the reduction of *Escherichia coli* and *Enterococcus faecalis* in soiled hands after washing with soaps with various antimicrobial compounds, and determine microbial survival in rinsates. Four commercial soaps with different antimicrobial compounds were analyzed. *Escherichia coli* ATCC 25922 and *Enterococcus faecalis* ATCC 19433 were inoculated (10^3 and 10^6 CFU/g, final concentration) on sterilized agricultural soil. Previously decontaminated hands were put in contact with soil for 2 min, and immediately washed with liquid soaps with and without antimicrobial compounds (non-antimicrobial bland soap, triclosan, citric extracts, chloroxylenol, chlorhexidine gluconate and distilled water (control). Remained bacteria on hands were determined by a membrane filtration method using selective media (Rapid *E. coli* 2 Agar and *Streptococcus* KF Agar plates). Hand rinsates were collected and incubated for 20 h at 25°C, and viable bacteria were determined at various times. Results were analyzed with NCSS, LLC Version 6.0. Washing hands with soap with chlorhexidine gluconate provided the lowest concentration of *E. coli* remained per hand ($P < 0.05$) (3.17 ± 0.0 log CFU [99.9% of reduction] and 4.17 ± 0.2 log CFU [99.99% of reduction]), when inoculum of 10^3 and 10^6 CFU/ml were applied, respectively. Similarly, for *E. faecalis* the higher reduction was obtained with chlorhexidine gluconate, [3.0 log CFU to 3.15 ± 0.3 log CFU (99.9% of reduction)] followed by chloroxylenol [6.0 log CFU to 4.43 ± 0.3 log CFU (99.99% of reduction)]. In most cases, the level of viable bacteria in rinsates remained constant during the period analyzed. This study shows the efficacy of antimicrobial soaps in soiled hands which can be used to reduce contamination during handling products.

(Key words: antimicrobials, handwashing, hand soaps, food handlers)

Survival Of Non-Spore Forming Foodborne Pathogens In Cold Brewed Coffee

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Increasingly popular among coffee consumers is a product known as “Cold Brew” that is made by water extraction of ground coffee at ambient temperature for 16-24 hours; then filtered, bottled, and kept under refrigeration to the point of retail sale. The product does not receive any thermal processing and has a pH of about 5.0. Thus, it is a low acid food whose preservation is dependent upon refrigeration and any inherent antimicrobial characteristics. Processors avoid pasteurization, acidification, or preservatives for quality concerns. The objective of this study is to document the survival/growth of foodborne pathogens intentionally introduced into “Cold Brew” products held at commercial refrigeration temperatures. Fresh cold brewed coffee in sealed bottles was obtained from a regional coffee roaster. Populations ($\sim 1 \times 10^5$ CFU/ml) of (3 strains each of *E. coli* O15:H7, *Salmonella* species and *Listeria monocytogenes*) were introduced individually into cold brew (pH 5.0) and into controls (0.1 M potassium phosphate buffer, pH 5.0) and held at 4° C / 21 days. Enumeration was at 2 day intervals. Growth was not observed in either the coffee or controls with any of the strains (n=3). Viable cells were not recovered (n=3) after (7 days-*Salmonella*), (11-days *E. coli*), and (14 days- *L. monocytogenes*). During the same time intervals, populations in the buffer controls experienced only a 1-1.5 log reduction (the range n=3). We observed “Cold Brew” does not favor the survival or growth of non-spore forming bacterial pathogens; likely due to a lack of nutrients and or the presence of antimicrobial factors from the coffee. Other investigation is being conducted to assess if *Clostridium botulinum* poses a safety threat to this low-acid product.

Key words: Coffee, Pathogens, Cold-Brewed

Evaluation of Mexican *Pimenta dioica* L. Essential Oil against Mycotoxin Producing Fungi

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Toxigenic fungi are responsible for causing yield losses of food and represent a risk to health consumers. The mycotoxins of greatest importance are the Ochratoxin A, Aflatoxins and Fumonisin, which are produced by fungi of *Aspergillus*, *Penicillium* and *Fusarium* genera. Synthetic fungicides are used to control the growth of toxigenic fungi, however, these compounds have adverse effects, such as high toxicity and modification of sensorial properties. It is of great importance the search for effective alternatives, natural, safe and economic against the growth of toxigenic fungi. The objective of this study was to evaluate the antifungal and antitoxigenic activities of the *Pimenta dioica* L. essential oil against strains of *A. westerdijkaei*, *A. ochraceus*, *A. flavus*, *A. parasiticus*, *A. carbonarius* and *F. moniliforme*. The essential oil was obtained using the method of hydrodistillation; the chemical composition was determined by GC-MS; the Minimum Inhibitory Concentration (MIC) was determined using the method of macrodilution, and the production of OTA, FUM and AFLA was quantified by an ELISA assay. The yield of the essential oil extracted was 1.03 ± 0.16 ml/100 g and were found as major components: eugenol (58.68 %), methyl-eugenol (30.57 %), β -pinene (1.34 %) and 1, 8 cineol (3.92 %). The study of the growth rate showed a strong inhibitory effect in all the strains from a concentration of $0.6 \mu\text{L/mL}$, with a MIC in a range of 0.6 to $2.5 \mu\text{L/mL}$, being *A. carbonarius* the most sensitive species and *A. flavus* and *A. ochraceus* the most resistant. There is a complete inhibition in the production of assayed mycotoxins above $0.6 \mu\text{L/mL}$. The *Pimenta dioica* L. essential oil exhibit antifungal and antitoxigenic activity against dangerous fungi. This could have applications as an antifungal treatment in stored food.

Keywords: antifungal, *Pimenta dioica*, essential oil

Antibacterial Activity of Ozonized Olive (*Olea europaea* L.) and Venadillo (*Swietenia humilis* Zucc.) Oils against *Escherichia coli* and *Staphylococcus aureus*

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Ozonized oils are antimicrobial agents obtained from the combination of ozone and unsaturated fatty acids of vegetables oils. The aim of the present study was to evaluate the antimicrobial effectiveness of ozonized olive oil (OOO) and ozonized venadillo oil (OVO) against *Escherichia coli* and *Staphylococcus aureus*. Ozone was generated using the OzoneLab™ OL80F/DST-2S Desktop Ozone Generator (DST Lab, Canada) by passing Oxygen gas with an electric chamber at a fixed voltage (120 V) and a constant flow rate of 481mg/h. Olive oil was commercially acquired and venadillo oil was obtained by seeds ethanolic extraction. Ozonization was carried out during two periods of time, 6 and 12 h for Olive oil, and 6 h for Venadillo oil. The peroxide value of each sample was determined using the official methodology of AOAC 965.33. The antibacterial activity was conducted by the agar dilution method to determine the minimum inhibitory concentration (MIC) and the bacterial Log₁₀ reduction using *Escherichia coli* ATCC 700609 and *Staphylococcus aureus* ATCC 29213. All susceptibility tests were repeated 3 times. Analysis of variance (ANOVA) was performed using Bacterial Log₁₀ reduction as response variable. Tukey test was used to determine differences between bacteria, ozonized oils, and ozonization time with a significant level of ≤ 0.05 . Data were subjected to MINITAB 15 (2007) for statistical analysis. The lowest MIC (4.5 mg/mL) against *E. coli* was obtained when OOO and OVO were ozonized during 12 and 6 hours, with 2.5 Log₁₀ of bacterial reduction, respectively; while, the lowest MIC against *S. aureus* (1.5 mg/mL) was obtained when OVO was ozonized during 6 hours, with 3.4 Log₁₀ of bacterial reduction. The OOO reached peroxide values of 642.53 and 703.7 mmol-equiv/kg after 6 and 12 hours, respectively, while an 892.12 mmol-equiv/kg was obtained after 6 hours for OVO. No differences among ozonized oils were observed. However, *S. aureus* showed higher sensibility to the ozonized oils. Data reported here suggest that both ozonized oils are promising effective treatment for bacterial infections. Long term and large-scale human trials are needed to ensure that ozonized oils can provide consistent and reliable access to natural antibacterial products.

Keywords: Bactericide, Ozonized oils, Venadillo oil, *Escherichia coli*, *Staphylococcus aureus*)

Plant Products Inhibits Growth and Alters the Swarming Motility, Biofilm Formation, and Expression of Virulence Genes in Enteroaggregative and Enterohemorrhagic *E. coli*

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The purpose of this study was to determine the effects of plant products on the growth, swarming motility, biofilm formation and virulence gene expression in enterohemorrhagic *E. coli* O157:H7 and enteroaggregative *E. coli* strain 042 and a strain of O104:H4 serotype. Extracts of *Lippia graveolens* and *Haematoxylon brassiletto*, and carvacrol, brazilin, Citral and rifaximin were analyzed. Bactericidal studies were done by a broth microdilution method. All products showed bactericidal activity with minimal bactericidal concentrations ranging from 0.08 to 8.1 mg/ml. Swarming motility was determined in soft LB agar. Most compounds reduced swarming motility by 7% to 100%; except carvacrol which promoted motility in two strains. Biofilm formation studies were done in microtiter plates. Rifaximin inhibited growth and reduced biofilm formation, but various concentrations of other compounds actually induced biofilm formation. Real time PCR showed that most compounds decreased *stx2* expression. The expression of *pic* and *rpoS* in *E. coli* 042 were suppressed but in *E. coli* O104:H4 they varied depending on compounds. In conclusion, these extracts affect *E. coli* growth, swarming motility and virulence gene expression. Although these compounds were bactericidal for pathogenic *E. coli*, sublethal concentrations had varied effects on phenotypic and genotypic traits, suggesting strain to strain variability, and in addition, some also increased virulence gene expression.

Keywords: *Escherichia coli* O157:H7, Biofilm, Swarming, Gene expression

Bacterial Metabolites from Intra and Inter-species Influencing Thermotolerance: The Case of *Bacillus cereus* and *Geobacillus stearothermophilus*

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Bacterial metabolites with communicative functions could provide protection against stress conditions to members of the same species. Yet, information remains limited about protection provided by metabolites in *Bacillus cereus* and inter-species. This study investigated the effect of extracellular compounds derived from heat shocked (HS) and non-HS cultures of *B. cereus* and *Geobacillus stearothermophilus* on the thermotolerance of non-HS vegetative and sporulating *B. cereus*. Cultures of *B. cereus* and *G. stearothermophilus* were subjected to HS (42 °C or 65 °C respectively for 30 min) or not-HS treatments. Cells and supernatants were separated and mixed in a combined array, then exposed to 50 °C for 60 min and viable cells determined. For spores, D-values (85 and 95 °C) were evaluated after 120 h. In most cases, supernatants from HS-*B. cereus* cultures added to non-HS *B. cereus* cells caused their thermotolerance to increase (D50: 12.2–51.9) when compared to supernatants from non-HS cultures (D50: 7.4–21.7). While the addition of supernatants from HS and non-HS *G. stearothermophilus* cultures caused the thermotolerance of non-HS cells from *B. cereus* to decrease initially (D50: 3.7–7.1), a subsequent increase was detected in most cases (D50: 18–97.7). In most cases, supernatants from sporulating *G. stearothermophilus* added to sporulating cells of *B. cereus* caused the thermotolerance of *B. cereus* 4810 spores to decline, whereas that of *B. cereus* 14579 increased. This study clearly shows that metabolites in supernatants from either the same or different species (such as *G. stearothermophilus*) influence the thermotolerance of *B. cereus*.

Keywords: *Bacillus cereus*, *Geobacillus stearothermophilus*, Sporulation

Molecular Detection of Hepatitis A Virus and Human Enteroviruses in Naturally Growing Shellfish from Panama Bays

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Prothotaca asperrima, *Donax punctatostratus* and *Anadara tuberculosa* are the main bivalves shellfish for exploitation, consumption and exportation in Panama and grows naturally in Panama bays (Bique, Chinina and Espave Bays). These bivalves are filterers feeders presenting a concern for public health and quality control for national and international commercialization. A reverse transcription-semi-nested-PCR method was used to detect hepatitis A virus (HAV) and human enteroviruses (hEV) in naturally contaminated shellfish from the three bays of Panama. A total of 36 shellfish samples were evaluated, the results were statistically analyzed, and compared with the European Union legislation using traditional fecal contamination indicator (Thermotolerant Coliforms and *Echerichia coli*). HAV was detected in 50% of the *D. punctatostratus* and *P. asperrima* samples, and 25% of *A. tuberculosa*. A co-contamination with HAV and hEV was detected in 25% of *D. punctatostratus*. According to the microbiological indicators Bique Bay and Chinina Beach were classified in Category B, and are not safe for consumption and exportation, while Espave Bay was classified in Category A, suggesting that is the only bivalves-growing zone appropriate for human consumption. This is the first study of viruses in shellfish in Panama, and the results will be useful for defining microbiological parameters to improve the sanitary control of shellfish harvesting.

Keywords: Food Safety, RT-PCR, Human Enterovirus, Hepatitis A Virus, Bivalves-Shellfish

Prevalence of *Campylobacter* spp. From Chicken Carcasses from Retail Markets in Culiacan, Sinaloa, Mexico

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Campylobacter species are responsible for the highest percentage of gastroenteritis worldwide. Infection can lead to serious sequelae such as Guillain-Barre syndrome and reactive arthritis. Of the species, pathogenic to human, 90% of disease is caused by *Campylobacter jejuni* and most of the rest by *Campylobacter coli*. Both can be isolated from raw and undercooked poultry representing a high risk to public health. The aim of the present study was to identify the presence of *C. jejuni* and *C. coli* from retail chicken samples. Thirty whole chicken carcasses were purchased from various local retailers. The liquid from each package was collected and enriched in a sterile cell culture flask with a 0.2µm vent cap with antibiotics, and incubated at 42°C with gentle shaking under microaerobic conditions. After incubation of the enrichment broth for 24h, 250µl sample was filtered for 30min in a sterile mixed cellulose ester membrane filter (47mm in diameter and a pore size of 0.65µm), which was placed on the surface of ABA plates. After incubation filters were removed, and plates were incubated for 24 to 48h at 42°C under microaerobic conditions. The recovered isolates with a *Campylobacter*-like colony morphology (pale orange colonies) were inspected visually for a very small, curve (S-shaped) single-cell morphology and corkscrew motility by light microscopy. A descriptive analysis was performed to determine the prevalence of *Campylobacter* species. A total of 57% (17/30) of the retail whole chicken carcasses were contaminated by *Campylobacter* and 94 isolates were recovered, however, further identification by multiplex PCR targeting the gene *lpxA* need to be performed. This is the first study carried out in the Northwestern part of Mexico identifying the presence of *C. jejuni* and *C. coli* in retail chickens. Our findings showed a high prevalence of *Campylobacter* contamination representing a public health concern. The results may also aim in the developing of control strategies to prevent contamination of these pathogens.

Keywords: *Campylobacter jejuni*, *Campylobacter coli*, poultry, public health risk, multiple PCR

STEC Screening and STEC Identification using real-time PCR

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Every year, food-borne illnesses caused by Shiga toxin-producing *Escherichia coli* (STEC) claim many lives worldwide. STEC are most commonly transmitted through raw ground beef, raw or inadequately pasteurized milk, sprouts and vegetables. Most infections are caused by *E. coli* serotype O157 and a number of non-O157 *E. coli* serotypes (e.g., “Big Six”). In 2011, *E. coli* O104:H4, not a member of the “Big Six”, caused a serious outbreak in Germany. ISO/TS 13136 requires screening for the virulence factors *stx1*, *stx2*, and the intimin *eae*, following identification of five serotypes (O26, O103, O111, O145 and O157). Besides O157, the US focuses on the “Big 6” (O26, O45, O103, O111, O121 and O145). Moreover, in the European Union there was an extension of regulation (EC) 2073/2005, which additionally requires testing for O104 serogroup. BIOTECON Diagnostics has developed two real-time PCR kits that enable the easy screening for STEC and the subsequent identification of the most important eight serotypes (O26, O45, O103, O104, O111, O121, O145 and O157) in less than 24 hours. The foodproof® STEC Screening LyoKit detects *stx1*, *stx2*, *eae*, and the internal amplification control in one single PCR reaction. The assay is based on ISO/TS 13136, but it was further expanded to detect all known variants of the *stx*-genes. In particular, *stx2f* is missing from the ISO method, but can be easily detected with the screening assay. Following screening, the most important eight serotypes can be identified by melting curve analysis in just one additional PCR reaction using the foodproof® STEC Identification LyoKit. During validation, all tested 81 STEC strains comprising at least 13 different O-serotypes STEC have been detected and correctly identified. The limit of detection of pure DNA is at least 20 genome equivalents for all eight target serotypes. For convenience, safety, and easy storage the reaction mixes in the foodproof® LyoKits are pre-filled and lyophilized, so that the sample DNA can be added directly to the reaction tube. Thus, these kits allow an easy and convenient screening and identification of the “Big Six”, O157, and O104 in less than 24 hours using real-time PCR technology.

Novel *Vibrio* Detection Method for Species and Toxigenicity Gene Identification Using Real-Time PCR

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Vibrio parahaemolyticus, *Vibrio vulnificus* and *Vibrio cholerae* are known as waterborne contaminants of seafood that cause severe health problems worldwide. Traditional detection methods are time consuming and error-prone, while identification by PCR can be accomplished in less than 24 hours with high specificity and sensitivity. BIOTECON Diagnostics developed a lyophilized real-time PCR assay that simultaneously detects *V. parahaemolyticus*, *V. vulnificus* and *V. cholerae* in combination with individual identification of the associated pathogenicity factors *ctx*, *tdh*, *trh1* and *trh2* via melting curve analysis in just one single reaction, using sequence specific 5' nuclease-probes. By using novel sequence targets, false-positive and false-negative results, known from other targets like e.g. *tlh* or *hlyA*, are avoided. 149 strains were tested for inclusivity, 73 were tested for exclusivity. With 100 % inclusivity and 100 % exclusivity, the assay is superior to other methods for *Vibrio* detection. The sensitivity of the foodproof® *Vibrio* Detection LyoKit is 1 genomic equivalent (GE) per reaction for species detection and 10 – 25 GE per reaction for toxin detection. The assay is compatible with all common raw and processed seafood matrices like whole squid, raw oysters or smoked salmon. Seafood often is laden with high numbers of dead cells of *Vibrio* spp., which frequently leads to false-positive results with other PCR methods. BIOTECON Diagnostics' sample preparation includes a live/dead discrimination by using Reagent D, which efficiently removes DNA of at least 10⁴ cfu/g dead *Vibrio* and thereby avoids such problems.

Determining the Effectiveness of Citrilow™ and Peragonn™ Used as dip Applications for Broiler Parts

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The microbiological quality of broiler parts; front halves, saddles, deboned boneless skinless breasts, wings, tenders, and boneless leg meat was determined using Aerobic Plate Count (APC), and the incidence of *Campylobacter spp.* and *Salmonella spp.* Treated products, using a dip application of either Citrilow™ (pH 1.3) or Peragonn™ (300 ppm) were compared to untreated or control parts. The control samples were taken for each sample group including the incoming load and after deboning, prior to treatment. Treated samples included dip application of Citrilow™ and Peragonn™ with the incoming load, and after deboning for parts used in this study (n = 66). Citrilow™ concentrations were determined using a calibrated pH probe, and Peragonn™ concentrations were determined using a peroxyacetic acid titration test kit. The treated samples were submerged in the antimicrobial for 3-5 seconds with a post application drip of 3-5 seconds. All samples were aseptically collected following the Food Safety and Inspection Service (FSIS) Directive 10,250.1 for sample collection. APC counts were transformed into log₁₀ colony forming units per milliliter (CFU/mL), and qualitative *Salmonella spp.* and *Campylobacter spp.* were measured as a percent positive for each samples, were 0% represents no detected presence, and 100% represents a detected presence. Results were organized based on part type and treatment using a Student's T-Test to separate means and determine statistical significance using a 95% confidence interval. All untreated, control parts had a 2.24 log₁₀ CFU/mL APC and were 68% positive for *Campylobacter spp.* and 8% positive for *Salmonella spp.* Peragonn™ showed an overall higher reduction in bacteria with a 1.14 log₁₀ CFU/mL in APC compared to 0.67 log₁₀ CFU/mL for Citrilow™. Peragonn™ showed higher reductions for *Campylobacter spp.* (83% vs. 48%) and (100% vs. 50%) for *Salmonella spp.* when compared to Citrilow™. Citrilow™ reduced APC counts ($P < 0.05$) for both tenders and boneless leg meat more effectively when compared to Peragonn™. In summary, a dip application of Peragonn™ was most effective at reducing general bacteria as well as *Campylobacter spp.* and *Salmonella spp.* while Citrilow™ was more effective on tenders and leg meat.

Keywords: Antimicrobial, broiler parts, *Campylobacter spp.*, dip application, *Salmonella spp.*

Evaluation of Power and Exposure Time during Ultrasonic Homogenization for retrieving Strongly Attached Cells of *Salmonella* and *Escherichia coli* O157:H7 on Valencia Orange Surface Stored at 25 and 35°C

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Pathogenic bacteria may arrive and strongly attach onto orange surfaces during various stages of the productive chain. Ultrasonic homogenization may be used to remove strongly attached cells of microorganisms to fruit. However, settings for optimal sonication removal have not been tested and therefore reports show a variety of ultrasonic treatment settings. To determine the effect of power and exposure time for ultrasound treatments in recovering strongly attached cells of *Salmonella* or *Escherichia coli* O157:H7 in orange maintained at 25 and 35°C. Forty-eight unwaxed oranges (*Citrus sinensis* var. Valencia) and without mechanic damage were inoculated with a cocktail of washed cells that included three strains each of rifampicin-resistant *Salmonella* and *Escherichia coli* O157:H7. Inoculated fruits were maintained at room temperature for 1 h previous to storage at 25 and 35°C for 0, 1, 2 and 3 days. In each time at both temperatures, three pieces were removed for counting strongly attached cells (SA) of each pathogenic bacterium on LSPR agar at 35°C for 24 h, according to low (192 W) and high (300 W) power at 40 KHz and minutes (1, 5 and 8) of exposure to ultrasound during homogenization. Two experiments with six replicates were performed. Recovery of both pathogens was not significant ($P>0.05$) when samples were homogenized at different power and ultrasound exposition times. Population of SA was similar ($P>0.05$) at 35°C and 25°C; higher counts were obtained at the beginning of storage. As storage time progressed, recovering of SA from the fruit was lower ($P<0.05$) under both storage temperatures; which could be a consequence of pathogens sensitivity to desiccation and presence of inhibitory substances on the orange surface. Low (192 W) or high (300 W) power of ultrasound at 40 KHz exposed during 1, 5, or 8 min can be used for recovering strongly attached cells of *Salmonella* and *Escherichia coli* O157:H7 from the Valencia oranges.

Keywords: sonication, orange, strongly attached cells, pathogenic bacteria

***In vitro* Activity of Essential Oils Encapsulated in Chitosan on Corn Mycotoxigenic Fungi Contaminants**

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Mycotoxins are toxic secondary metabolites produced by several fungi species and appear as natural contaminants in food when weather conditions are favorable. *Aspergillus* and *Fusarium* are two of the genera most frequently isolated from contaminated food products such as cereal grains and other commodities. Fungi are generally controlled by synthetic chemicals, however, the resistance of these pathogens to the fungicides has made ineffective some of them, creating the need for new products. Essential oils (EOs) have been studied as an alternative method to control fungal pests. Nevertheless, due to their instability and volatile nature, techniques or methods to prolong the effect of their bioactive compounds are required. Therefore, the aim of this study was to evaluate the antifungal effect of GRAS pure essential oils (pEOs) of cinnamon, clove and thyme and encapsulated with chitosan (eEOs) in the radial growth, spore germination and production of fumonisins and aflatoxins by *Fusarium verticillioides* and *Aspergillus parasiticus*. It was found that, compared to the eEOs, pEOs presented high inhibitory effect in radial growth and spore germination, up to 100%, which was more significantly observed at concentration higher than 500 ppm being 1000 ppm the best. Also, morphological alterations in the growth of each fungus were caused by the eEOs, but in general, they presented only a fungistatic effect. Fumonisin and aflatoxin production decreased up to 53 and 66%, respectively, in corn grain treated with the eEOs compared to controls.

Keywords: *Fusarium verticillioides*, *Aspergillus parasiticus*, mycotoxin production; chitosan microcapsules; fungal inhibition

Fast and reliable screening and identification of the most relevant beer spoilage bacteria plus detection of spoilage yeasts in beer by real-time PCR

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In general, beer is a hostile environment for most microorganisms. Only a few kinds of bacteria are able to grow under such inhospitable conditions like the ethanol concentration, the relatively low pH and the dissolved carbon dioxide concentration and are able to spoil beer. The detection and identification of such beer spoilage bacteria by conventional methods in a routine lab of a brewery is a very time consuming and laborious task. This study attempts to clarify that real-time PCR provides an easy, fast, and reliable alternative testing solution. For the existing foodproof® Beer Screening Kit BIOTECON Diagnostics uses hybridization probes (LightCycler® technology). This kit allows the detection of 30 beer-spoilage bacteria, including identification of 12 species, in a single reaction within 24-48h. The range of detected organisms includes the most beer relevant species of the genera *Lactobacillus*, *Pediococcus*, *Pectinatus* and *Megasphaera*. The method is adjusted to the routine lab permitting a throughput of up to 94 samples per PCR run. With this kit real-time PCR is performed on a LightCycler® instrument from Roche and uses FRET (fluorescence resonance energy transfer) to detect the DNA. It will be demonstrated that after a PCR run, the absence or presence of beer spoilers can be detected immediately. Subsequent melting curve analysis allows the identification of the most important spoilage bacteria like *Lactobacillus brevis*, *L. lindneri* or *Pediococcus inopinatus* from a positive result without any further testing. Differences such as length, G-C-content, and base sequence, make the signal obtained by melting curve investigation distinct for nearly every probe-DNA combination. Within the target organisms another beer spoiling bacteria, *Lactobacillus acetotolerans*, will be included as number 31. A second foodproof® Beer Screening Kit for almost all the other PCR instruments is currently developed. The kit is based on 5' nuclease technology (TaqMan). It also allows the detection of the above-mentioned 31 different beer-spoilage bacteria in one test. In addition, it will be shown that the detection of hop tolerance genes in a separate fluorescence channel is possible. *Lactobacillus brevis*, the most important bacterial beer spoiler can be identified in a third fluorescence channel. Beer spoilage organisms also include several so-called wild yeasts, of which *Saccharomyces* species are generally considered the most important. Wild yeast can be defined as any yeast that a brewer did not intentionally introduce into a beer. Similar to beer spoiling bacteria, wild yeasts can produce a wide variety of undesired flavors in finished beer. To detect the most important spoilage yeasts, BIOTECON Diagnostics currently develops a real-time PCR kit, which detects the genera *Saccharomyces* spp., *Zygosaccharomyces* spp. and *Dekkera/Brettanomyces* spp. in one single test. Both new kits are planned to be launched by the end of 2016. Validation data for all three methods, including sensitivity, species in- and exclusivity, accuracy, matrix compatibility and other will be demonstrated in the presentation.

Fast and reliable screening of *Legionella* spp. and identification of *L. pneumophila* in water by real-time PCR including live/dead discrimination

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Rising numbers of legionellosis outbreaks all over the world show the high demand of diagnostic tools to monitor water systems such as drinking water systems, cooling towers, air conditioning systems, fountains, and whirlpools. Purpose was the development of a quantitative multiplex real-time PCR assay for the simultaneous detection of *Legionella* genus (*L. spp*) and *Legionella pneumophila* in water. In addition, *L. pneumophila* serogroup 1 detection is targeted as this serogroup accounts for more than 90% of all legionellosis infections. An internal control was included to control PCR inhibition. As special feature, the PCR assay was designed to allow discrimination between live and dead cells (so called viability PCR), in contrast to conventional PCR assays which always detect DNA from live and dead cells. Furthermore, the determined quantity of *Legionella* cells by the assay gives rapid information about the need for action, when compared to national alert levels for *Legionella* spp. and helps to monitor effectiveness of disinfection methods within water systems. In order to develop the PCR assay, primers and probes were designed for each target (*Legionella* genus, *L. pneumophila* and *L. pneumophila* serogroup 1), the PCR was established and compared for single- and multiplex assay performance. Specificity (inclusivity/exclusivity) was tested with DNA extracts. Sample matrix compatibility, sensitivity and viability PCR were tested with genomic DNA as well as spiked water samples. Different filtration protocols (membrane filters with different diameter, pore size, material) were tested for various water samples. Live/dead discrimination and subsequent DNA preparation were conducted either using the filter directly or with cells rinsed from the filter. Optimization of the mix components (e.g. concentrations of primers, probes, nucleotides, ions and Taq polymerase) was necessary to reach high efficiency for quantification purposes as well as to be stable against inhibiting substances in the water. Specificity (inclusivity and exclusivity) was tested with a large panel of *Legionella* species as well as close relatives and bacteria of the same habitat. For each target, no false-negative or false-positive results were obtained for all tested strains. The sensitivity was at least 10 genomic equivalents (GE) per reaction for DNA extracts and 10 cells per 100 ml filtrated sample of different water matrices and with different filtration protocols. The sample preparation includes a live/dead discrimination step, which efficiently removes DNA of at least 10³ cfu/ml dead *Legionella*. 100 % specificity and high sensitivity meet the demands of testing laboratories. As water samples upon disinfection treatment are often contaminated with dead cells of *Legionella*, live/dead discrimination step prevents false positive results which may be encountered with other PCR methods. Comparison studies of cell numbers obtained by culture-based detection (ISO 11731) and by our **foodproof**[®] *Legionella* Detection LyoKit in various water samples and systems are planned in order to assess the predictive value as alternative to the labour-intensive and slow culture method. In conclusion, this novel diagnostic tool for *Legionella* detection provides a new approach with viability PCR to improve surveillance in water systems and prevention of new infections.

Antimicrobial Susceptibility of *Salmonella* Isolated from Beef Cattle in Honduras

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The objective of this work was to determine the antimicrobial susceptibility patterns of *Salmonella* isolates recovered from beef cattle raised and harvested in Honduras. Antimicrobial susceptibility of *Salmonella* isolates (n=47) from beef cattle (hides, carcasses at pre and post-evisceration, and subiliac lymph nodes) was determined by microbroth dilution method and the minimum inhibitory concentration (MIC) to nine antimicrobial classes was estimated. *Salmonella* isolates were inoculated in Gram-Negative MIC plates (CM1AGNF, Thermo Scientific®) and incubated at 35°C for 18 h. Values of MIC (µg/ml) were obtained using the Sensititre® OptiRead™ system and Sensititre® software SWIN® (V3.3). Interpretive criteria from the National Antimicrobial Resistance Monitoring System (NARMS) were used to categorize the results as resistant, intermediate, or susceptible. Procedures of R (v.3.3.2) were used for statistical analyses. Fisher's exact test was used when the interpretative criteria were compared by country region. *Salmonella* isolates were 72.3% (34/47) resistant, 8.5% (4/47) intermediate, and 19.2% (9/47) susceptible to at least one antimicrobial class. From the resistant isolates, 41.2% (14/34) displayed multidrug resistance (MDR) defined as an isolate that is non-susceptible to at least one antimicrobial in three or more antimicrobial classes. *Salmonella* displayed resistance most frequently to fluoroquinolones, a prohibited antimicrobial for veterinary use in Honduras (68.4%, 26/38) followed by aminoglycosides (58.0%, 22/38), β-lactams (47.4%, 18/38), and cepheims (47.4%, 18/38). On the other hand, all isolates (47/47) were susceptible cephalosporins (ceftriaxone and ceftiofur antibiotics). *Salmonella* was much less resistant to penicillin, 23.7%; (9/38), macrolides, 18.4% (7/38); tetracycline, 15.8% (6/38); and chloramphenicol, 10.5 % (4/38). All the isolates were susceptible to the sulfides class. The resistance pattern was not affected ($P = 0.2454$) by the region where cattle were raised or by the sampling stage along the production chain ($P = 0.8364$). Antimicrobial and multidrug resistant *Salmonella* may be a source of infection via consumption of contaminated beef products. Surveillance and education programs should be developed and put in place so that Honduran farmers, producers and consumers may prevent the development and spread of antimicrobial resistant foodborne infections.

**Antimicrobial Activity of the Combination of Three Essential Oils *Citrus sinensis*,
Cuminum cyminum and *Pimenta dioica*.**

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Essential oils are known since antiquity for its antimicrobial properties and have application in food preservation; however, this activity occurs at high concentrations, several studies suggest that combinations of essential oils show antimicrobial activity at lower concentrations due to synergy between its components being this an alternative to increase their effectiveness. The aim of this study was to test whether the combination of essential oils of orange (*Citrus sinensis*), cumin (*Cuminum cyminum*) and allspice (*Pimenta dioica*) show an increase of antimicrobial activity against *E. coli* ATCC 11229, *S. aureus* ATCC 29213 and *C. albicans* ATCC 10231. Essential oils were obtained by distillation steam with stripping; the identification of the composition was performed by coupled gas chromatography–mass spectrometry. Minimum Inhibitory Concentrations (MIC) was determined for each essential oil by microdilution method. The combinations were evaluated in proportions of 1: 1 for each pair of oils and 1: 1: 1 for the three oils (100 mg/mL each oil), by disk diffusion method. Tests were performed in duplicate. The data were processed and analyzed by ANOVA test with a 95% confidence level using the statistical software Statgraphics Centurion XVI version. The results show that the major chemical components were limonene (84.61%), cuminaldehyde (28.07%) and methyl eugenol (40.09%), for orange, cumin and allspice, respectively. The MIC for each test strain was in the range of 100 to 200 mg/mL. The inhibition zone obtained for pure essential oils were 8.8 to 10.9 mm, meanwhile, combinations showed inhibition zones 12 to 15 mm against *E. coli* and *S. aureus*, whereas for *C. albicans* were 10 to 16 mm. This shows that combinations of oils of orange, cumin and allspice increase their antimicrobial activity.

Keywords: essential oils, combination, antimicrobial

Study of the Biofouling Process on Stainless Steel Surfaces in the Dairy Industry

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The biofouling process involves biofilm formation when deposits of proteins or minerals are available on surfaces. In the dairy industry, this process represents a food safety hazard, increasing production costs, and reduced heat transfer efficiency, leading to increased energy requirements. The aim of this work was to study the biofouling process on two types of stainless steel plates of 6.25 cm², mainly used in food processing environments, 304-2B and electropolished. Roughness was determined by atomic force microscopy, whereas surface free energy was determined by the contact angle between a reference liquid and the stainless steel plates. Microbiota from raw milk was used to promote the formation of biofilms on both types of stainless steel surfaces, and population was determined by the plate count method. Viability of cells in biofilms was identified by fluorescence differential staining. Fluorescence *in situ* hybridization (FISH), with specific probes was used to identify microbial groups. Roughness of 304-2B and electropolished stainless steel plates was 32.7±0.18 nm, and 2.16±0.15 nm, respectively. Major components of deposits type A were: protein 55±4.7% on 304-2B plates, and 48±3.5% for electropolished plates; whereas for type B deposits were: minerals 72±3.3 and 70±1.2%, respectively. Surface free energy was significantly higher ($p<0.05$) for both types of plates containing deposits (A and B): 60.1±5.3, and 62.7±0.3 mN/m for 304-2B plates; 61.4±2.3 and 60.6±1.5 mN/m for electropolished plates, than those without deposits (38.1±0.9 and 46.4±1.1 mN /m), respectively. Biofilms microbial population recovered from electropolished plates, regardless of the presence of deposits was significantly ($p<0.05$) lower than that recovered from type 304-2B plates. Electropolished plates population (log CFU/cm²) without deposits was 5.9±0.13, 6.4±0.33 for type A deposits, and 5.6±0.15 for type B deposits; whereas 304-2B plates showed populations of 6.2±0.10, 6.8±0.06, and 6.2±0.14, respectively. From fluorescence differential staining type A deposits, regardless of the type of plates, showed more cells viability. From FISH microscopy on the biofilms, we identified *Streptococcus* sp., *Lactococcus* sp., and *Listeria* sp., and yeasts. Surface roughness of 304-2B stainless steel plates significantly promoted adhesion of organic matter, facilitating higher deposits leading to biofilms formation.

Keywords: Biofouling, stainless steel, FISH.

High Oxidation Solution in Mango (*Mangifera indica*) Fresh Sanitization

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Electrolyzed Oxidizing Water (EOW); which is obtained by passing a solution of Sodium Chloride 1% between two electrodes of high purity platinum, separated by a membrane of specific ion exchange, is a power sanitizer once exceeds 850 mV. This solution has high potential; however, is important to know the technical and scientific feasibility as a sanitizer in packing fresh mango. In this work the sanitizing power of EOW was evaluated in mango surface (*Mangifera indica*) for pathogen removal of commercial interest. The sanitizing power of EOW was evaluated *in vivo* and compared with Peracetic Acid and Calcium Hypochlorite 150ppm; the surface of mango ataulfo variety was inoculated with a bacterial population of 10^8 UFC applying treatments at 4, 25 and 35 °C, for a time of 1, 3 and 5 minutes of exposure to sanitizer and three application methods (ultrasonic nebulization, immersion and spray jet), data were analyzed with Statistica software version 10 using a fractional factorial design 3^{4-1} with $\alpha = 0.05$. The EOW showed a better bactericidal effect *in vitro* at 4 °C, inactivating the cells of *Salmonella* and *E. coli* after 15 seconds of exposure; Peracetic Acid and Calcium Hypochlorite at 150 ppm were shown to be very effective in the inactivation of these pathogen after 15 seconds of exposure; however, after enrichment, Peracetic Acid showed a sublethal damage to cells at 4 and 35 °C and was from 60 seconds when negative for the pathogens of interest were found. The EOW proved to be a very effective sanitizer for eliminating *E. coli* and *Salmonella sp* on mango surface by ultrasonic nebulization and immersion, at times no more than one minute of contact; while its antimicrobial activity was affected by the spray jet. The Peracetic Acid was mainly affected by the application method and found to be inefficient in elimination of pathogens, requiring longer times than EOW, while Calcium Hypochlorite showed complete inactivation of pathogens with any application. EOW, combined with ultrasonic nebulization, makes this a very attractive alternative in the food industry in food safety terms.

Keywords: Mango, *Salmonella*, *E. coli*, Electrolyzed Oxidizing Water, Ultrasonic Nebulizer.

Distribution of Premature Stop Codons in Internalin A of *Listeria monocytogenes* Strains and Evaluation of their Cell Invasion and Intracellular Growth

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Consumption of foods contaminated by *Listeria monocytogenes* may result in invasive listeriosis, which mortality in high risk groups range from 20% to 30%. Crossing intestinal barrier is crucial for disease development and it is mediated by interaction of InlA protein, expressed by *Listeria*, with E-cadherin receptor present in epithelial cells. Fifty-nine *L. monocytogenes* strains from serotypes 1/2a (n=13), 1/2b (n=9), 1/2c (n=10), and 4b (n=27) were included in this study. Twenty-two of these were from clinical cases, 12 from food processing environments, and 25 from beef samples. The 2,400-bp *inlA* was amplified and sequenced. To determine the effects of InlA mutations on virulence, intracellular growth curves were performed using the enterocyte cell line Caco-2, which expresses E-cadherin, and immortalized murine bone marrow-derived macrophages (iBMDM). CFUs were enumerated at 2 h, to study invasion, and 8 h, to study growth. We determined that premature stop codons (PMSC) in *inlA* are very common in serotype 1/2c (lineage II), but were not present in any of the 22 strains from clinical cases or lineage I strains (n=36). Strains with PMSC were significantly hampered in their ability to invade Caco-2 cells, matching what we observed for other, non-pathogenic *Listeria* species. Some strains with reduced invasion ability that did not carry PMSCs in *inlA*, suggesting other factors, in addition to InlA, affect invasion of this cell type. Interestingly, our data revealed that most serotype 4b strains from the environment and beef efficiently invaded epithelial cells. In addition, there was a strong correlation between serotypes and intracellular multiplication ability. For example, most strains from serotypes 1/2a, 1/2c and 4b grow worse in both Caco-2 and iBMDM, while serotype 1/2b grow better than reference strain 10403s in Caco-2 and worse in iBMDM. Here we demonstrate the conservation of *inlA* gene among *L. monocytogenes* strains, and confirm that PMSC are more common in lineage II, particularly in 1/2c strains. We also showed, *in-vitro*, that mutations in *inlA* affect Caco-2 invasion. Further studies are necessary to uncover more details regarding the factors that contribute to differential growth in iBMDM.

Acknowledgments: FAPEMIG, CAPES, CNPq, FIOCRUZ

Keywords: *Listeria monocytogenes*, InlA, cell invasion, intracellular growth

Standardization of Murine Norovirus Production (MNV-1) in Raw 264.7 Cell Line.

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Human norovirus (HNoVs) represents principal agents of nonbacterial gastroenteritis worldwide. Despite economic losses caused by this virus, vaccines or effective drugs for treatment have not been developed yet in part due to the poor understanding about the biology and the impossibility of culture with a cell line, therefore the study of HNoVs depends majorly of work using viral surrogates. Murine Norovirus (MNV) are related to Norovirus genotype V and replicate efficiently in cell cultures, emerging as an ideal substitute for studying HuNoVs biology. The implementation of this system will allow the evaluation of alternative compounds with anti-viral properties. The objective of this work was the Standardization of production of MNV in the cell line Raw 264.7. The viral strain (MNV-1) CW1 (PTA-5935) was used. For the proliferation of virus, the RAW 264.7 cells were maintained in DMEM (FBS 10%; O₂ 95%; CO₂ 5%; 37°C), and were infected with MNV in EBSS solution by pipetting the virus directly on a monolayer of confluent cells (> 80%) and was incubated for 3 h. Then the solution was removed and fresh media (without FBS) was added and incubated during 3 days. Apparition of cytopathic effect and detachment was monitored every day. Infected cells were collected and transferred to sterile containers. Two cycles of freezing and thawing were performed followed by centrifugation at 2000 rpm for 5 min and supernatant was collected and dispensed in aliquots before to freeze at -80°C. Supernatants were used for infection of healthy cells and determine the TCID₅₀. Raw 264.7 cell line was propagated and used for the production of MNV. Supernatants were infectious, showing cytopathic damage according to time. The TCID₅₀ of the viral stock produced was determined. The standardization of RAW 264.7 cells and production of MNV-1 was achieved for being used as a study model.

Keywords: Norovirus, murine norovirus, gastroenteritis

Evaluation of the Combination of Bacteriocin 29 and Pediocin 133 in an Antimicrobial Coating incorporated on frankfurters

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Frankfurter is a smoked and cooked sausage ready-to-eat and its shelf life could be reduced by a post-process microbiological contamination during the peeling and final packaging stages, which will affect the consumer health. Bacteriocins are antimicrobial peptides with a great potential as natural biopreservatives, particularly Enterocin 29 and Pediocin 133 have highly active against *Listeria spp* and Gram-positive spoilage bacteria such as *Brochothrix thermosphacta* and *Weissella viridescens*. The objective was to evaluate the antimicrobial activity of a biodegradable coating added with pediocin-133 and/or enterocin-29 on frankfurters. The antimicrobial activity of the lyophilized extract of the bacteriocins produced by *E. faecium* MXVK29 (enterocin 29) and *P. parvulus* MXVK133 (pediocin 133) was tested by the diffusion agar method; also the minimum inhibitory concentration (MIC) was determinate. The film forming solution (FFS) was made of whey protein isolate (WPI), glycerol (80:20) and each bacteriocin, or the combination of both (50:50). Frankfurters were inoculated individually with *L. innocua*-ATCC33090, *B. thermosphacta*-NCIB-10018 and *Weissella viridescens* (5×10^5 CFU/mL), and covered with the FFS. A frankfurter control was tested without bacteriocin. Samples were vacuum packaged and stored at 4 °C for 12 days and at 10 °C for 28 days. Samples were taken at different days for microbial enumeration. Addition of bacteriocins to coating reduced the growth of the tested strains (1-2 log) during storage. The combination enterocin/pediocin reduced the growth of *L. innocua* 2-log until 12 day, after this time, a decrease of 1-log was observed. *B. thermosphacta* does not demonstrate inhibition during the first 5 days in all treatments, after this time the combination reduced the growth 1-log until 40 days. *W. viridescens* was inhibited by the combination of bacteriocins until 26 days (1.5-log less than the control). The combination of enterocin-29 with pediocin-133 at the concentration of 2000 UA/mL improve the shelf life of frankfurters reducing the growth of pathogens or spoilage bacteria foodborne, so that, the antimicrobial biodegradable coating could be as part of the hurdle technology.

Keywords: antimicrobial, coating, bacteriocins, combination, sausages

First Massive Molecular Assessment of Bacterial Microbiota in Mexican Propolis

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Propolis is a resinous material collected by honey bees from surrounding botanical sources such as plant exudates and used for colony health and productivity. In Mexico and other countries, propolis is frequently consumed by people to improve health and prevent or treat different diseases. Bees and their hives are inhabited by millions of different types of microorganisms (microbiota) but unfortunately the microbiota present in propolis has not been fully described. Samples of raw (not commercial) propolis were obtained from four states in Mexico (Jalisco, Querétaro, Tamaulipas, and Zacatecas, one sample from each site) and frozen at -20°C until use. Total genomic DNA was obtained from each sample using the Wizard Genomic Purification Kit (Promega) with minor modifications. Briefly, 10 g of frozen sample was macerated in a mortar, washed with 5 mL of hexane, and filtered in a Whatman N°1 paper (11 µM pore size) to remove the presence of wax. A total of 80 mg from each sample was then mixed with 100 mg zirconia/silica beads (0.1 mm) and proceed with tradicional protocol for DNA extraction. Purified DNA samples were used to perform PCR for amplification of the 16S subunit of the ribosomal RNA and massive sequencing was performed using the MiSeq instrument (Illumina). DNA was successfully obtained from all four samples. Over 100 different bacterial groups were detected with wide variation in bacterial composition among the four samples. Overall the most abundant group was *Rhodopila* spp. (median: 14%; range: 0.1-27%), a group encompassing bacteria with the highest redox potential among all microbial life. Two of four samples contained very high abundances of this group (20% and 27%). Other high abundant groups include *Corynebacterium* spp. (median: 8.4%; 1.6-19.5%), a widely distributed bacteria in nature, and *Sphingomonas* spp. (median: 5.9%; 0.03-14.3%), a group that has been used for numerous biotechnological applications because of its biodegradative capabilities. *Bacillus* and *Prevotella* spp. alone comprised as much as 88% (53% and 35%, respectively) of all microbiota in one sample. Our results revealed for the first time the bacterial composition of propolis using massive sequencing, thus helping understand its biological characteristics and beneficial properties.

Keywords: propolis, bacteria, microbiota, 16S, Illumina

A Combination of Commercial Citrus Based and Chemical Preservatives can Reduce *Campylobacter jejuni* In Vitro and Chicken

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Campylobacter is associated with foodborne gastroenteritis in humans, and chicken plays a very important role for microbial dissemination. *C. jejuni/coli* have emerged over last decades as a significant pathogen of humans causing 400-500 million cases of campylobacteriosis each year worldwide. Methods to control contamination of these bacteria in foods are not completely successful. The purpose of this study was to determine the efficacy of commercial, citrus-based and synthetic, preservatives and their mixtures, against survival of *C. jejuni* In Vitro and in a food model. Minimal Bactericidal Concentration (MBC) of Trisodium Phosphate (TSP), Citrosan and Citrol® was determined against two strains of *C. jejuni*. The synergistic effect of preservative mixtures was determined using the checkerboard method. The most effective combination was evaluated in chicken wings using the Fisher method. Sensory analysis of this mixture was conducted by a semi-trained panel using the duo-trio method. The MBC against *C. jejuni* of TSP, Citrosan and Citrol were $0.5 \pm 0.04\%$, $0.05 \pm 0.0006\%$ and $0.0006 \pm 0.0001\%$ respectively. Combinations lower than individual MBC inhibited microbes, among them TSP:Citrosan at 0.4:0.03 %, TSP:Citrol at 0.3:0.0003% and Citrosan:Citrol 0.4:0.0005%. When mixtures were analyzed in chicken wings, the combinations 2:0.3:0.05% TSP:Citrosan:Citrol and 0.3:0.05% Citrosan:Citrol, both showed a reduction of at least 4 log of *C. jejuni* by 48 h. Sensory analysis showed no significant difference among the mixtures when compared with the chicken wings without preservatives.

Keywords: *Campylobacter*, antimicrobial, preservatives

Molecular Method Associated with Membrane Filtration for Pathogen Detection in Jalapeño Pepper and Cantaloupe

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According to CDC, only in US, each year 48 million people suffer foodborne illnesses, 128,000 are hospitalized and around 3,000 die due to consumption of contaminated food or water. *Salmonella* spp., *Escherichia coli* O157:H7, and *Listeria monocytogenes*, are among the major pathogens that can be found as contaminants of fresh produce, and still now, reduce the risks of contamination are a real necessity, especially found assays able to reduce time-consuming and/or be more efficient. A modification of an assay previously performed by our group, where a membrane filtration protocol was developed for detection of *L. monocytogenes*, *Salmonella* and *E. coli* O157:H7 in artificially contaminated cantaloupe and jalapeño pepper, was made with the purpose of reduce the time of the assay, without affecting the sensibility and selectivity of the detection. Cocktails of bacteria (1×10^2 and 1×10^4 cells/ml) were made and inoculated onto decontaminated jalapeño pepper or cantaloupe. Following a membrane filtration protocol, the resulting membrane was used to DNA extraction and PCR method was performed. The protocol was compared with those where enrichment was used. Our results showed that direct protocol (membrane-filtration following of PCR) was able to detect bacteria, even with a low concentration (1×10^2 cells per ml) of pathogen. The method showed similar results to those observed when enrichment was used. The method proposed may be useful in the food industry to reduce time and maintained a high specificity of detection.

Keywords: PCR, membrane filtration, fresh procedure

Natural Products and Heat Shock Alters Swarming and Gene Expression of Shiga-Toxin Producing *Escherichia coli*

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Shiga-toxin producing *Escherichia coli* (STEC) strains are pathogenic for humans and capable to causing severe illnesses such as bloody diarrhea, hemorrhagic colitis, and hemolytic uremic syndrome. Heat and natural antimicrobials are being used to control STEC. This study analyzed the effect of heat and natural products on swarming and expression of virulence genes in strains of STEC (serotype O103, O26 and O111). Methods: Control strains were non-pathogenic *E. coli* and EHEC O157:H7. Citral, eugenol and hexanal were used alone or in combination with heat stress (HS, cultures from 37°C subjected to 46°C for 1h and then to 55 °C for 1h). Minimum bactericidal concentration and sub-inhibitory concentrations were determined. Swarming was determined in plates with 0.3% agar. Total RNA was extracted from O26 serotype and the cDNA synthesized for analysis of gene expression by qPCR, using *rp16s* as housekeeping gene. Results: MBC against the five strains ranged from 0.9 to 1.3 mg/mL for citral, 0.58 to 0.73 mg/mL for eugenol and 2.2 to 2.5 mg / mL for hexanal. Natural products and heat sock significantly reduced cell viability. Eugenol and hexanal reduced swarming of O26 STEC by 16% and 14% respectively and O26 swarming was equal or greater than EHEC O157:H7. Eugenol w/wo HS decreased (0.5 to 0.4-fold) *flhC* gene (flagella) expression of STEC O26 compared to control without treatment. In a similar way, hexanal plus heat decreased 0.5 fold *flhC* expression. This decrement in *flhC* expression could explain reduction of swarming observed. Eugenol treatment decreased 0.2 fold expression of *rpoH* and *rpoE*; and hexanal plus HS reduced (0.6 fold) *rpoS*. However, Citral w/wo HS, eugenol with HS and hexanal without HS overexpressed (1.8, 1.4, 1.2, 0.6 fold) *rpoS* gene. *stx1* gene expression was reduced 0.4 and 0.2 fold after HS and citral plus HS respectively. Citral showed the higher decrease (42% of reduction compared with untreated control) in swarming mobility of STEC O26, followed by citral plus HS (30% of reduction). Conclusions: This study indicates that combined use of natural products and heat stress affects the growth and swarming motility and expression of genes involved in virulence.

Keywords: Shiga-toxin producing *Escherichia coli*, Swarming, Gene expression

Use of *Bacteroidales* as an Indicator of Fecal Contamination Source Tracking in Tomato and Strawberry

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Fecal contamination associated with the consumption of vegetables is a health issue worldwide. Current methods used to investigate the possible presence of pathogens, such as *Salmonella* spp. and *E. coli* O157: H7 in vegetables, are time-consuming and do not indicate the origin of contamination. It has been reported that the order *Bacteroidales* can be used as an alternative indicator and for tracking the source of contamination, due to host-specific sequences conserved in its genome. The objective of this work was to identify the source of fecal contamination by using genetic markers specific for host *Bacteroidales* and determine the association between fecal contamination indicators, *Bacteroidales* and traditional bacteria, in strawberry and tomato rinses. Validation of oligonucleotides of host-specific (human, bovine and canine) markers of the 16S rRNA gene of *Bacteroidales* was performed using PCR. Tomato and strawberry samples were contaminated with diluted stools of human and animals which harbor *Bacteroidales* (between 6 and 7 log CFU/100 μ l) and traditional indicators (2 to 5 log CFU/ml) depending of host. Traditional indicators (*E. coli*, total coliform and *Enterococcus*) were enumerated and the universal *Bacteroidales* marker AllBac was quantified by qPCR. The host source was identified by PCR. Results showed that the limit of detection of the PCR was 1.35 to 10.35 logarithmic gene copies, corresponding to an LOQ up to 2 cells. No correlation between levels of *Bacteroidales* and traditional bacterial indicators was observed, levels of *Bacteroidales* were 2 log CFU higher than traditional indicators; however, traditional indicators showed high variation, and *E. coli* from bovine source was not detected in low-dilution contaminated samples. When samples were contaminated (1:1000 dilution of feces), host specific markers were detected in almost all cases. When low concentration of feces (dilution 1:10,000) were inoculated in produce, was possible the detection of dog feces by PCR in all tomatoes and in most of half (60%) of in strawberry samples. Based on these results, use of *Bacteroidales* provide valuable information to identify the source of fecal contamination, and could help to reduce the risks of contamination of produce.

Keywords: *Bacteroidales*, vegetables, microbial source tracking.

Effectiveness of Commercial Sanitizers for Reducing *Salmonella* on Tender Cactus Pads (*Opuntia ficus-indica*)

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Tender cactus pads or “nopalitos” (*Opuntia ficus-indica*) are often pre-trimmed, cut and packaged, and while usually consumed cooked they may also be consumed raw in salads or in juice. Therefore, use of an effective sanitizer is of great importance to assure the microbiological quality of fresh cactus pads. The objective of this study was to evaluate the efficacy of different sanitizing treatments on reducing a *Salmonella* Typhimurium ATCC 23564 strain (kanamycin resistant) population on fresh cactus pads. After washing and cutting off the spines, cactus pads were treated with sodium hypochlorite at 150 ppm, lactic acid at 1.5%, and two commercial antimicrobial formulations, Citrik Agro (1 and 3 mL/L) and Microdyn (8 drops/L), a citric-based and a colloidal silver, respectively. Fresh cactus pads were inoculated with a bacteria suspension of approximately 7 log₁₀ CFU/mL. After inoculation pads were maintained overnight in a biosafety cabinet to allow for attachment of *S. Typhimurium* cells before exposing them to the treatment solutions for 5, 10 and 15 min. Bacterial cells were enumerated by using direct plating on Hektoen enteric agar supplemented with kanamycin (50 µg/mL). Treatment of cactus pads with lactic acid, in all times tested, caused a significant reduction ranging between 1.1 and 4.2 log₁₀ CFU/g; sodium hypochlorite, Citrik Agro® and Microdyn® produced variable results ranging from 1.7 – 2.1, 0.0 – 1.7 and 0.0 – 1.1 log₁₀ CFU/g, respectively. These results indicate that lactic acid can be considered a potential antimicrobial agent in the sanitization of fresh nopal pads without spines.

Keywords: Cactus, *Salmonella*, Sanitizers, *Opuntia ficus-indica*

Antimicrobial Resistance Profiles of *Staphylococcus aureus* Isolated from Pasteurized Cheeses in Panamá

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The diseases caused by consumption of contaminated food have emerged as an important cause of morbidity and mortality worldwide. They have been described around two hundred and fifty agents causing food (ETA) diseases. The incidence these infections caused by Gram positive increased by selective pressure of antibiotics on the environmental, human and animal microbiota is a major risk factor in the emergence and spread of resistant microorganisms such as *Staphylococcus aureus* (*S. aureus*), being Cheese a food that can serve as vehicle of this pathogen for its dissemination. In Panamá, home preparation and consumption of cheese is high. This study was conducted to carry out the analysis of the microbiological quality of pasteurized cheeses, made in the Department of Experimental and Applied Microbiology (LAMEXA) of the University of Panama. This work aimed to evaluate the microbiological quality of pasteurized white cheese for the presence of *S. aureus* and its antibiotic resistance profile. Cheeses of different brands obtained from local supermarkets were selected and analyzed using the serial dilution technique, the coagulase test and antimicrobial susceptibility test by the Kirby-Bauer method. The results of five replicates of each showed that analyzed cheeses showed significant contamination by *S. aureus*. The Domitila cheese presented a risk of food poisoning by exceeding the permitted range for consumption. Fourteen different antimicrobial resistance phenotypes (with two to seven antibiotics) were found. Fifty-five (55%) and ninety-six (96%) of strains analyzed were resistant to erythromycin and vancomycin, respectively. It was concluded that improvements on the processing, transportation and storage of cheese is needed as well as control of the excessive use of antimicrobials throughout the food chain to avoid risks to public health.

Keywords: Cheese, detection, toxic infections, antibiotic resistance, *S. aureus*

Determination by PCR of the presence of horsemeat (*Equus caballus*) in meat products marketed in Mexico

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The aim of this study was to detect the presence of horsemeat in fresh meat and processed products, mainly in outlets (butcher shops) where the probability of horsemeat as beef is bid was high, as this practice constitutes adulteration because the sale of horsemeat consumer is not yet regulated. Adulteration detection was performed by the PCR technique, technique that is based on DNA analysis and allows replication in vitro million copies of genetic material of interest specifically. For this analysis were worked a total of 15 samples, of which 4 were processed products and 11 were fresh products, these samples DNA was extracted using Sambrook method. Genetic material obtained was quantified by a nanospectofotometro to corroborate quantity and quality of the DNA obtained, the primers used were; forward primer: 5' - CCA GCT CCA GAC CTC TCA TCA AAC ATC TCT TGA TGA AA- 3', reverse primer : 5' - CGA CTC ACT AGA GGG TTC TAG TA -3', conditions for amplification were: 1 Cycle at 94C , 35 cycles at 94 for 30s , 60 ° C for 30s , 72 for 30s and 1 cycle at 72 for 7 min. The results of amplification were assessed on agarose gels 1.5% dying ethidium bromide. Of the total samples analyzed for the presence of the species horse only in three samples were detected the adulteration, this samples were fresh products. The results show that the adulteration of meat products with horsemeat is a practice that makes illegally in some outlets in Mexico City. The technique proposed here can be implemented as a control tool in this type of products to ensure product authenticity and consumer safety.

Keywords: Adulteration, PCR, AND, Meat Products.

***Yersinia enterocolitica* Distribution in a Pork Processing Chain in Minas Gerais State, Brazil**

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Yersinia enterocolitica is a foodborne pathogen usually associated to pork chain production, once pigs are considered as reservoirs of this organism. This species is characterized mainly by their cell membrane lipopolysaccharides, allowing the identification of 6 biotypes and many other serotypes; virulence is not influenced by serotype, demanding the characterization of these pathogenic markers. The present study aimed the identification of the main sources of contamination by *Y. enterocolitica* in a pork production chain in Minas Gerais state, Brazil. Considering a full pork production chain (two pig farms and one slaughterhouse), surface samples were collected from finishing barns (n = 20), pig carcasses (before bleeding = 100, after buckling = 100, after evisceration = 100, after final washing = 100, tonsils = 100, mesenteric lymph nodes = 90), processing environment (knives, tables, hands of the employees = 180) and end products (n = 70). The samples were enriched in Peptone-Sorbitol-Bile Broth treated with 0.5% KOH (25°C for 72 h), and streaked onto plates containing *Yersinia* Selective Agar (30°C for 48 h). Typical colonies were subjected to identification by PCR targeting a 16S rRNA region for *Yersinia* spp. and *inv* for *Y. enterocolitica*. PCR was also used for serotype identification (targets: *per*, *wbbU*, *wbcA* and *wzt*) and virulence (targets: *ail* and *ystB*). A total of 106 isolates were obtained and 42 presented positive results for 16S rRNA; from those, 16 were identified as *Y. enterocolitica* due to *inv* detection. All *Y. enterocolitica* isolates presented positive results for *ail*, considered a stable antigenic marker for virulent strains, and for *wbcA*, allowing their classification as belonging to serotype O3, often associated to human diseases. Considering these results, 8 samples from the pork chain were positive for *Y. enterocolitica*, being 1 from a pig carcass after bleeding, 5 from tonsils, and 2 from mesenteric lymph nodes. The results identified the presence of *Y. enterocolitica* in the pork production chain, and demonstrate the relevance of pigs as carriers of this foodborne pathogen.

Acknowledgments: FAPEMIG, CAPES, CNPq

Keywords: *Yersinia enterocolitica*, pork chain, virulence

Food Safety Training for Spanish-speaking Foodservice Workers using Visual Messages

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Every year, unsafe food handling practices result in an increased incidence of foodborne illness among consumers around the world. Poor personal hygiene, improper time temperature control, improper cleaning and sanitizing, and purchasing food from unsafe sources have been identified as common unsafe practices in foodservice establishments. The increasing number of non-English speaking foodservice workers has led to challenges in providing food safety education and training to this demographic. Owing to low literacy levels among this demographic, using visuals is an excellent method for conveying critical food safety messages. In this study, visuals were utilized along with hands-on activities to train immigrant Hispanic foodservice workers in Southern Iowa, United States about proper use of proper personal hygiene, food thermometers, refrigerator thermometers, and cleaning and sanitizing of foodservice equipment and surfaces according to guidelines outlined by the 2005 Food Code. Ninety-five participants viewed minimal-text visuals depicting critical food safety messages, completed the handwashing exercise, measured the temperature of cooked meat, and cleaned and sanitized unclean surfaces. After training, participant food safety knowledge and behaviors improved, thus proving that visuals are a powerful tool for conveying messages to an audience who may have language barriers. Foodservice establishments can use these visual tools to train all foodservice workers about food safety irrespective of their native language. Visual-based training can also be used with other ethnic minorities, children, home makers, the elderly, and individuals with learning disabilities to convey safe food handling messages.

Keywords: Food safety, Spanish, Foodservice workers

Molecular Characterization of *Salmonella* Isolates from Beef Cattle Lymph Nodes and Feces by Pulsed-Field Electrophoresis

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Bovine lymph nodes are a potential source of *Salmonella* contamination when lymphatic tissue is included into ground beef as part of the lean trimmings. The way *Salmonella* disseminates among bovine lymph nodes is still unknown; some possible routes have been suggested including transdermal (cuts on the hide, biting flies) and gastrointestinal contamination. In order to assess the genetic diversity and determine the spread of different clones in cattle carcasses, 33 confirmed *Salmonella* isolates from lymph nodes (mandibular, mediastinal, and mesenteric) and feces originally isolated from one slaughter facility in Merida, Mexico were analyzed using pulsed field gel electrophoresis (PFGE). The *Xba*I macro-restriction of *Salmonella* isolates yielded 15 unique PFGE subtypes at 48% similarity. Three main PFGE patterns were identified with 4 (12.1%), 9 (27.3%), and 4 (12.1%) isolates clustered in each group respectively. Isolates that could not be assigned a serotype based on their banding pattern were sent for serotyping; high concordance (60.6%) was found between PFGE predicted serotype and serotype based on the traditional anti-sera serotyping method. Six different serotypes were identified, with *Salmonella* Poona being the most common (30.3%), followed by *S. Montevideo* (24.2%), *S. Muenster* (24.2%), *S. Kentucky* (9.1%), *S. Fresno* (3%), and *S. Havana* (3%). No relationship was found among serotypes from the mesenteric lymph nodes and feces, only one carcass had the same serotype in both isolates. Antimicrobial susceptibility phenotypes were determined for all isolates; few of the isolates (15.4%) were pan-susceptible while the majority (84.8%) was multidrug resistant. The findings show that PFGE can be used as a monitoring tool to better understand the pathogen's dispersion, and they reflect the need of improving interventions at different points in the food chain to avoid further *Salmonella* spread in the slaughter facility and into the meat supply.

Keywords: *Salmonella*, PFGE typing, *Salmonella* ecology, food processing plant

Subchronic Toxicity Analysis in Animal Models of a Nutraceutical Supplement to Control Metabolic Syndrome

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In recent years, nutraceuticals consumption has proved to be a revolution against conventional pharmaceuticals because of their curative potential and disease prevention. Recently, different kinds of nutraceuticals have been developed to be intended for their implementation in a regular basis healthy diet. Most of nutraceuticals involve bioactive compounds, which seem to be safe for their ingestion. However, for their commercialization, it is required the safety study to comply with the rules of marketing products for human use. The goal of this study was to perform *in vivo* subchronic toxicity assay for a nutraceutical developed by the company. The assay was carried out on New Zealand rabbits and Wistar rats as animal models as part of the toxicological preclinical study. The assay was performed for 90 days in 4 animal groups of each animal species according to the NOM-062-ZOO-1999 protocols. The first group was the control treated with placebo, second group were supplemented with dose at 50 mg/kg, third group with 70 mg/kg and the fourth with 90 mg/kg using orogastric cannula twice a day. Blood chemistry, blood count and liver enzymes activities were determined before and after treatment application. Moreover, corporal mass and glycemic index were registered for each specimen twice a week. Statistical analysis of values obtained for each of determined parameters did not show significant difference between the control and supplemented groups. However, the decrease on glycemic index was observed in the case of animals that had a high glucose level in the beginning of assay. According to the corporal mass register, all specimens gained weight that is related to a normal animal growth. However, less accumulation of fat was observed in treated animals compared with the control group. These results suggest that the tested product is not toxic in animals therefore it is probably a secure nutraceutical for human ingestion. Additionally, the effect of this product on metabolic syndrome symptoms was observed. Nevertheless, chronic toxicity and teratogenicity evaluation in animal model must be performed to have all security for human consumption.

Keywords: Nutraceuticals, subchronic toxicity, nutraceuticals safety.

Evaluation of Current Food Safety Practices at Various Restaurants and Hotels in Pakistan

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Food safety as rapidly growing and serious public health concern in developing countries has diverted the focus of food safety experts, policy makers and legislators to formulate and standardize food safety legislations with proper enforcement to give access to safe, hygienic and wholesome food. Food safety system in Pakistan is facing new challenges due to rapid population growth, globalization of food trade, poor sanitation, unhygienic practices and lack of consumer awareness. The purpose of study was to assess and evaluate the current food safety practices adopted by various restaurants and food safety knowledge and awareness among food handlers. In present study cross sectional Survey of 120 restaurants and hotels of 9 towns of Lahore capital which are under jurisdiction of Punjab Food Authority were carried out in collaboration with Punjab Food Authority. Structured questionnaire was developed as per Food Code 2013 Dubai Municipality, Food Code 2013 US Public Health Services and General Guidelines of Food hygiene, Codex Alimentarius that contains detail of restaurant and hotel, management commitment, personnel hygiene, establishment design and facilities, maintenance and sanitation, control of operation and product information and control of operation. The food establishments rated against criteria set by "Food Standards Agency UK.SPSS version 16 was used for all data analysis and descriptive statistics including frequencies mean and standard deviations were calculated for all variables as appropriate. Results of this study showed that restaurants and hotels have not properly adopted food safety practices. On part of management and personnel, situation at food establishments is highly pathetic,36% restaurants needs immediate improvement,75% needs major improvement, only 2% food establishments have showed good sign. Situation of personnel hygiene is also very pathetic,17% needs immediate improvement and 26% require major improvement and no any restaurant have meet the very good criteria. 80% restaurants require immediate improvement because of their maintenance and infrastructure. 60% urgent improvement in response to control of operation. This study is quite helpful for restaurants to improve and adopt food safety practices. It has highlighted that appointment of competent and certified person in charge and food safety trainings are means of improving food safety culture. Adoption of good personnel hygiene practices, appropriate establishment design and facilities, maintenance and sanitation, strict control of operation, time and temperature control, mechanism of product traceability and recalls, strong product information and consumer awareness can be taken to curtail the risks of food borne diseases and to minimize the health consequences associated with the consumption of unsafe food in Pakistan.

Keywords: Food Safety Practices, Restaurants and Hotels, Evaluation

Inactivation of *Salmonella* and coliforms in alfalfa seeds by acetic, lactic and malic acid.

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Alfalfa sprouts are eaten raw as salad ingredient and have been linked to several foodborne outbreaks mainly associated to *Salmonella*. This pathogen may be present in seeds and it may grow during sprouting. Therefore, is necessary a disinfection treatment before the sprouting. The objective of this work was to assess the effectiveness of three organic acids on *Salmonella* and coliforms inactivation in alfalfa seeds. Seeds were inoculated by immersion in a *Salmonella* suspension by 20 min. A five-strains pool of rifampicine-resistant *Salmonella* (8.1 Log CFU/ml) was used. Inoculated seeds were dried for 24 h at room temperature. Dried seeds (10g) were exposed to acetic, lactic and malic acids (5%) during 10 min. Water treatment was used as a control. After all treatments, seeds were homogenized in phosphate buffer (PB, 0.2 M, pH 7). Before and after acids application, *Salmonella* and coliforms were quantified using tripticase soy agar added with rifampicine, and violet red bile agar, respectively. All plates were incubated at 35 °C/ 24 h. Germination efficiency (automatic irrigation for 15 min, three times per day) was determinate in 100 seeds for each treatment before and after neutralization with PB. The assay was done in three independent occasions by triplicate each one. Results were analyzed by ANOVA and Tukey HSD mean test. Treatments with acetic and lactic acid resulted in a 2.6 Log CFU/g *Salmonella* reduction; while, malic acid reduced 2.5 Log CFU/g. For coliforms, population reductions were 2.4, 2.0 and 1.8 Log CFU/g for acetic, lactic and malic acids, respectively. Germination in neutralized seeds trend to show higher rates (91 to 95%) than those not neutralized (86 to 89%). Organic acids showed similar antimicrobial effect against *Salmonella* and coliforms. Seed disinfection with organic acids may be an ecological alternative to improve alfalfa sprouts safety.

Impact of Food Safety Practices on Microbiological Indicators for Small and Very Small Pork Harvest and Not-Ready-To-Eat (NRTE) Manufacturers In Texas

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United States' meat industry members identified as small or very small are held to the same regulatory requirements as larger industry members, though often without access to advanced technologies useful for the sanitary harvest and processing of meat products. The objective of the current study was to determine the impacts of application of food safety enhancement practices on numbers of microbiological indicators for Texas-located small and very small facilities harvesting pork and/or producing not-ready-to-eat (NRTE) pork products. Five establishments were visited and microbiological indicators (aerobic bacteria [APC], coliforms, *E. coli*, and *Enterobacteriaceae*) collected from product manufacture or slaughter/dressing environment surfaces to produce a microbiological baseline analysis for each facility. Microbiological indicators were enumerated on indicator-appropriate plating media following decimal dilution preparation in 0.1% peptone diluent. Following enumeration of indicators, plants were re-visited and a food safety practices assessment was completed identifying recommended changes in animal slaughter/dressing, environmental sanitation, non-meat ingredient hygienic handling, and/or product handling procedures for each facility. Establishments were given a period of 1.0-2.0 months to implement changes recommended and then visited again for follow-up microbiological analyses. Student's t-tests were used to compare means of like samples across tested facilities to identify differences ($p < 0.05$) from the initial microbiological sampling with the follow-up microbiological sampling completed after implementation of enhanced food safety practices. There were no differences between the means of microbiological indicators from baseline analysis and post-food safety assessment follow-up testing for floors, walls, cutting knives, swabbed employee aprons, or facility drains ($p \geq 0.05$). Numbers of microbiological indicators were highest on facility floors ($5.2 \pm 1.9 \log_{10}$ CFU/cm² APC, $2.2 \pm 1.2 \log_{10}$ CFU/cm² coliforms, $1.5 \pm 1.3 \log_{10}$ CFU/cm² *E. coli*, and $2.9 \pm 1.4 \log_{10}$ CFU/cm² *Enterobacteriaceae*) and drains ($4.9 \pm 1.8 \log_{10}$ CFU/cm² APC, $2.3 \pm 0.7 \log_{10}$ CFU/cm² coliforms, $1.7 \pm 1.8 \log_{10}$ CFU/cm² *E. coli*, and $2.3 \pm 1.7 \log_{10}$ CFU/cm² *Enterobacteriaceae*), as compared to other sampling sites. Microbiological indicators have been reported useful for determining sanitary conditions in a process environment. Results from the current study indicate that in sampled facilities the implementation of enhanced food safety practices did not impact environmental microbiological loads in sampled facility sites.

Keywords: Food safety, pork processing, sanitation, microbiological indicators

Integral Program for Safety, Hygiene and Quality of Food Purchased at Permanent Establishments in the Benemérita Universidad Autónoma de Puebla (BUAP).

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The aim of this program was to provide sufficient knowledge to enable the development of expertise in the people responsible for the receipt, storage, preparation and service of food that is sold in cafeterias at the Benemérita Universidad Autónoma de Puebla (BUAP). Methods: Six cafeterias from the Architecture, Engineering, Electronics, Biology, Economics and Languages Faculties were inspected in "Ciudad Universitaria". The findings were reported and delivered to dealerships in each cafeteria in order to improve hygiene practices when handling food. In addition to this, training was given to all the food handlers of each cafeteria, such training was based on the NOM-251-SSA1-2009: Hygienic Practice for Food Processing, Beverages or Food Supplements. The course was held over two days, four hours each. This allowed improving food-processing practices that are sold in the BUAP. At the beginning and at the end of the training the basic knowledge of food safety practices were measured and evaluated. In general, food handlers had low level of knowledge on food security. However, the results of the post-training assessments showed that participants were able to gain knowledge about the receipt, storage, preparation and service of food, nevertheless it is recommended to continue with subsequent training that will strengthen the knowledge related to: food hygiene, cleaning and disinfection, as well as preparation and service.

Keywords: Food safety; Food training; Employee handling practices; Food service establishments; Hygiene

Evaluation of Antimicrobial Activity of Phenolic Compounds From *Moringa oleifera* Leaves Against *Staphylococcus aureus* and *Shigella sp.*

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Moringa oleifera is a tree native to India that possess multiple benefits for human health, attributed to its high content of bioactive compounds, mainly polyphenols, being used as a traditional medicine in treating over 300 diseases. The objective of this study was to characterize the phenolics compounds form *M. oleifera* leaves obtained by maceration and to evaluate its inhibitory effect on microbial growth of *Staphylococcus aureus* and *Shigella sp.* The hydroalcoholic extract (ethanol 70%, v/v) from *M. oleifera* leaves was prepared by maceration (36°C, 136 rpm) with a kinetic sampling each 24 h during 5 days. The analytical determinations of condensed and hydrolysable tannins were performed by the method of butanolysis and Folin-Ciocalteu respectively. The characterization of the phenolic constituents was performed by High-Performance Liquid Chromatography coupled to Mass Spectrometry (HPLC-MS). The growth inhibitory effect was tested by the disk diffusion susceptibility method (6.5mm of diameter) against two pathogenic bacterial strains transmitted by food, *Staphylococcus aureus* and *Shigella sp.* The results showed an average concentration of 178±7 mg as Procyanidin C1 Equivalent (PC1E)/100g of Dry Weight (DW) of condensed tannins and 1203±75 mg as Gallic Acid Equivalent (GAE)/100gDW of hydrolyzed tannins. Among the main compounds characterized by HPLC-MS present in the extracts of *M. oleifera* leaves include the hidroxy-caffeic acid, isoquercetin and cryptochlorogenic acid. Finally, the concentrations used (160-13.3 mg/mL) showed that the extract from leaves of *M. oleifera* presented an antimicrobial effect for *S. aureus* under all concentrations used and a minimum inhibitory concentration (MIC) of 160 mg/mL for *Shigella sp.* The results confirmed the presence of bioactive compounds in extracts from leaves of *M. oleifera* whit antimicrobial potential for control of pathogenic microorganism such as *S. aureus* and *Shigella sp.* However, further studies for the isolation of the main compounds responsible for this antimicrobial activity are still needed.

Keywords: *Moringa oleifera*, maceration, HPLC-MS, antimicrobial activity, polyphenols

Antimicrobial Activity of Plant-Based Biomolecules against Opportunistic Bacteria Identified in Apple Trees from Cuauhtémoc, Chihuahua.

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The fire blight is a disease that causes severe damage to apple trees resulting in considerable economic losses. *Erwinia amylovora* is the trigger agent of this disease; however, it has been shown that the presence of two other bacteria may be related to the damage caused to the apple tree and that they work either individually or together with *E. amylovora*. Currently, the control of fire blight has been based on the use of chemicals that are toxic to the pathogen and in turn to the surrounding medium; hence, the development of alternative treatments based on vegetable-based molecules such as eugenol and thymol, which are phenolic compounds with demonstrated antimicrobial activity. The objective of this study was the identification of bacteria associated with fire blight other than *E. amylovora*; as well as determining the bactericidal activity of eugenol and thymol against them. From pure bacterial cultures an identification method that included macroscopic and microscopic characterizations, API 20E®, and molecular characterization was performed. Using a modified version of the methodology of Cabrefiga (2007) the bactericidal activity of eugenol and thymol was determined against strains characterized in ranges of 100 to 1000 ppm, using resazurin as an indicator. Employing the bioinformatic study of the 16S ribosomal gene sequence of each bacterium, it was shown that the strains belong to the genre *Pseudomonas* and *Serratia*. For the bactericidal activity the following results were obtained: Thymol 200 ppm for *Serratia* and 600 ppm for *Pseudomonas*; Eugenol 700 ppm for *Serratia*. From these results, it can be supposed that these molecules can be the key to an alternative treatment against fire blight.

Keywords: Fire Blight, phenolic molecules, opportunistic bacteria, apple tree, antimicrobial activity.

Antimicrobial Potential of Extracts From Litchi (*Litchi Chinensis*) Husk and Seed Cultivated in Huasteca Potosina

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The litchi is an exotic fruit grown in some parts of the Huasteca Potosina, which has been reported to contain antioxidants bioactive compounds. However, until now little is known about its antimicrobial properties. The objective of this work was to evaluate the antimicrobial potential of extracts obtained by maceration from litchi husk and seed against foodborne pathogens (*Staphylococcus aureus* and *Shigella* sp.). First a physicochemical characterization of the fruit was carried out, considering parameters such as pH, °Bx and moisture of the pulp, husk and seeds. Subsequently the hydro-alcoholic extracts (ethanol 70%) of husk and seed from litchi were obtained by maceration with stirring at 180 rpm at 30 °C for 24 h. The antimicrobial assay was carried out by the disk diffusion susceptibility method (6 mm of diameter) applying different concentrations of the extracts. The results showed that after pulp, the husk represents the second part with respect to the whole fresh fruit (22±2%), followed by seed (16±0%). The antimicrobial assays revealed that both extracts from husk (6 mg total solids/mL) and seed (16 mg total solids/mL) had activity against *S. aureus* with inhibition diameters of 9±1 and 8±1 mm, respectively. On the other hand, *Shigella* sp. showed inhibition diameters of 10±2 and 7±1 mm. In conclusion, the extracts obtained from the husk and seeds from litchi provided interesting results regarding the potential antimicrobial against gram positive and Gram negative microorganisms. Then, this study suggests the use of the extracts from these wastes to develop control agents against foodborne pathogens.

Keywords: *Litchi chinensis*, Husk, Seed, Potential Antimicrobial

Recovery of Presumptive Shiga toxin-producing *Escherichia coli* from Chicken Carcasses from Retail Markets in Culiacan, Sinaloa, Mexico

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Shiga toxin-producing *Escherichia coli* (STEC) divides in *E. coli* O157 and non-O157. Both groups are zoonotic enteric pathogens associated with human gastroenteritis worldwide, ranging from diarrhea to life-threatening diseases such as hemorrhagic colitis and hemolytic uremic syndrome. *E. coli* O157 and non-O157 can be isolated from raw poultry representing a high risk to public health. The aim of the present study were to develop and optimize and isolation and enrichment procedure for the recovery of STEC O157 and non-O157 from chicken carcasses. Thirty whole chicken carcasses were purchased from various local retailers. The liquid from each package was collected and enriched in a two-step enrichment in tryptic soy broth with an incubation for 2 hours at 25 °C and then 8 hours at 42°C. The enrichments were then subjected to an immunomagnetic separation with anti-O157 beads, were plated directly on CHROMagar O157 (C-O157) selective medium and were further incubated for 18-24 hours at 37°C. Our preliminary results indicated that a total of 141 presumptive STEC isolates were recovered on C-O157 selective medium from all tested chicken carcasses samples. The presumptive STEC colonies had distinctive colors that were suspected of being STEC O157 and nonO157, the colony color appearance consisted of pink; blue with white perimeter; blue with pink perimeter; blue, white perimeter, blue halo; turquoise; bluish turquoise, swarmy; pink with blue center. Our findings indicate that the use of a two-step enrichment, followed by immunomagnetic separation, effectively recovered presumptive STEC isolates from chicken carcasses from retail markets in Culiacan, Sinaloa. Futher research might help to determine the prevalence of STEC O157 and non-O157 among, and can help to develop strategies to prevent contamination of these pathogens in food.

Keywords: STEC O157 and non-O157, poultry, public health risk

Characterization of Condensed Tannins (Procyanidins) from Litchi (*Litchi chinensis*) Husk by Thioglycolysis-HPLC-ESI-MS

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Litchi (*Litchi chinensis*) is an exotic tropical fruit widely distributed in the huasteca potosina region from Mexico. As a major byproduct of litchi fruit, the husk contains significant amount of condensed tannins with antioxidant and antimicrobial properties. However, there is not comprehensive information regarding this class of compounds from litchi husk. Therefore, the objective of this study was to characterize the condensed tannins from litchi husk by thioglycolysis-HPLC-ESI-MS. Extraction of condensed tannins from litchi was carried out using an ultrasonic bath (40 kHz transducers) during 20 min. Successive solvent extractions were performed in the following order: hexane to remove lipophilic compounds, methanol (70 %, v/v) for polar compounds and aqueous acetone (70 %, v/v) to remove the polymers of condensed tannins. Only the methanol and aqueous acetone extract were used to the analytical determinations of hydrolyzables (Folin-Ciocalteu assay) and condensed tannins (butanolysis). Condensed tannins from litchi were depolymerized by thioglycolysis prior to the HPLC-ESI-MS analysis. The results indicating that total tannins (sum of hydrolyzables and condensed) were 3.4 and 8.9 g/100 g of litchi husk for methanol and acetone extracts, respectively. Near to the 60% of the total tannins correspond to condensed tannins in both extracts. According to the thioglycolysis characterization several oxidation markers previously reported in the literature in other vegetable materials were observed. The main m/z in negative mode observed were 575, 609 and 679 in the methanol extract and, 863, 575, 609 and 593 in the aqueous acetone extract. With this we can suggest that the structure of condensed tannins in the methanol extract mainly comprised dimeric and trimeric catechin units. In contrast, in the aqueous acetone extract the nature of the condensed tannins was characterized by the presence of tetrameric and oligomeric catechin units. Besides, A-type condensed tannins were confirmed indicating a degree of oxidation in the structures. With these results a tentative structure of the tannins condensed presents in the methanol and aqueous acetone extracts from litchi husk could be elucidated.

Keywords: Procyanidins, HPLC-ESI-MS, tannin depolymerization, antioxidants, antimicrobial.

The Essential Oil of Oregano Show a Good Preventive Activity on Biofilms of *S. Aureus* Strains Isolated from Food

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Essential oils from oregano were tested against *Staphylococcus aureus* strains isolated from food to the aim of new antimicrobial strategies reducing antibiotic resistance. *S. aureus* is a serious opportunistic pathogen and biofilm of *S. aureus* are related to chronic and recurrent infections in livestock. Additionally staphylococcal food poisoning due to the productions of heat stable enterotoxins is a relevant problem in food safety. Twenty food isolates of *S. aureus* and two reference strains *S. epidermidis* RP62A and *S. aureus* ATCC 2592 were characterized by PCR for the presence of the genes *ica*, *bap*, *sas C*, *agr* involved in biofilm formation. The analysis for biofilm capability *in vitro* was performed using Safranin coloration methods. Since essential oils from several plants can act as antimicrobial the essential oil from *Origanum vulgare* subsp. *hirtum* was tested against some of the staphylococcal isolates both in planktonic and sessile forms. The analysis on biofilm capability showed that the presence or absence of genes involved in adhesion and colonization did not interfere with biofilm capability and strong biofilm producers strains were negative for some of the tested genes. This is not surprising since biofilm formation is highly dependent on nutrient broth and growth conditions *in vitro*. The same genes might play a fundamental roles *in vivo*. MIC values of 800 µg/ml were obtained for all strains in planktonic form but sub-Mic level of 100µg/ml were used to analyze the activity on biofilm formation. On a total of 5 strains one was inhibited by almost 40% but almost 70% inhibition was observed in *S. aureus* ATCC 25923 and more than 80% in food isolates. A good ability to inhibit biofilm formation at sub-MIC level and is very important in preventing biofilm formation and increasing animal health in livestock farms. The inhibition of biofilms formation of various food pathogens and food spoilage organisms by oregano essential oil could be particularly relevant also in sanitation procedure in food processing facilities, considering that oregano is an aromatic plants used for food preparation in several typical dishes since centuries.

Keywords: biofilm, *Staphylococcus aureus*, oregano essential oil, preventive strategy

Antimicrobial Activity of Peptide Acid Fraction of Honey from *Apis mellifera ssp. sicula* on *Listeria monocytogenes* Strains

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Honey is considered as food and medicine since years in different cultural settings worldwide. The broad-spectrum antimicrobial properties can probably be attributed to several factors including the acidity, osmotic effect, high sugar concentration, presence of bacteriostatic and bactericidal compounds present in the honey. To the aim of biodiversity conservation through traditional food-product valorization we tested antimicrobial property of honey from the *Apis mellifera ssp. sicula*. The Sicilian black honeybee (*Apis mellifera ssp. sicula*) is a subspecies with darker color and smaller wings of the more common honeybees (*Apis mellifera ssp. ligustica*). It has African origins, but it is more docile and productive than the African honeybees. The Sicilian subspecies risked the total extinction in the eighties due to the large diffusion of *ligustica* bee breeding in Sicily. Antimicrobial property of *sicula* bee honey were assessed on reference strains of *S. aureus*, *L. monocytogenes* and *Pseudomonas aeruginosa*. MIC analysis were performed on the following *S.aureus* strains: ATCC 6538; ATCC 25923; ATCC 29213; *P.aeruginosa* ATCC 15442 and *L.monocytogenes* ATCC 7644 were also tested. MIC values of 12.5 % (w/v) of honey were obtained for all tested strains. Additional analysis were performed using the peptide acid fraction of honey (HAF) on 7 field isolates and the reference strain ATCC 7644 of *Listeria monocytogenes*. Pathogenic strains of *L.monocytogenes* represent a serious problem in food industry because of their multiplication at 4°C and survival at -20°C. Furthermore, *L. monocytogenes* can persist in food-processing premises due to its high capacity to organize biofilm. Bacterial biofilm communities are intrinsically resistant to several antimicrobial treatments and sanitization procedures and are often involved in persistent environmental contaminations. The HAF showed MIC values of 17 µg/ml in all 7 isolates and 8.6 µg/ml in the *L.monocytogenes* reference strain ATCC 7644. The results showed a high antimicrobial activity of HAF with potential future application in food safety.

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Keywords: Honey, Antimicrobial activity, *Apis mellifera ssp.sicula*, *L. monocytogenes*

Biodiversity Conservation, Food Protection and Economy: Prion Gene Analysis for TSEs Control in Native Goats

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The conservation of endangered breeds could be achieved by establishing economic reasons for their survival such as the valorisations of their productions for both quality but also for biosecurity. Five main native goat breeds are present in Sicily (South-Italy): *Messinese*, *Girgentana*, *Argentata dell'Etna*, *Maltese* and *Rossa Mediterranea*. For biodiversity conservation the valorisation of animal products might be important for an economic impulse in marginal areas worldwide. In Sicily this process has been performed for the endangered *Girgentana* goat. This breed is characterized for high quality of milk which has an ideal balance between fat-content, protein and a low concentration of capronic and caprylic acid. Traditionally the animals were kept in the farmer's house and farmers would sell milk door to door milking the goat on the spot. Hygiene regulations led to a steep decline in the breed's numbers up to the recent period with only 1,600 heads. An association of the remaining farmers promote the production of raw-milk cheeses and yogurts boosting the farmers income and increasing the number of *Girgentana* breeders. The discovery on prion infectivity in milk raised new concerns over risks related to Transmissible Spongiform Encephalopathies (TSEs) exposure with sheep and goat dairy products. We studied the polymorphisms in the PRNP gene to evaluate the genetic resistance to TSEs in order to further valorised the safety of local dairy products. The analysis of the PRNP gene in a representative sample showed that K222 protective variant is very common in *Girgentana* (18,7%) and in *Rossa Mediterranea* goat (15%) suggesting a rapid realization of a breeding plan for TSEs resistance based on K222 protective variant for TSE-free productions. The breeding for TSEs resistance could eliminate the prion diseases in small ruminant flocks assuring biosecurity in farms and a higher biosafety of milk and dairy products. These results might be important to increase interest in the breeding of *Girgentana* and *Rossa Mediterranea* goats preserving goat biodiversity. An important economic role can be achieved through the production of "drinking-milk" of a high quality and greater safety, requested for particular food products, such as the milk for elders and infants.

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Keywords: Biodiversity Conservation, Food Protection, Economy, Prion Gene Analysis.

Conservation of Genetic Resource in Caprine Population of Algeria to Protect and Ensure the Local Food Productions

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Goats represent an important economic resource in marginal areas of the world, such as the semi-desert lands of Sahara in Algeria. The total number of goats in Algeria exceeds 3.5 million heads characterized by their great diversity and heterogeneity due to uncontrolled mixing of local populations with imported breeds. Algerian goats are hardy and adaptable to rear in difficult areas where represents a significant source of milk and meat for human consumption. The traditional breeding of goats is economically relevant representing an important source of proteins especially in Saharan populations. Algerian goat populations are located in geographically diverse areas with a predominance of the "difficult" zones (mountain area, steppe and Sahara), certain breeds are in endangered status with consequent loss of local genetic resources. In addition to a breeders infatuation for selected dairy breeds (exotic), especially the Alpine, was also described. We analyzed four main Algerian breeds: *Arbia*, *Naine de Kabylie*, *Mekatia* and *M'zabite* reared in different areas of the country. In this study, morph-biometric characteristics and genetic variation of the *PRNP* gene to prion disease genetic resistance were analysed to evaluate the potential biodiversity of Algerian native breeds to preserve local food production. The results showed a difference in phenotypic traits and a high frequency of polymorphisms in *PRNP*, suggesting a considerable genetic biodiversity of native goats in Algeria. Consumption of goat milk in Algeria is very ancient and spread all over the country. Goat farming is mainly characterized by milk production of appreciable quality. Breeding system is varied and mostly familiar with three to five local goats breed for self-consumed milk. In Algeria selective breeding practiced by farmers over the centuries has resulted in hardy breeds that are well suited to free-range grazing and able to survive and produce the most difficult and arid periods. These animals represents a significant source of milk and meat (animal proteins) for human consumption. The knowledge of genetic resources is the first step for a rational management, an improvement of the breeds and the conservation of autochthonous genetic resources to protect and ensure the local food productions to the whole population.

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Keywords: Native Algerian goats, biodiversity, food security, economy in marginal areas

A Unique Rapid Detection and Quantification Assay for Total Count of Yeasts and Molds in Dairy Products Based on Multiplex Real-Time PCR

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Ubiquitous in the environmental, foods can easily become contaminated with yeasts and molds becoming predominant spoilers, particularly in dairy products. Thus, their presence and amount are regularly monitored. Conventional methods can take ≤ 14 days. A rapid test would economically benefit the dairy industry with faster product release. Validation of the sensitivity, robustness and specificity of a lyophilized real-time PCR assay (the **foodproof**[®] *Yeast & Mold Quantification LyoKit*) for detection and quantification of yeasts and molds in dairy products. Ten different dairy sample types were diluted 1:10 and spiked with yeasts and molds at specific concentrations of $\leq 6 \times 10^3$ cfu/g. 800 μ l of homogenized sample was treated with Reagent D for live/dead cell differentiation. Live cell DNA was extracted and real-time PCR performed. Live/dead differentiation efficiency, sensitivity (DNA and cell spiked samples), specificity (inclusivity and exclusivity), and robustness were determined for the new **foodproof**[®] *Yeast and Mold Quantification LyoKit*, and compared to the classical ISO-method (ISO 6611). Genomic DNA from 15 yeast and mold species was tested with 11 replicates. 100% of replicates were positive, even at 0.39 GE in all dairy samples. All sample types spiked with 10^2 and 10^3 cfu/g *Yarrowia lipolytica*, *Aspergillus niger*, *Candida kefyr*, and *Hypopichia burtonii* showed appropriate positive signal. All samples spiked with 6000, 600, 60 and 6 cfu/g showed positive results with a deviation of < 1 ct. Thus, quantification was successful (LOD of < 10 cfu/g). Comparison to ISO 6611 showed good correlation independent of matrix type. Specificity results showed 100% success for inclusivity (290 strains from 260 species) and exclusivity testing (> 60 bacteria, plants and mammal cells). Validation of the new commercial kit showed results in > 4 hours equivalent to or better than ISO 6611 for the detection and quantification of yeasts and molds in dairy products.

Diamond V Original XPC™ Reduces *Salmonella* Prevalence, Numbers, Virulence and Antibiotic Resistance in Commercial Broilers and Turkeys

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This study was conducted to determine the effects of Diamond V Original XPC on pre-harvest *Salmonella* in commercial broiler chickens or turkeys at processing plants, including evaluation of virulence and antibiotic resistance. For commercial broilers, 82 houses from 6 different companies were monitored; 36 were fed diets that included 1.25 kg/MT Original XPC (XPC), and 46 were given the standard company feed program (CON). For commercial turkeys, 31 barns of males from 5 different companies were fed either XPC (12 barns) or CON feed (19 barns). The average broiler age was 38d and turkey males averaged 139d. One cecum was collected from 25 to 50 birds from each house (2600 total chicken samples; 1628 total turkey samples) during evisceration at commercial processing plants, and analyzed for *Salmonella* prevalence and numbers. *Salmonella* positive samples were tested for virulence and antibiotic resistance to florfenicol, enrofloxacin, and ceftiofur. All data were analyzed in SAS by species with *Salmonella* prevalence analyzed using chi-square and *Salmonella* numbers, virulence and antibiotic resistance analyzed using GLM. Broiler chicken *Salmonella* prevalence was significantly lower ($P < 0.0001$) for XPC than CON samples (7.6 vs. 23.4%, respectively). Average numbers of *Salmonella* were lower for XPC than CON (15.4 vs. 162.7 CFU/g, respectively). Virulence, as measured by cell culture invasiveness, was significantly less in XPC than CON isolates (0.16 vs. 1.05%, respectively). Antibiotic resistance for florfenicol, enrofloxacin, and ceftiofur was lowered for XPC isolates compared to CON. *Salmonella* prevalence in turkeys was reduced XPC as compared to CON (4.8 vs. 20.9%, respectively). *Salmonella* numbers were also reduced for XPC vs. CON (4.6 vs. 38.3 CFU/g, respectively). Virulence was lower in XPC than CON (0.16 vs. 1.06%, respectively). Resistance to antibiotics was lower ($P < 0.03$) for XPC compared to CON. The addition of Original XPC in the feed from 0d to market reduced cecal *Salmonella* prevalence, numbers, virulence and antibiotic resistance in commercial broiler chickens and turkeys. Results show that Original XPC is an effective pre-harvest intervention.

Keywords: XPC, *Salmonella*, Virulence, Antibiotic Resistance, Poultry

Application Of Bacteriophages To Reduce Shiga Toxin-Producing *Escherichia coli* (STEC) On Fresh Beef Surfaces

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The Shiga toxin-producing *E. coli* (STEC) are pathogens of concern associated with beef, capable of causing moderate to severe human disease, ranging from hemorrhagic colitis to hemolytic uremic syndrome (HUS). The use of organic acids, hot water washes, and other chemical antimicrobial interventions have been employed as carcass-applied interventions to reduce the prevalence of bacterial pathogens present, including the STEC. Nonetheless, exploration into other carcass decontamination technologies can provide additional tools in the arsenal of interventions for food safety protection. The objective of this study was to determine if lytic bacteriophages infective to O157 and non-O157 STEC applied to inoculated briskets were effective for reducing STEC numbers. Fatty sides of hot boned, unchilled briskets were spray-inoculated with a cocktail mixture (~8.0 log₁₀ CFU/ml) of *E. coli* serotypes O157:H7, O26:H11, O45:H2, O103:H2, O111, O121:H19, and O145. After a 30 min attachment period, inoculated briskets were treated with a phage intervention by spraying using a hand held trigger spray bottle. The intervention was allowed to dwell for 15 min, after which five 10 cm² excisions were aseptically taken before the briskets were chilled and serially diluted. Sampling of STEC survivors was completed prior to and after 24 hr chilling (5°C) for both phage-treated STEC-inoculated briskets and non-treated STEC-inoculated control briskets. The commercial phage antimicrobial containing 10⁸ PFU/ml phages was diluted to 10⁷ PFU/ml (Phage1), 10⁶ PFU/ml (Phage2), and 10⁵ PFU/ml (Phage3) solutions, and compared to treatments of 55°C H₂O and 3.5% lactic acid (LA) tempered to 55°C prior to application. The mean number of STEC attaching to the briskets was 6.9±0.3 log₁₀ CFU/cm² prior to intervention application. Mean counts of STEC post-treatment were 6.7±0.3 for 55°C H₂O treatment, 6.6±0.3 for 55°C LA, 6.8±0.5 for Phage1, 6.8±0.2 for Phage2 and 6.8±0.3 for Phage3. While chilling produced a significant reduction in STEC counts for the inoculated, non-treated control ($p=0.0125$), no differences were detected between pre-chill STEC survivors compared to post-chill STEC survivors for treated briskets. Nevertheless, phages should continue to be studied in order to fully determine their capacity to assist in beef safety protection from the STEC.

Keywords: Food safety, bacteriophages, STEC, beef

Chitosan Nanocomposites Coupled with Lysozyme: Effect of Cell Viability and Morphometry of *Aspergillus parasiticus*

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Chitosan-lysozyme (CS-LZ) nanoparticles (NP's) were elaborated by nanoprecipitation method, using commercial chitosan (CS) of 153 kDa. NP's were characterized through dynamic light scattering (DLS) to evaluate size and dispersion; furthermore, biological activity against *Aspergillus parasiticus* was evaluated through cell viability assays by XTT, morphometry and spore germination. The results evidenced the obtaining of CS-LZ NP's with a molecular size between 11.5-13.5 nm. When evaluating antifungal activity it was found that the spores developed in CS-LZ NP's amended medium showed a significant reduction in cell viability (37% of viable spores). In control media added with lysozyme, the spores showed a high viability (60-100%), whereas in CS NP's amended medium the inoculated spores showed viability between 43-55%. Regarding morphometry, *A. parasiticus* spores incubated in presence of CS-LZ complex NP's (215 µg/ml) and CS NP's showed a slight increase at 24 h, finding average diameters of 4.76 ± 0.074 and 4.90 ± 0.070 µm, respectively. The average diameters of spores grown in acetic acid and water controls showed values of 4.69 ± 0.074 and 4.59 ± 0.074 µm, respectively. It was found that both, CS-LZ complex NP's and CS NP's, presented a strong inhibitory effect against *A. parasiticus*, finding 0% of germinated spores at 24 h in both treatments, while in the controls >85% of germinated spores at 24 h were counted. Results suggest that lysozyme-chitosan complexation in NP's form is feasible to reduce the cell viability and the spore germination of fungi, which constitutes an alternative for obtaining bionanocomposites with more effective antifungal properties compared to the effect of the separated compounds.

Keywords: chitosan-lysozyme nanocomposites, cell viability, morphology

Safety in Mexican Food... Question and Paradigm.

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Mexico is a country with an ancient and almost the Perfect dietary culture that is based in maize, beans, jitomate (instead of tomato), ahuate (instead of avocado), etc., which cover the basic food requirements (carbohydrates, proteins, lipids, and vitamins). However most of Mexican people have been altered that nutrimental mixture (Mexican cuisine) that became in one of the worst food worldwide since we are the country with the first place in obesity, by the wide-ranging consumption of carbohydrates, consequently the particular health implications (diabetes and heart diseases). Besides, the safety food is a Paradigm since the nutrimental content and good preservation techniques avoid the not innocuous content, mostly added during the no proper production processes, means the application of residual pesticides and polluted water during the crops and vegetable culture, the appliance of substances to increase growth and weight in animals, including the feeding mixture (grains plus fluids and animal waste products), plus inadequate preservation processes of the products. By instance, mycotoxins on or in maize grains under storage. In spite of that, Mexican law still misses the Sustainable Policies in good nutrition, Food Safety and Biosecurity. Under this sight, we have the responsibility and right to inform to the proper Mexican authorities in order to establish the legislation as first step to recover as possible our almost lost Mexican sustainable agriculture and animal farming, besides the revalidation of the Mexican Cuisine, by instance: nixtamalized maize (great Prehispanic technique to make easier the protein assimilation and mycotoxin degradation) for hand-making tortillas. The investigation has the aim to establish the consideration to apply for an authentic Food Safety Policies by a Congress decree law, and the COFEPRIS apply it sans restrictions. The information in this abstract was achieved from scientific publications, or direct testing. ¿Why foreign Safety Polices are applied in Mexico for the food exportation?. All the best in safety requirements are for the European countries since they have a strict Health and Education Policies. Moreover, there are two challenges for the most Mexican industries: being socially responsible and clean. ¿What is Costly: Prevention or Remediation?

Keywords: Safety Food, Sustainable Policies, Mexican law

Genomic Characterization of the Virulence of *Salmonella* Saintpaul Strains from Environmental and Clinical Origin

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Salmonella's global presence is a result of its wide hosts range and its ability to survive in diverse environments, mostly because of gene regulation strategies, which may also define its degree of virulence. While the transmission of non-typhoidal salmonellosis to humans has been traditionally linked to the consumption of animal products contaminated with *Salmonella*, little is known about the contribution of non-host environments to the transmission of the pathogen. In order to survive hostile environments, *Salmonella* might experience adaptation mechanisms including metabolic changes and genomic modifications, which may promote the decline or increment of its pathogenicity. The existence of bacterial natural reservoirs may represent a decisive contribution to the transmission of the disease through the contamination of aquatic systems and food production chains. The diversity of *Salmonella* serotypes present in the environment, however, differs from those commonly related to the occurrence of non-typhoidal Salmonellosis. The assessment of the presence and/or variability of specific genetic markers involved in the virulence of *Salmonella* strains isolated from host and non-host settings, will allow to better define the role of the environment in the variation of *Salmonella*'s pathogenicity. In this study, we used a comparative genomic approach for the identification of differential pathways and regulation mechanisms involved in the virulence of *Salmonella* Saintpaul strains isolated from environmental and clinical samples. Whole genome sequences of *S.* Saintpaul strains S337 (clinical) and S05 (environmental) were obtained by NGS with the Ion Torrent PGM (Life Technologies) platform. The genome was assembled with the MIRA 3.4.0 (Bastien Chevreux) software and annotated with RAST fully automated service. The genomic sequences of six *S.* Saintpaul strains, available in the NCBI public database, were also included for more representative results. BLASTatlas (CMG-Tools) was used for mapping and visualization of whole genome homology of genes, for which *S.* Saintpaul S337 was used as the reference strain. The results show the insertion of two prophages, one mobile element, the RTX toxin and the ApaG protein, within the main differences along the genomes compared.

Keywords: Comparative genomics, virulence genes, environmental strains, *Salmonella* Saintpaul

Microbial Changes and Proteolysis during Ripening of Artisanal Chihuahua Cheese Elaborated on Different Seasons

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Production of Chihuahua cheese in Chihuahua State, Mexico traditionally had required the use of raw cow's milk; a ripening period is not necessary for this type of cheese. The aim of this work was to describe the microbial changes and proteolysis during the ripening time of artisanal Chihuahua cheese elaborated on three different seasons of the year. Blocks of raw milk cheeses were collected from five artisanal dairies (A-B) during autumn, winter and summer, and were stored at 6.5°C. Portions were taken from the freshly prepared cheese and every 30d during a ripening period of 9 months. Dynamic of coliforms, *S. aureus*, mesophilic and thermophilic lactobacilli, *Lactococcus sp.*, thermophilic cocci and *Enterococcus sp.*, were determined by plate count on the respective selective culture medium; proteolytic pattern was obtained by the SDS-PAGE technique. Microbial counts were analyzed by a repeated measurement design using ripening time as covariable, while SDS gels were analyzed using the free software Image J. Seasonal influence on microbial dynamic was observed ($P < 0.05$); highest initial counts of coliforms ($5.14 \log \text{CFU g}^{-1}$), *S. aureus* ($4.13 \log \text{CFU g}^{-1}$) and mesophilic lactobacilli ($7.86 \log \text{CFU g}^{-1}$) were detected during summer. Counts of all microorganisms increased during 60-90d, but coliform and *S. aureus* significantly decreased throughout the ripening time ($P < 0.05$). After 270d, coliform were $1.24 \log \text{CFU g}^{-1}$, while from day 90th, *S.aureus* was absent. In contrast, the prevalence of mesophilic and thermophilic lactobacilli during ripening was observed. Influence of season and factory on proteolysis pattern during maturation was detected; little peptides (5-10KDa) were observed in samples of all the cheeses elaborated on factory B and summer cheeses of factory A, but not in the other samples; on the other hand, it was observed a marked predominance of peptides between 250 and 20 KDa on cheeses from factory C as well as on winter and summer cheeses from factory D and E. Ripening time together with the particular procedures of each farm had a strong seasonal influence on microbial counts as well as on proteolysis pattern of artisanal Chihuahua cheese.

Keywords: Chihuahua cheese, ripening, seasonal influence, proteolysis

Detection of *Salmonella* in Ready-To-Eat Bagged Salads Using an Automated Testing Method

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Prepared ready-to-eat bagged salad has an increasing demand in the food market. Contamination of leafy greens by pathogenic bacteria can occur at all step w in the production chain, from a variety of sources such as water, soil, equipment, field workers and retail handlers. *Salmonella* has commonly been associated with the consumption of leafy green vegetables. Even though *Salmonella* has been connected to many outbreaks associated with the consumption of leafy greens, the prevalence of *Salmonella* is typically low. The objective of this study was to detect the presence of *Salmonella* in ready-to-eat bagged salad using a Roka Atlas system, which is an automated testing system designed to detect the target organism using rRNA identification. Two hundred forty individual 300-315 g-salad bags were collected from top retail markets in the Bryan/College Station area in Texas. The entire contents of the bag were pre-enriched in 3 L of Universal pre-enrichment broth selective for *Salmonella*, then incubated at 35°C for 12- 24 hours. Portions of the pre-enriched broth were added to Roka tubes at 12 and 24 hours and placed in the automated system for detection. Confirmation of every sample testing positive by the Roka Atlas system was required to be conducted following plating methods as described in FDA protocols, including biochemical and serological tests. However, *Salmonella* was not detected in any (0%) of the 240 samples tested. The results of this survey can be used for conducting risk assessment, especially when the pathogen is quantified in samples that test positive.

Development, optimization and evaluation of a real time PCR method for the detection of *Salmonella Gallinarum*

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Avian salmonellosis is a bacterial disease caused by a group of bacteria in the genus *Salmonella*. All species of birds are susceptible to *Salmonella* infection, and the disease is characterized by its severity and lethality during acute infectious processes. In Mexico, outbreaks and bacterial dissemination are monitored through national campaigns using an approved method (NOM-005-ZOO-1993); while at international level the World Organization for Animal Health (OIE) listed the disease as notifiable. Despite the high selectivity of the standardized methods, the time to deliver the results is longer, than the time required for the bacteria to breed and kill the host. In this situation, it has become necessary to develop, optimize and evaluate new methods, which make use of advanced techniques such as Quantitative Polymerase Chain Reaction (qPCR), that shows higher sensitivity and deliver faster results than standard methods. Furthermore, it is important to evaluate the methodologies performance to determine the validity of their results. Therefore, this research aims to develop and evaluate a methodology for qPCR to detect the etiologic agent of avian salmonellosis. Two primers “SGALf” (forward) and “SGALr” (reverse) were designed, which amplify a 147 bp fragment of the ROD9 gene with high specificity; a Taqman® probe, “SGALs”, was used for the detection of the PCR product. Subsequently, primers and probe concentration, as well as the temperature of annealing were optimized using the response surface methodology (RSM). Results show that temperature and probe concentration are significant for threshold cycle (T_c) variation, while for Δ RN, both primer and probe concentration are significant. Finally, the method was validated demonstrating that it is repeatable, reproducible and robust, with a detection limit of 10pg DNA. Moreover, it showed high selectivity for *Salmonella Gallinarum*, presenting exclusivity from 30 different serovars of *Salmonella* and one *E. coli*. These data demonstrate the development and validation of a reliable and fast qPCR method for the specific detection of *Salmonella enterica* serovar *Gallinarum*.

Keywords: PCR real time, *Salmonella Gallinarum*, evaluation.

Determination of Bacteriocin Production by Lactic Acid Bacteria Isolated from Chihuahua cheese Made in an Artesanal Way.

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Bacteriocins are a group of proteinaceous compounds produced by different bacteria. The most important bacteriocins are the ones produced by Lactic Acid Bacteria (LAB) that have antimicrobial activities against food-borne pathogens like *Listeria monocytogenes*. In this study thirty-one strains of LAB, isolated from the elaboration process of Chihuahua cheese made in an artisanal way, were tested for bacteriocin production using a screening technique (spot-on-the lawn) using two media culture: Man- Rogosa-Sharpe agar (MRS) and yeast extract-supplemented with trypticase soy agar (TSAYE); to compare the antimicrobial activity in a media with four times more glucose (MRS) in contrast with a media with low quantities of glucose respectively. The strains were spotted onto the different media and overlaid with agar TSAYE seeded with an indicator strain (*Listeria monocytogenes* and *Staphylococcus aureus*). *Lactococcus lactis* BS-10 (Chr. Hansen) was used as a positive control, as is known to produce nisin. All of the 31 strains, showed distinct inhibition zones in the MRS media against the two indicator strains, but just three of them showed antimicrobial activity against *Listeria monocytogenes* in TSAYE agar. Therefore, inhibition could be attributed to low pH due to lactic acid produced in the media with large glucose concentration. The three strains that showed inhibition with low glucose concentration will be further analyzed for bacteriocin production. They have been identified as *Lactococcus lactis*, which is a nisin producer and *Lactobacillus mudanjiangensis* that has been reported in fermented foods previously. This organism can producer of a novel bacteriocin and their presence in Chihuahua cheese can help on the control of microbial pathogens.

Keywords: bacteriocins, LAB, Chihuahua cheese

Evaluation and Enzymes Indicative of Oxidative Stress in *Fusarium verticillioides* Exposed to Antifungal Fraction *Jacquinia macrocarpa*.

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A *Jacquinia macrocarpa* antifungal fraction has shown ability to inhibit the development of the pathogenic fungus *Fusarium verticillioides*, which is the main fungus that affects corn during its culture. The aim of this work was to evaluate the induction and accumulation of reactive oxygen species (ROS) and the activity of the enzymes responsible for detoxification of ROS, superoxide dismutase (SOD) and catalase (CAT), and their relationship with the viability of *F. verticillioides* exposed to the *J. macrocarpa* antifungal fraction. ROS production was evaluated using dichlorofluorescein diacetate (DCFH-DA). CAT activity was determined by disappearance of H₂O₂ observed at 240 nm, whereas SOD was determined by inhibition of nitroblue tetrazolium (NBT) reduction. Spore viability was assessed using 2,3-Bis-(2-Methoxy-4-Nitro-5-Sulfophenyl)-2*H*-Tetrazolium-5-Carboxanilide (XTT). Concentrations of 1.0 and 5.0 mg mL⁻¹ of the *J. macrocarpa* fraction induced intracellular ROS production up to 136 % and 180 %, respectively, during 70 min of exposure. That result indicated that there was an accumulation of O⁻² and H₂O₂. CAT activity decreased in the presence of different concentrations of *J. macrocarpa*, being 1.25 mg mL⁻¹ the highest concentration that inhibited the enzyme activity almost completely. In contrast, SOD activity was not affected by different concentrations of *J. macrocarpa*. The fungus viability decreased with increases of *J. macrocarpa* concentration, causing almost 50 % loss in viability at a concentration of 5 mg mL⁻¹. *J. macrocarpa* fraction induced the production and accumulation of intracellular ROS. Aside of that, this antifungal fraction also inhibited the activity of CAT, which possibly caused the accumulation of ROS affecting the viability of *F. verticillioides*. This study is important to understand the mechanisms of action of plant extracts and develop safe antifungal preparations to be used during the development of corn in the field.

Keywords: Extract plant, *Fusarium verticillioides*, activity enzymes, ROS

Growth of *Salmonella* and *Escherichia coli* on Sprouts and Microgreens Using Alfalfa Seeds.

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Microgreens and sprouts are produce items that have similar characteristics such as nutritional and flavor value. Although they possess similar characteristics both require different conditions for development. Some concerns have risen in determining whether there is truly any difference between the two products. While sprouts have been repeatedly connected in numerous of food-borne disease outbreaks, and have become restricted to federal regulations, no food safety incidents linked to microgreens have been reported to date. In addition, reports about food safety aspects of microgreens are very limited. The objective of this study was to determine possible differences in the accumulation of pathogenic bacteria on sprouts vs. microgreens, and to measure the behavior of *Salmonella* and *E. coli* at the time of harvesting on microgreens and sprouts. Alfalfa seeds were inoculated with a cocktail of *Salmonella* and *E. coli* strains, and then planted on soil mixture for microgreens and a jar containing with water for sprouts. Microgreens were harvested an inch above soil surface on day 14 and sprouts were harvested on day 5 after germination. Harvested samples were serially diluted and plated on Lactose Sulfur Phenol Red Rifampicin agar (LSPR). The results indicated total counts of pathogenic bacteria were 7.3-log cfu/g for microgreens and 8.5 log cfu/g for sprouts. When enumerated separately there was no difference in the populations of *Salmonella* and *E. coli* on microgreens however, sprouts contained less pathogenic *E. coli* (7.5 log cfu/g) compared to *Salmonella* (8.5 log cfu/g). Higher counts of pathogenic bacteria were found on sprouts vs. microgreens could mostly be due to high humidity and warm temperature during growth. The findings also suggest that *Salmonella* and *E. coli* grew equally on microgreens but as for sprouts *Salmonella* proliferated better under conditions used for sprouts than *E. coli*.

Persistence of Fecal Indicator Bacteria and *Bacteroidales* Universal Marker on Two Different Texture Surfaces.

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Food borne outbreaks related with consumption of contaminated produce are increasing over time. As regular practice to reduce the risk of contamination, microbial quality of produce must be measured, been fecal indicator bacteria (such as coliforms, *Enterococcus* spp. and *Escherichia coli*) usually quantifying. However since these bacteria are present in almost all animals, the source of the contamination is no clarified. Recently, some groups of microorganisms have been emerging as key-points for the determination of microbial source tracking (MST). Members of *Bacteroidales* have been recognized be host-specific, representing promissory options for it. However at present, very few reports are about persistence of *Bacteroidales*, and most of them, only have been studied in water. Due to this, the determination of the persistence of the universal marker AllBac (present in all *Bacteroidales*) and traditional fecal indicators (*Enterococcus faecalis* and *E. coli*), on two different-texture surfaces was analyzed. Pools of sterile human and dog feces independently were inoculated with *E. faecalis* ATCC 19433 (5.3×10^8), *E. coli* ATCC 25922 (1.8×10^{10}) and *Bacteroides thetaiotamicron* (3.4×10^9). Aliquots were placed onto 47 mm Millipore filters (smooth surface) and 47 mm by 2 mm width flat cork (rough surface). Samples were maintained in a bioclimatic chamber at 25°C and 95% RH by fifteen days. Each five days samples were washed, and plated onto selective agars (*Streptococcus* KF and Rapid *E. coli* 2) and presence of AllBac marker was analyzed by PCR using SensiFAST™ SYBR®. *E. faecalis*, *E. coli* and the AllBac marker were detected in all samples analyzed (filter and cork). The results suggest that texture of surfaces seems not to be an important issue for bacteria persistence.

Keywords: *Bacteroidales*, *E. faecalis*, *E. coli*, persistence, MST.

Evaluation of antimicrobial activity of polyphenolic compounds against three pathotypes of *E. coli*

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Use of natural compounds with the purpose of increase product shelf life had been widely adopted in recent years. Some phenolic compounds have been reported as good alternatives of it, replacing chemical preservatives due to their high antimicrobial activity. The objective of this study was to evaluate the activity of polyphenolic compounds (tannic acid, gallic acid, methyl gallate and epigallocatechin gallate) on growth and biofilm formation of three pathotypes of *E. coli* (enteropathogenic, enterohaemorrhagic, and enterotoxigenic) and their antioxidant capacity. Preliminary antimicrobial assays were performed using the agar well diffusion technique. Minimum bactericidal concentrations (MBCs) of polyphenols were evaluated by a microdilution method. The biofilm formation index (BFI) and the antioxidant capacity was measured by spectrophotometric methods (Trolox antioxidant capacity [TEAC] and radical DPPH). Results showed that methyl gallate was able to inhibit all the strains tested, showing inhibition halos from 8 to 14 mm. The MBCs for tannic acid, gallic acid, methyl gallate and epigallocatechin gallate were 1.5, 2.2, 1.12 and 0.64 mg/ml, respectively. All polyphenols compounds inhibited biofilm formation at lower concentrations of the MBCs (75%). No significant differences were observed on the antioxidant capacity of gallic acid and methyl gallate (75.27 and 77.17% inhibition of radical DPPH respectively). Results showed that polyphenolic compounds arbor a high antioxidant and antimicrobial activities; however is necessary more research about it, to be use as food preservatives.

Keywords: *E. coli*, pathotypes, antimicrobial activity, polyphenols.

Evaluation of UV-C radiation and natural antimicrobials (thymol and carvacrol) on *Salmonella* spp. biofilm formation in stainless steel surfaces

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Many outbreaks have been found to be associated with biofilm. It is well documented that biofilm has become a problem in food industries as it renders its inhabitant's resistant to antimicrobial agents and cleaning. The aim of the research was to evaluate the effect of UV-C radiation and thymol and carvacrol on *Salmonella* spp. biofilm formation in stainless steels surfaces. *Salmonella* biofilm formation and minimum inhibitory concentration (MIC) of each antimicrobial were determined. Then UV-C radiation was applied (60 seconds at 0.68 kJ/m² dose) and then one half of MIC values were applied. MIC values for thymol and carvacrol were 250 and 500 mg/L respectively, a 3 log reduction were achieved with both antimicrobials and UV-C light. Natural antimicrobials and UV-C radiation have demonstrated the ability to have effect on inhibit *Salmonella* spp. biofilm formation.

Microbiological Quality of Slices of Ham Treated with Seed Extract Citrus Vacuum Packed and Refrigerated

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Many of the health problems of packaged meat products occur because of poor hygiene practices of workers, a situation that promotes the growth of microorganisms, with reduced health quality and shelf life of these products. With this approach exist in the market different substances that help in the sanitary control of meat products, among which the use of derivatives citrus. In this paper was evaluated the effect of adding a seed extract of citrus in the sanitary quality of ham slices of rabbit meat packed with or without vacuum, in terms of total coliforms in plate, total aerobic bacteria (TAB) was evaluated and lactic acid bacteria (LAB). Six treatments were applied in slices 1 and 2 "witness" without antimicrobial, packed with and without vacuum respectively; 3 and 4 with 0.01% of seed extract citrus and packaged with and without vacuum; 5 and 6 with 0.02% of seed extract citrus and with and without vacuum packaged respectively. All lots were stored refrigerated at 4° C. Microbiological testing samples packaged with and without vacuum at baseline and after 1 and 7 days were conducted. Color profile parameters (CPP) with a Minolta CR-300 and pH with an Orion Five Star were evaluated. The results were analyzed with Desig Expert 8.0.4, by analysis of variance (ANOVA), which was included factor analysis to establish the pH and CPP changes ($P < 0.05$). The product packaging without vacuum showed a reduction of 1.76 log CFU/g of total coliforms and 0.15 log CFU/g of TAB with 0.01% antimicrobial added. The vacuum packaging combined with 0.02% of antimicrobial and refrigerated storage at 4 ° C, are the barriers and conditions that maintain the highest health status kept slices of ham rabbit meat absence of LAB and TAB, as well as the decrease of total coliforms.

Keywords: slices ham, seed extract citrus, vacuum packaged, microbiological quality

Determination of Aflatoxins Presence in Spices Used in the Elaboration of Meat Products

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Aflatoxins are considered as one of the most important natural contaminants in food due to the presence of these in plant products such as grains and spices. Likewise, they represent a common source of contaminants in meat products, these can get contaminated indirectly through additives and spices used in their preparation, or directly with fungi of the genus *Aspergillus flavus* and *Aspergillus parasiticus*. The aim of this study was to determine the amount of total aflatoxins in spices used in the production of meat products, this becomes relevant if we consider that there are few previous studies that report the degree of contamination of different raw materials. The samples were obtained from different food processing plants, these were corn starch, potato starch, garlic powder, onion powder, chili guajillo powder, cinnamon, peanut paste, paprika and textured soy. The determination of aflatoxin was performed using the kit of Neogen® Verator aflatoxin. According to the results, 75% of the samples tested positive for total aflatoxins (AT), of which the sample with the highest number of aflatoxin was cinnamon powder with a concentration of 52.71 µg/kg, followed by paprika 26.06 µg/kg; the guajillo powder, garlic powder, onion powder, peanut and potato starch showed concentrations of 4.24, 2.05, 1.61, 1.57 and 2.75 µg/kg respectively, in samples such as cornstarch and soy texturized the aT results they were negative. Mexican law tolerates a maximum of 20 µg/kg in food for human consumption, demonstrating that some products are over this limit, however in at least 29 countries, the maximum permissible limit is 2 µg/kg. This study demonstrates that some feedstocks commonly used for the formulation of meat products, were subjected to contamination through meat processing, which represents a potential risk to public health.

Keywords: aflatoxins, spices, meat products.

Survey of *Salmonella* in Retail Meat Markets in Cancun, Merida, and Veracruz, Mexico

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The purpose of this study was to create a baseline for the prevalence of *Salmonella* in beef products sold in meat markets in Mexico. Thirty whole-beef samples were collected per season (summer, spring, fall, and winter) in each of three Mexican cities – Cancun, Merida, and Veracruz. The stores visited in Cancun and Merida procured beef from non-federally inspected facilities (non-TIF), whereas the stores in Veracruz obtain beef from a single TIF facility. All meat samples were manually swabbed with a pre-moist EZ Reach® sponge. Swab samples were enriched in tryptic soy broth and incubated overnight at 37 °C. Enrichments were subjected to BAX® PCR platform and to selective enrichment and isolation, if positive. Presumptive confirmation of culture-positives was done via latex agglutination. Chi square or Fisher's Exact Test were conducted on SAS v 9.4, with a 5% level of significance. Samples collected during the summer were more frequently contaminated than in any other season. Significantly lower prevalence was observed in Veracruz (38.0%) versus Cancun and Merida (100.0 and 88.0%, respectively). During fall and winter, *Salmonella* was significantly less frequent than in summer, regardless of the city. Values in Cancun and Merida ranged from 20.0 to 45.2% in those seasons, whereas in Veracruz, the prevalence was significantly lower than in other cities during the same period, 12.0 and 2.1 % in fall and winter, respectively. The frequency of *Salmonella* isolation had a second peak during springtime. Values varied from 92.0 to 100.0% in Cancun and Merida, but were significantly lower in Veracruz (24.0%). These results demonstrate that the prevalence of *Salmonella* in retail beef in Mexico is extremely high, particularly in summer and spring. Furthermore, *Salmonella* in meat procured from TIF facilities is significantly less prevalent than that obtained from non-TIF facilities. Urgent sanitation and educational interventions at the meat processing and retail settings are needed to improve food safety and protect public health.

Keywords: *Salmonella*, Mexico, retail, beef

Effect of Gastrointestinal Fluids on Gold Nanoparticles Agglomeration State

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The increasing interest in nanofood has led to great excitement about potential benefits but also concern over the potential for adverse human health effects. The gastrointestinal tract represents a likely route of entry for many nanomaterials, both directly through intentional ingestion or indirectly via nanoparticle dissolution from food containers or by secondary ingestion of inhaled particles. The gastrointestinal tract is a site of complex, symbiotic interactions between host cells and the resident microbiome. Moreover, when evidence is provided convincingly demonstrating, by appropriate analytical methods, that nanofood completely dissolves/degrades in the gastrointestinal tract, the hazard identification and hazard characterization can rely on data for the non nanoform substance (if available) as long as the possibility of nanofood absorption before the dissolution/degradation stage can be excluded. We studied the behavior of agglomeration state Gold nanoparticles (AuNP's) in the gastrointestinal tract environments. *Green synthesis of AuNP's*: We used ascorbic acid (reducing agent), tetrachloride gold (III) in aqueous media and pectin polymer as stabilizing agent. The size particle was evaluated by Transmission Electron Microscopy (TEM) and UV-VIS spectroscopy (size 25-40 nm). Gastrointestinal environments: Pharmacopoeias media for dissolution method for solid dosage forms were used. Gastric and intestinal media were used with and without enzymes and specific pH. United States Pharmacopeia (USP): *Gastric* pH 1.2 and pepsin enzyme. *Intestinal*: pH 6.8 and pancreatic enzyme. European Medicine Agency (EMA): *Gastric* pH 1.2 and pepsin enzyme. *Intestinal*: pH 6.8 and pancreatic enzyme. Mexico Pharmacopoeia (FEUM): *Gastric* pH 1.2-2.0, pepsin enzyme. *Intestinal*: pH 6.8 and pancreatic enzyme. Patented media of ARIS (Automatic Robotic Intestinal System): *Gastric* pH 2-2.5 and enzyme cocktail. *Intestinal* 5.5-5.5 and enzyme cocktail. The agglomeration state was evaluated by UV-VIS spectroscopy and Transmission Electron Microscopy in all media. Statical analysis: All experiments were independently repeated at least three times. Statics were determined by ANOVA. No significant differences were observed between gastric and intestinal media without enzyme. However, the presence of enzyme in intestinal media (in all cases) impact on the AuNPs agglomeration state. TEM images suggest agglomeration state and UV-VIS absorption band moving between 535-648 nm ranges suggesting agglomeration matter. Adequate characterization of NanoFood is essential for establishing it's identify and physico-chemical forms in food/feed products and under testing conditions.

Keywords: NanoFood, Gold Nanoparticles, Gastrointestinal media, ARIS.

Visible “Soil” as a Bacterial Concentration Indicator on Farmworkers Hands in Northern Mexico

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Effective hand hygiene techniques for farmworkers are necessary to reduce hand to produce microbial contamination and produce-associated illness. Anecdotally, visible “soil” on worker hands has been assumed to be an indicator of hand contamination, including microbial contamination. To address this assumption, the goal of this project was to determine if, on farmworker hands, visible “soil” on farmworker hands was associated with microbial load. 181 farmworkers were asked to wash their hands to standardize hand microbial loads. Workers were then asked to harvest tomatoes without gloves for 30 minutes, practice hand hygiene (e.g. hand wash, hand sanitizers) and then rinse their hands in 0.1% peptone solution. The solutions were analyzed for Absorbance_{600nm} (turbidity) and microbial load (*Enterococcus spp.*, coliforms and *E. coli*). Hands were photographed after rinsing and assigned a “Hand Score” based on visible soil on the palm, soil on the finger pads, soil under the fingernails, multicolored soil, and total soil by two independent reviewers. Hands ranged in Absorbance_{600nm} (0.175 ± 0.19 SD), Hand Score (3.9 ± 1.8 SD), log₁₀ *E. coli* CFU/hand (1.40 ± 0.73 SD), log₁₀ Enterococcus (3.84 ± 1.58 SD), and log₁₀ coliforms (2.61 ± 1.59 SD). Using Spearman’s correlation tests, Absorbance and Hand Score were significantly correlated ($\rho=0.540$, $p<0.001$). In contrast, Hand Score and concentrations of *E. coli* ($\rho=0.025$, p 0.826) and coliforms ($\rho=-0.089$, p 0.440) were not significantly correlated. Hand Score and concentrations of *Enterococcus* ($\rho=0.273$, p 0.015) were significantly weakly correlated. Our results suggest that while visible hand “soil” is a good proxy for hand rinse turbidity, visible “soil” is not an indicator of microbial load for all microorganisms on farmworker hands. Thus, farm workers or managers cannot depend on visual “cleanliness” to assess their hands’ microbiological “cleanliness”, including when using hand hygiene methods.

Keywords: Foodborne disease; Hand hygiene; Farmworker; Soil

Evaluation of Cleaning and Disinfection Practices Related to the Presence of Bacteria in Six Butcheries of Xochimilco, Mexico

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Approximately 1.8 million people die annually due to ingestion of contaminated food. The way the meat is handled in butchereries threatening consumer health because it facilitates the presence of pathogenic microorganisms. Analyze the presence of bacteria serves as an indicator of the hygienic conditions of a product. The aim of this study was to evaluate the efficiency of cleaning and disinfection, and bacterial load on work surfaces, knives and raw pork from six butchereries. Cleaning and disinfecting of floors, refrigerators, utensils, walls, dishcloths, aprons, coveralls, boots and hands dispatchers was evaluated, considering the level of cleanliness, proper use of detergent and disinfectant. Assessments were made based on the method of "Sinner Circle". Two samples were taken by swabbing, a work surface, utensil, and meat (100 g) before and after applying cleaning and disinfection. the presence of *E. coli* and *Salmonellae* was determined. All butchereries showed best scores for cleaning of floors (grades 7 to 10), while the lowest scores were for cleaning boots and aprons walls that remained between 2 and 3 points. The cleaning of utensils and dishcloths were intermediate (2.5 – 6 points) except for one butchery which scored lower values. However, the level of cleanliness was low in four butchereries (3.5 - 5) while only two earned scores above 6. The overall evaluation of each butchery showed that the level of cleaning and disinfection was low (3.8 – 5 points) so it is necessary that operators were trained in that items. Poor use of detergents and disinfectants especially applied to walls, dishcloths, aprons and boots was detected. All butchereries showed the presence of *E. coli* on surfaces and knives, below the allowed limit, this indicated deficiencies in cleaning and disinfection. However, after applying cleaning and disinfecting values decreased to levels below 50 CFU g⁻¹. In the case of *Salmonella* only three butcher shops were positive, prior to cleaning and disinfection, after all it was absent. Hygienic practices in butcher shops were not efficient and did not eliminate the presence of *E. coli*, although counts were below the limits allowed while they were effective in reducing *Salmonella*.

Keywords: GMP, Meat hygiene, Hygiene evaluation, Food borne pathogens

Incidence and Behavior of *Salmonella* spp. in Low Water Activity Food Items

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In recent years, salmonellosis outbreaks related to the consumption of low water activity food items such as peanuts, almonds, pistachios and chocolate have been reported. In Mexico most of these products are sold in bulk, making them more suitable for contamination with foodborne pathogens; unfortunately, there is a lack of information regarding the safety of this type of food. The purpose of this investigation was to determine the incidence and behavior of *Salmonella* in low water activity food items. Samples of peanuts (70), pecans (70), raisins (70), sun-dried tomatoes (70) and chocolate chips (70) sold in bulk were collected in city markets. The presence of *Salmonella* spp. was determined by BAM/FDA methods and Official Mexican Methods. The behavior of *Salmonella* spp. in peanuts, raisins and sun-dried tomatoes was evaluated. Samples (1,500 g) of each product were spray-inoculated with two different *Salmonella* rifampicin resistant (200 ppm) strain cocktails: cocktail A (reference strains) consisted of five ATCC *Salmonella* strains; cocktail B (native strains) consisted of five *Salmonella* strains isolated from each product (peanuts, raisins or sun-dried tomatoes) during the incidence study. After the inoculation, samples were dried in the hood and stored at room temperature (~27°C). Periodically, the population of *Salmonella* in each product was determined by surface plating in tryptic soy agar supplemented with rifampicin (200 ppm); plates were incubated at 35°C during 24 h. Death rate was calculated using the DMFit v.2.0. program (www.combase.cc). *Salmonella* spp. was detected at high levels in peanuts (31%), pecans (40%), raisins (30%), sun-dried tomato (56%), and chocolate chips (26%). The pathogen survived in peanuts for up to 70 days, whereas it decreased in raisins and sun-dried tomatoes after six and five days, respectively. In general, *Salmonella* died faster in the products that were inoculated with the reference strains than the native strains cocktail. These findings highlight the risk at which consumers are exposed, and the necessity of implementing strategies to control the presence of foodborne pathogens in low water activity food.

Keywords: low water activity food, raisins, peanuts, sun-dried tomato, *Salmonella*.

So Many to Train, So Little Time: USDA and FDA, Partners in FSMA Training for Small Producers and Processors

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In January 2011, President Obama signed into law the Food and Drug Administration Food Safety Modernization Act (FSMA). The FDA proposed several major authorities and mandates to implement the Food Safety Modernization Act. The mandates focus on Prevention, Inspection and Compliance, Response, Imports, and Enhanced Partnerships. These mandates shift the focus of Food Safety regulation from responding to contamination to prevention across the US and abroad. In order to fulfill these mandates, FDA partnered with the US Department of Agriculture, National Institute of Food and Agriculture to establish a National Training, Education, Outreach and Technical Assistance infrastructure. Through this partnership, a competitive grants program was developed in 2015 to establish National and Regional Centers to deliver education, training, outreach and technical assistance guidance to owners and operators of small to mid-sized farms, beginning farmers, small processors or small fresh fruit and vegetable merchant wholesalers. Due to this initial year of success the program, Food Safety Outreach Program, was expanded in 2016 to include opportunities for smaller grants to ensure funds for training and education were available at the local, state and county, level for producers and processors impacted by FSMA both directly and indirectly. In addition to FSMA's domestic mandates, there are policies that will significantly impact US food imports including the Food Supplier Verification Program. To reduce the disruption of imported products from many countries, training, education, outreach, and technical assistance will be necessary. This session will highlight a successful model for developing a food safety education and training program established through US Federal competitive grant funds that encourages partnerships with Federal agencies, Universities, Cooperative Extension, State and Local Government, and Non-Governmental and community based organizations to provide training, education, and outreach to small and mid-sized producers and processors. An overview of the programmatic logistics from inception to current and the programs successes impacts and outcomes will be provided in great detail.

Antioxidant Activity and Antimicrobial effect of *Tagetes lucida cav* (Yerbaniz) against *E. coli*, *S. aureus*, *Klebsiella spp.* and *Salmonella spp.*

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The aim of this study was to extract secondary metabolites of *Tagetes lucida cav* (Yerbaniz), and demonstrate the biological potential of these compounds. leaves, stems and petals was used, an aqueous extraction was performed 1:5 m/v at 60 °C., the extract was filter with membranes #1, subsequently the extract was subjected to separation by adsorption affinity columns for get total polyphenols. The biological activity was evident to antioxidant activity was determined by DPPH, ABTS and FRAP methods. The antibacterial activity for *S. aureus*, *E. coli*, *Klebsiella spp* and *Salmonella spp* was determined by the Kirby-Bauer agar diffusion method. It was obtained in yield of 3.22 g for each 200 g of sample equivalent to 1.61%. For determination of Medium Inhibitory Concentration (IC₅₀) by DPPH, ABTS and FRAP method *Tagetes lucida* reached the IC₅₀ (Medium Inhibitory Concentration) at 700 ppm, 550 ppm and 600 ppm respectively. For antibacterial activity the bioactive compounds exert inhibition against 4 bacteria evaluated, the zone of inhibition for *S. aureus* oscillated between 9.4-15.2 mm, for *E. coli* was to 8.6-16.8 mm, while for *Klebsiella spp* and *Salmonella spp* the diameter of inhibition was of 10-18.8 mm and 10-17.4 respectively. Therefore it concludes that secondary metabolites of *Tagetes lucida cav* have high biological activity regarding the antiradical activity (DPPH, ABTS, FRAP) and antimicrobial activity against bacteria evaluated. This could indicate that *Tagetes lucida cav* can play an important role in different fields of food industry, as the Food Preservation and Conservation, development of functional foods and food safety.

Keywords: *Tagetes lucida cav*, Secondary metabolites, bioactive compounds

Antimicrobial Resistance of *Salmonella* Isolates Recovered from Beef Cattle in Mexico and Honduras

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Salmonella is a leading cause of bacterial gastroenteritis around the world and worrisomely, the number of antibiotic resistant strains identified in humans is steadily increasing worldwide. The main objective of this study was to determine the antimicrobial susceptibility profiles among *Salmonella* isolates recovered from beef cattle in Mexico and Honduras. *Salmonella* isolates had been previously recovered from retail beef samples collected from different wet markets at the two countries. *Salmonella* isolates were grown on blood agar and incubated at 35 °C for 24 h before testing with the Sensititre™ automated antimicrobial susceptibility system. The minimum inhibitory concentrations (MICs) 15 clinical antimicrobials were estimated using the Clinical and Laboratory Standards Institute interpretative criteria for a microbroth dilution method. Recovered isolates were subjected to the National Antimicrobial Resistance Monitoring System protocol utilizing the SWIN software. Multiple comparison tests using Prism 6 GraphPad Software were performed for the statistical analysis. From a total of 60 samples analyzed (Mex, n=30, Hon, n=30), Mex and Hon presented 77% resistance to at least one antimicrobial. Additionally, isolates exhibited 14 different resistance phenotypes, in which for Mex predominated resistance to tetracycline 83%, streptomycin 67% and chloramphenicol 60%, and for Hon isolates presented the higher resistance of 50% to both penicillin and B-lactam. Furthermore, Mex (58%) and Hon (65%) displayed multidrug-resistant (MDR) phenotypes. There was not a significant difference between the resistance profiles in Mex comparing with Hon as determined by two-way ANOVA ($P < 0.05$). These results indicated that there is a high incidence of antibiotic resistant *Salmonella* in retail beef that may be spread throughout the meat chain in these two markets. Further investigations are required to understand their origin and public health implications. Increasing awareness of adequate antibiotics used in animal production is necessary as well as interventions to mitigate the transfer of *Salmonella* resistant strains in the food chain.

Keywords: Antimicrobial resistance, antibiotics, *Salmonella*, beef, México, Honduras.

Risk assessment of dietary exposures to aflatoxin for *tortilla* corn consumption in Veracruz city

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Human exposure to mycotoxins is a public health issue worldwide. Although international variations in diet and cancer indicate that diet is an important risk factor for many cancers, it has been difficult to ascribe a clear role in cancer causation to exposure to specific individual chemicals or mixtures of chemicals, only alcohol intake and food contaminated with aflatoxins have been documented as risk factors in humans. Since aflatoxins are classified as carcinogenic and genotoxic contaminants, the ALARA (As Low As Reasonable Achievable) approach is recommended. Based on JECFA and SCF reports, even a very low exposure level to aflatoxins ($1 \text{ ng kg}^{-1} \text{ bw day}^{-1}$) may induce liver cancer cases. The aim of this study was to assess the probabilistic risk of mycotoxin ingesting for corn tortilla consumer in Veracruz. One hundred twenty samples of tortilla corn were randomly collected in 3 season: October 2013, October 2014, and February 2015 to estimate the intake of aflatoxin in Veracruz City, México. The quantification of aflatoxin was performed by high-performance liquid chromatography with fluorescence detection and electrochemical derivatization. Tortilla corn consumption was evaluated in the population of Veracruz City through dietary intake questionnaires. A daily consumption questionnaire was used to determine the consumption of corn *tortillas*. Descriptive statistics and Probability Density Functions (PDF) of the daily consumption were determined and analyzed using @Risk6 (Palisade, Inc.). Descriptive statistics of daily consumption include the mean, median, standard deviation and the 95th percentile. Furthermore, PDF for aflatoxin concentration, body weight and consumption of the inhabitants of Veracruz City were generated. Calculation of PDF is based in the Monte Carlo simulation method with 10,000 iterations. The estimated daily intake PDF led to a mean of $3.24 \text{ ng kg}^{-1} \text{ bw day}^{-1}$ with a standard deviation 4.40 and a 95th percentile of $11.47 \text{ ng kg}^{-1} \text{ bw day}^{-1}$ for October 2013 (season with the higher contamination), this represent a risk of 69.7 % based on JECFA data ($1 \text{ ng kg}^{-1} \text{ bw day}^{-1}$).

Keywords: Aflatoxin, Risk assessment, Monte Carlo, Probability density function

Lard Quality Based on Origin and Anatomic Region in the Swine Carcass

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Typical Mexican cuisine, such as carnitas, relies heavily on fat for its elaboration; therefore, a study of the quality of the lard that would normally be used in these dishes is of importance. The objective was to determine the characteristics of the lard produced from two feeding sources (tallow and canola oil) and from two different anatomical regions (intraabdominal fat and backfat); considering these as the principal factors in a CRD with a factorial arrangement. Data were analyzed with Proc GLM of SAS®. Samples (500 g) were taken from experimental pigs from the cross (Duroc x Landrace) x Large White (54 pigs fed with tallow and 54 with canola oil, with 106.5 kg and SEM=1.82). The fats were rendered for the production of the lard. The lipid profile composition was different between backfat from different feeding sources: 18:1 (Tallow=45.77 vs Oil=48.02, SEM=0.557), 18:2 (Tallow=11.36 vs Oil=13.56, SEM=0.673), 18:3 (Tallow=0.59 vs Oil=1.29, SEM=0.091) and 20:4 (only in Oil=1.00, SEM=0.026). The peroxides value was higher in the lard from animals fed with Tallow (2.29 vs 2.12 meq peroxides/kg, SEM= 0.050, $P < 0.02$), while the thiobarbituric acid reactive substances was higher in the animals fed with Oil (2.05 vs 2.48 mg MDA/kg, SEM= 0.050, $P < 0.0001$). The determination of both parameters could better explain the oxidative stability of the fat; however both techniques are sensitive to the interference of other compounds and may be muddled by other factors such as time and antioxidants. The acidity ($P < 0.01$), the percentage of free fatty acids (% Oleic acid, $P < 0.01$), and the melting point ($P < 0.0001$) were significant and expected according to the anatomical region of the animal. The feeding source only influenced in the melting point of the lard (Tallow=43.45 vs Oil= 42.19 °C, $P < 0.0001$). The lards produced, at least in quality parameters, only differ in their lipid profile, and the oxidative stability could probably be modified during the frying process.

Keywords: lard, carcass, quality, fat, swine

Oxidative Stability from Two Qualities of Lard during Heating with Pro-oxidative Factors

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The objective was to determine the quality and the oxidative stability of lard with two different lipid profiles in combination with heating and pro-oxidative factors (salt and acidity). Lard produced from the backfat of pigs from the commercial cross fed with either tallow or canola oil was used. The conditions of heating (95°C in stainless steel vessels) were used. The quality and oxidative stability determinations were done every 30 minutes of heating until a total of 90 min (4 times) within a CRD and the following were considered factors: origin of the lard (Tallow and Oil), use of NaCl (0.8 and 3.2%) and citric acid (0.08 and 0.32%), in a factorial arrangement (Proc Mixed and GLM, SAS®). During the lard heating process, differences in acidity (T0= 0.69, T30= 0.75, T60= 0.77 and T90= 0.81, SEM=0.013), free fatty acids FFA (T0= 0.35, T30= 0.38, T60= 0.39 and T90= 0.41 % Oleic Acid, SEM=0.006), peroxides (T0= 2.29, T30= 3.74, T60= 5.71 and T90= 8.70 meq peroxides/kg, SEM=0.410) and thiobarbituric acid reactive substances TBARS (T0= 2.13, T30= 2.23, T60= 2.37 and T90= 2.31mg MDA/kg) in function of time (P<0.0001) were found. The origin of the backfat (Tallow and oil, respectively) during the test showed differences (P<0.017) for acidity (0.73 vs 0.77. SEM= 0.009), FFA (0.37 vs 0.39 % Oleic Acid, SEM= 0.005) and TBARS (1.86 vs 2.69 mg MDA/kg, SEM=0.042). The use of NaCl affected (P<0.001) the value of peroxides (0.8%=4.18 vs 3.2%=6.07 meq peroxides/kg, SEM=0.360) and TBARS (0.8%= 2.18 vs 3.2%= 2.37 mg MDA/kg, SEM=0.043). The effect of the citric acid (0.08 and 0.32%, respectively) also modified the values (P<0.0001) of acidity (0.71 vs 0.80, SEM=0.009), FFA (0.36 vs 0.40, SEM=0.005), peroxides (4.04 vs 6.21 meq peroxides/kg, SEM=0.358) and TBARS (2.17 vs 2.37 mg MDA/kg, SEM=0.043). The use of lard with higher presence of unsaturated fats may cause loss of quality by increasing the oxidative reactions during heating, use of salt and the modification of the acidity of the medium. It would be adequate to evaluate the use of quality lards protected with natural antioxidants.

Keywords: lard, oxidative stability, heating, pro-oxidative factors

Prevalence of Salmonella strains in pork meat sold in two different types of establishments resistant to antibiotics of common use nationally

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The presence of pathogen microorganisms in products of animal origin remains an important study; cross contamination may worsen the prevalence of antibiotic resistant strains. The objective was to determine the bacterial flora and presence of antibiotic resistant Salmonella strains in pork meat from informal or formal stores nationally. The samples were grouped in seven national regions (Northeast, Northwest, Central pacific, South pacific, Center, Gulf, and Southeast) including the cities more representatives. From each city, 5 to 6 samples of 500 g of pork meat (ham) were taken from formal establishments (Supermarket chains) and informal (municipal markets or butcher shops). The results describe the frequencies of appearance of positive strains. The samples were analyzed for the following bacteria: aerobic mesophilic (BM), lactic (BL), enterobacteriaceae (EN), total coliforms (CT), *B. thermosphacta* (BT), *E. coli* (EC) and Salmonella (SA); reported as LogUFC/g. Surprisingly, the north, pacific and center regions had higher counts ($P < 0.05$) of BM (6.8 ± 0.67 , 7.2 ± 1.04 , and 7.1 ± 0.65), BL (5.7 ± 0.93 , 6.3 ± 0.96 , and 6.6 ± 0.87), EN (5.9 ± 0.99 , 6.3 ± 1.00 , and 5.6 ± 1.44), CT (6.1 ± 1.04 , 6.4 ± 1.01 , and 6.0 ± 1.27) in samples from formal establishments. Meanwhile, for the pacific and southeast regions the presence of BT (4.0 ± 1.27 and 5.2 ± 0.87) and EC (4.0 ± 1.35 and 5.6 ± 1.23) was elevated in samples from informal markets. In the northeast (73.3%), center pacific (95.2%), center (>62.5%) and gulf (>75%) regions a higher proportion of samples positive to Salmonella were determined in informal markets. From each sample positive to Salmonella, the colonies were isolated and purified and tested with different antibiotic Sensi-discs, highlighting the resistance with more than 30% of positivity. The northeast region presented resistance to Sulfametoxazol+Trimetoprim, Ampicillin and Tetracycline. Northeast included Estreptomycin and Southeast Cloranfenicol. Center pacific presented resistance only to Sulfametoxazol+Trimetoprim and Tetracycline, while south pacific had no more than 11% of positivity to every antibiotic. Gulf was the same as Northeast except in Ampicillin. The presence of antibiotic resistant Salmonella strains was representative in each of the samples from the different regions of the country, except for the center region.

Keywords: pork meat, Salmonella, resistant, antibiotics, bacteria

Antimicrobial Effect of Polyphenolic Compounds and Lactic Acid Bacteria Supernatants against *Clostridium perfringens*

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Clostridium perfringens is an anaerobic, spore-forming, rod-shaped bacterium, which produce multiple toxins, where the enterotoxin (CPE) is responsible of a very common human food borne illness. The high frequency of this toxi-infection is in part due to the bacterial ability to withstand conditions of food processing such as high temperatures, packaging and preservation processes (modified atmospheres, and defective canning). Use of plant and microorganisms-derived compounds are alternatives for food preservation. Various polyphenols (plant-derived compounds), and metabolites produced by lactic acid bacteria (LAB), are reported to exhibit antioxidant, anti-inflammatory, and/or antimicrobial properties, and could be good alternatives as bio-preservatives for the food industry. Due to this, the aim of the present study was to evaluate the antimicrobial capacity of eleven polyphenolic compounds and supernatants of seven LABs against two *C. perfringens* strains (enterotoxigenic FD-1041 and non-enterotoxigenic FD-1). A diffusion assay in solid medium was used to measure antimicrobial activity. The effect of sublethal doses of active compounds, on biofilm formation was also evaluated. Results showed that tannic acid, epigallocatechin gallate, caffeic acid and hesperetin showed antimicrobial activity at concentrations ranged from 12.5 to 500µg/ml. Also, sublethal doses of polyphenolic compounds enhanced biofilm formation in both strains of *C. perfringens*. supernatants of *Lactobacillus fermentum*, *Lactococcus. Lactis* and *L. reuteri* showed antimicrobial activity at concentrations of 10-13µg protein /ml. The activity of LAB supernatants was maintained when pH was neutralized; however, it was lost when heated at 65°C. Results suggest that polyphenolic compounds and LAB supernatants could be promissory options to be used as preservatives to control *C. perfringens*. However, further studies in foods are necessary to determine their efficacy.

Keywords: antimicrobial, food safety, lactic acid bacteria, polyphenolic compounds.

Quality Indicators of Milk and Improving Health in Cotija Cheese Processing

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The quality of milk produced on dairy farms is affected by pollution factors such as milking equipment, water, utensils, the cow, the same computer, causing the product may deteriorate. The objective was to evaluate the sanitary quality during milk processing with the Cotija cheese is made. 10 monthly samples were taken during the milking stage. To make improvements to the process of extracting the milk, a current diagnosis of quality was established and a program of BPH, which focused on physical facilities, sanitary equipment, cleaning and disinfection, control of operations, transportation was implemented and training. The samples were divided into two stages: one, prior to improve the sanitary conditions of farms and a second stage after a series of improvements. In analyzes obtained from step I, the dairy farms evidenced by a poor state both in facilities and in the aspect of health. In stage I, it is observed that 69.11% for BMA, was between 4.93 - 5.90 log₁₀ CFU / ml, 23% corresponded to intervals between 6.70 - 7.50 log₁₀ CFU / ml, values that exceed the limit established by the NMX F-700-SCFI-2004., which establishes the reference limit 106 CFU / ml. For the second stage sampling after starting a program of hygiene and operational improvements in the process of obtaining milk, 78% of the results of BMA were between 2.57 and 3.55 and log₁₀ CFU/ml. Compared with those who were obtained in the first stage the difference is highly significant, also these data would be within stipulated by the NMX-F-700-SCFI-2004., 16% corresponded to counts obtained 4.71 log₁₀ CFU / ml, only 5% of the samples exceeded the limits referenced.

Keywords: Quality, milk and cottage cheese.

Development and Validation of an Assessment Tool to Ascertain Readiness to Comply with the FSMA Final Rule for Preventive Controls for Human Food.

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The Food Safety Modernization Act (FSMA) was signed into law on January 4th, 2011 as a comprehensive overhaul of the food inspection system in the U.S. The FSMA framework changes the approach; enforcement and response capabilities of FDA to control the safety of foods produced in the U.S. and includes additional measures for imported goods. The framework includes several rules that focus in different stages of the food chain. The Current Good Manufacturing Practices, Hazard Analysis and Risk-Based Preventive Controls Rule, also known as Preventive Controls, applies to the manufacturing, processing, packing or holding of foods, and some facilities will need to comply with the rule requirements by September of 2016. Due to the complexity and extensiveness of the rule components, processors require technical assistance to support their efforts to comply with such requirements, and assessment tools that will allow them to determine the main areas in need of improvement, modification or development. The objective of this project consisted in the development of a semi-quantitative self-assessment tool to evaluate the level of readiness towards compliance with the requirements of the Final Rule for Preventive Controls for Human Food by the use of a Microsoft Excel[®] worksheets. The tool was designed to include all the main Subparts of the rule and the specific requirements with their respective subcomponents in a manner that allows processors or auditors to evaluate the readiness towards a specific requirements on a 6-point hedonic scale to include: not applicable (blank), not ready (purple), poor readiness (red), somewhat ready (orange), partially ready (yellow) or substantially ready (green) scores. These scores were set up in a drop down menu option to facilitate the evaluation process and the worksheet was programmed to provide a color coded, autofill score grading, as well as percentage of readiness against the main subcomponents of the rule. A final report is automatically generated summarizing the main rule subcomponents, the score and percentage of readiness towards compliance and a color-coded cell accompanying the numerical score. The tool was applied in several facilities (n=10) in Mexico, Paraguay, Colombia, Jamaica, Barbados and Trinidad y Tobago. Results demonstrate significant variability on a country to country basis, but several overall trends can be identified by the tool on rule components with the most needs for implementation including: allergen controls, supplier controls, sanitation controls, recall plans, some basic good manufacturing practices as well as hazard analysis deficiencies. Despite the fact that some facilities feature Food Safety Plans, these are not implemented or maintained properly. Evidence of significant confusion on the new rules and their implications was observed in most operations. Based on these assessments, targeted training can focus their efforts on areas in most need for capacity building in the region, thus increasing the likelihood of potential compliance in some of the operations exporting foods into the U.S. market.

Keywords: FSMA, preventive controls, assessment tools, food safety, FDA

Determination of Resistance in *Listeria* spp Ripened Cheeses.

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The increasing use of antimicrobials for human and animal health and livestock production has been accompanied by the development of mechanisms previously evasion by sensitive microorganisms. The objectives were to isolate and identify *Listeria* spp of a matured artisan cheese and then the evaluation of the sensitivity / resistance to 23 antimicrobials. A total of 95 sampling cheeses. Isolation and characterization was done according to the NOM-143-SSA1-1995. Amikacin, AM: Ampicillin, CB: carbenicillin, CF: Cefaletina, CRO: Ceftriaxone, CXM: Cefuroxime, CAZ: Ceftadecima, CL: Chloramphenicol, DC: dicloxacillin, E Also, antimicrobial susceptibility to 23 antimicrobials (AK was evaluated: erythromycin, GE: Gentamicin, NET: Netilmicine, NF: nitrofurantoin, PEF: pefloxacin, PE: Penicillin, SXT: trimethoprim + Sulfametazol, TLC: Tylosin, AMX: Amoxicillin, VAC: Vancomycin, ETR: Streptomycin, FLF: Fluofernicol, LCO: lincomycin, OXT. oxytetracycline) by the agar diffusion method Miuller-Hinton. Regarding isolation were isolated and characterized strains of *Listeria* sp 5. The 17.39% showed resistance to DC, PE, TLC, VAC, these antimicrobial DC and TLC presented total resistance. Although *Listeria* is a microorganism that acquires resistance to antimicrobials very slowly, in recent years has shown that this pathogen has developed resistance including some of those used to treat listeriosis, such as AM or association with it includes one aminoglucósidoscomo such as GE and other second choice as the FLF, E and OXT. All strains of *Listeria* showed intermediate sensitivity or sensitivity to E and VAC. This indicates that the studied strains have developed resistance to antimicrobials which were sensitive, also with the passage of time has made the percentage of resistant strains increases and have acquired multidrug resistance.

Keywords: cheese, *Listeria* sp and ripened cheeses

Validation of the method of detection of *Escherichia coli* O157: H7 in primary product by RT-PCR.

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Microbiological methods developed and currently used to determine food safety involve enrichment, isolation and identification of bacteria with a minimum of seven days, which could be a disadvantage if we compare these techniques with the polymerase chain reaction (PCR), which can determine the presence of pathogens in a sample in a twenty-four hour time and with high sensitivity. These procedures would support the sanitary control of Mexican farmers who export vegetables and vegetables, since it would comply with the regulations established by the Security Service Food the United States Department of Agriculture (FSIS / USDA), plus they get better diagnostic processes that lead to greater food safety. The objective of this work was to establish guidelines for the preparation of the report on the performance evaluation Appendix Regulatory: Reference method for pre-enrichment of the pathogen; *Escherichia Coli* O157:H7. NOM-210-SSA1-2014, and molecular detection of pathogens by RT-PCR in food matrices (Bacteriological Analytical Manual (Edition 8, Review A /1998) from FDA). 100 samples divided into 25 fresh coriander, 25 water, 25 livings surface, and 25 inert surface were used to determine the presence of *E. coli* O157: H7. The assays were performed in duplicate and repeated under the same conditions, on three consecutive days with two different operators. For detection of pathogens was used the StepOne RT-PCR system and the MicroSEQ® *E. coli* O157:H7 Detection Kit from Thermo fisher scientific following the specific instructions of the manufacturer. Quality parameters were evaluated for qualitative methods. (Alternative method): Limit of detection, relative effectiveness, relative specificity, relative sensitivity, reproducibility, repeatability, robustness, Inclusivity and Exclusivity. The results show that by applying the method reliable and reproducible results therefore can be used for analysis of the products described in this report. The minimum concentration of DNA concentration was 3 ng/μL, the method showed 100% of sensitivity and specificity though RT-PCR.

Keywords: *Escherichia Coli* O157:H7, RT-PCR, Validation.

Antibacterial Activity of Methanolic Extracts from Wild Blackberry (*Rubus adenotrichus*) Leaves, During Different Storage Periods

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Different cultures have used extracts from wild blackberry (*Rubus* sp.) as antimicrobial, effect attributed to the presence of polyphenols. This paper reports methanol extract of leaves of *Rubus adenotrichos*, collected in Uruapan, Michoacán, Mexico as antimicrobial potential. For antibacterial evaluation against *Clavibacter michiganensis* subsp. *Michiganensis*, methanolic extracts (ME) were obtained from dehydrated samples and resuspended in 10 % dimethylsulfoxide (DMSO). In order to understand the relationship between their antibacterial activity and polyphenols concentration, these were quantified by the Folin-Ciocalteu method. EM was stored in the dark at 4 °C for 0, 60 and 120 days (ME₀, ME₆₀ and ME₁₂₀ respectively). The ME₀ antimicrobial activity was qualitatively evaluated using 0.5 cm diameter discs impregnated with 50 µL of extract. Antimicrobial treatments for evaluation were: ME₆₀; ME₁₂₀; absolute control containing 10 % DMSO (AC) and positive control (PC) containing trimethoprim and sulfamethoxazole 25 µg/mL of potato dextrose médium. Inhibition was determined by counting colony forming units (CFU) by serial dilutions and plating in Petri dish. The analysis of the data was carried out in triplicate with a completely experimental randomized design. Tukey test was performed with the JMP statistical package, version 6.0.0, SAS. Significant differences were found in the polyphenol content, being ME₀ (5.20 ± 0.11 µg EAG/µL) superior, respect to ME₆₀ and ME₁₂₀. Qualitative tests showed inhibition of 0.65 ± 0.16 cm, while the inhibition of the bacteria percentage, did not show a significative diference between ME₆₀ (98.8 ± 0.38 %) and ME₁₂₀ (96.4 ± 0.49 %). This experiment shows that the methanolic extract inhibited the development of the phytopathogenic bacteria *Clavibacter michiganensis* subsp *michiganensis* and which retains its activity for at least 120 days of storage.

Keywords: *Clavibacter*, polyphenols, antimicrobial activity

Antimicrobial Spectrum and Toxicology of a Natural Food Grade Additive Obtained from Avocado Seed

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Avocado fruit contains a family of lipid derivatives (acetogenins) known to exhibit antimicrobial activity. Acetogenin enriched extracts, obtained at laboratory scale by centrifuge partition chromatography (CPC), possess antimicrobial activity against *Clostridium sporogenes* vegetative cell growth and endospore germination. The objectives of this study were to characterize a food grade acetogenin enriched extract (Avosafe®), obtained from avocado seed, by its chemical profile, antimicrobial spectrum, and toxicology. Lyophilized seed extracts were enriched in acetogenins by CPC. Active fractions were then pooled and extraction solvents removed to obtain the food grade extract. Analytical standards were purified by preparative chromatography and acetogenin quantification was performed by HPLC-MS and HPLC-PDA. Avosafe® was tested against important food pathogens (eight Gram-positive bacteria, two Gram-negative bacteria, and two yeasts) by the disc diffusion test and determination in liquid culture of minimum inhibitory (MIC) and bactericidal concentrations (MBC). Preliminary toxicology on Avosafe® was determined by the Ames mutagenicity assay and acute oral toxicity to rats (fixed dose method). For all tests Avosafe® was formulated in propylene glycol. Avosafe® was enriched in a total of eight main acetogenins (71.3% w/w); persenone A and AcO-avocadene were the most abundant (20.4 and 21.9% w/w, respectively), which showed larger inhibition zones (2-4 times) than commercial food preservatives (Nisaplin® and Mirenat®). Of the tested microorganisms, Avosafe® showed antimicrobial activity only towards Gram-positive bacteria (*Listeria monocytogenes*), and particularly sporulated bacteria (*C. sporogenes*, *C. perfringens*, *Bacillus subtilis*, and *Alicyclobacillus acidocaldarius*). MIC values ranged from 3.9–15.6 $\mu\text{g mL}^{-1}$. Avosafe® was non-mutagenic and the acute median lethal oral dose (LD50) to rats was determined at $>2\ 000\ \text{mg kg}^{-1}$ with no signs of abnormalities in organs and tissues. Results strengthened the potential of avocado acetogenins as natural antimicrobial food additives.

Keywords: acetogenins, avocado, antimicrobial, *Clostridium*, centrifuge partition chromatography

Microbiological Analysis of Goat Milk during Milking the Four Herds in the Laguna Region of Coahuila, Mexico

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By its nutritional properties, milk is an excellent culture medium for microorganisms, which usually come from abroad. The main sources of contamination of milk and milk products are given in the farm ambient: goat (udders, skin, feces), stable (flies, air, water, fodder, straw and soil) and utensils (milking equipment, buckets or tubs, jars, filters and cooling); as well as the collection, transportation, receipt and industrial processing. The objective of this research was to determine the number of Colony Forming Units (CFU) of Total Coliforms (TC) and identification of microbial flora present in goat milk. They performed six sampling in four dairy goat herds (6X4) between the months of February to July 2012 in the municipalities of Matamoros & Viesca, Coahuila; Mexico. We evaluated the milker of the hands (MH), direct milk from the udder (DMU), milk collection tub (MCT) and milk storage tubs (MST). The results were analyzed statistically using the program STATGRAPHICS Centurion version VI. There is a significant difference (LSD) ($P < 0.05$) between 6 samples and the 4 dairy herds in the CFU count for TC, taking into the MH an mean of 4.75 & 145.25 with standar error (*s.e.*) of 71.08, DMU with mean of 12.75 & 120.5 *s.e.* of 47.14. MCT with mean of 0 & 125.5 with *s.e.* of 36.54, no significant difference ($P > 0.05$) in MST having an mean of 131.7 & 339.75 with *s.e.* 104.5, identifying themselves bacteria of sanitary interest in MH, DMU & MST the *Escherichia coli* (*E. coli*), *Shigella* spp., & *Salmonella* spp., and MCT *E. coli* & *Shigella* spp. These results indicate that there is a high prevalence of UFC of TC, this is evidence that goat's milk obtained during milking and not to carry the Good Manufacturing Practices indicates that the milk is of poor quality. Unpasteurized milk remains the microbial flora, which can multiply and release toxins responsible for causing gastrointestinal diseases to humans.

Keywords: Colony Forming Units, Coliforms, pathogenic bacteria, pollution

Purification of Linamarin from Cassava Root Extract (*Manihot esculenta* Crantz)

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The cassava root (*Manihot esculenta* Crantz) ranks fourth in the world as a crop, after wheat, corn and rice, millions of people depend on cassava in Africa, Asia and Latin America because it is a food base population with limited resources. Cassava roots are a good source of carbohydrates, some vitamins and minerals, plus metabolites such as hydroxycoumarins and flavonoids, with potential biological function, however, its bitter taste is associated with high levels of cyanogenic glucosides (linamarina and lotaustralin) making it potentially toxic when root tissues are damaged, releasing cyanhydric acid (potent inhibitor of complex IV of the respiratory chain) by the action of their endogenous enzyme (β -glucosidase). The objective of this work was to isolate the linamarin of cassava extract by chromatographic techniques for evaluation in animal model. A methanol extract of cassava flour was obtained, which was carried a column chromatography (CC), which eluted different solvent mixtures with polarities in increasing order (hexane, ethyl acetate, acetone), fractions of 15ml which were analyzed in thin layer chromatography (TLC) were collected. Linamarin presence was confirmed in the fractions coincided with the standard (Sigma Aldrich) via HPLC Varian ProStar 210 model, C18 reverse phase column 4.6x250mm, 5 μ m (Agilent), UV detector, vol. 20 μ L injection, 240nm wavelength, mobile phase A water: acetonitrile (80:20), mobile phase B acetonitrile, flow rate 0.6ml / min. The gradient was 100% A at 0 min, 99% A to 3min, 97% of A to 5 min, 99% A to 100% 7min and A at 10 min. 12 fractions of interest after separation by CC were obtained, which they were analyzed by HPLC. Fractions 62-64 had two peaks with retention times of 3.08 and the 3.4min, the first peak is estimated to linamarin isomer (lotaustralin), 65-72 fractions showed a peak with retention time between 3.4 and 3.5 min similar to the standard, in two asymmetric peaks 73-74 showed. The methodology developed linamarina allowed obtaining a high degree of purity which will allow subsequent use in toxicological by employees.

Keywords: Linamarin, chromatographic techniques, purification, cassava

Assessment of the Dietary Intake of Acrylamide by Young Adults in México

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In April 2002, the National Food Authority from Sweden published a study in which the presence of a carcinogen in experimental animals identified as acrylamide was reported for the first time. The main mechanism for the formation of acrylamide in foods is through Maillard reaction between reducing sugars (such as glucose or fructose) and the amino terminal of asparagine, during heat processing. Given that acrylamide is recognized as a health risk because of its proven neurotoxic and probable carcinogenic effects, it is necessary to conduct survey studies where the concentration of acrylamide can be determined and used to construct a reliable database to support bills so legislation in this regard can be established. Due to the above, the aim of present work was to estimate the content of acrylamide (AA) in food consumed by young people in Mexico and calculate its intake in this population sector. Twenty samples of heat-processed commercial foods, widely consumed in Mexico were obtained from supermarkets and local convenience stores, and analyzed in triplicate to determine their concentration of acrylamide ($\mu\text{g}/\text{kg}$ of product) by HPLC-UV and later assess the intake in young adults. Significantly high contents of acrylamide were found in most foods evaluated; the highest levels were found in fried products ($5,914 \mu\text{g}/\text{kg}$ in potato chips). Intake of Acrylamide was estimated in $0.68 \mu\text{g}/\text{kg}$ bw/day and this was estimated based on food and portions that subjects reported. The estimated daily intake could be at levels above the limit established to avoid the risk of neurotoxicity. This research provides relevant information for public health experts, policy makers and consumers in general.

Keywords: Acrylamide, Food-intake, Health, México.

Evaluation of liver damage in Wistar rats by chronic oral administration of acrylamide

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Acrylamide (2-properamida) is a toxic and carcinogenic chemical. Since 2002 its presence was reported in food products so far have not been described liver damage that can cause chronic oral administration in instant soup, its intrinsic toxicity and the potential health risk involved with their consumption. The objective of this work was to evaluate liver damage in Wistar male rats caused by chronic administration of acrylamide in instant soup. 24 male Wistar rats weighing 250-300 g were randomly assigned to four groups (n=6), group 1; control, group 2; acrylamide standard (50 mg/Kg), Group III and Group IV; acrylamide from instant soup (25 and 50 mg/Kg). All groups were administered every 24 hours for 14 days, after this time it was obtained blood samples by transcardiac puncture and liver function was determined the serum activity of alanine aminotransferase enzymes (ALT), aspartate aminotransferase (AST) and alkaline phosphatase; total protein, albumin, total bilirubin and direct bilirubin (markers of liver damage). Results showed significant differences (P<0.05) in the values of liver function determinations in the high dose (50 mg/Kg) relative to the vehicle group, related to impaired liver function. In determining total protein and albumin it was obtained significant differences in the group treated with 50 mg/Kg, compared to control. Total bilirubin and direct bilirubin showed differences between groups whereas the values of enzymes (ALT, AST and ALP) showed significant differences in the three treatment groups acrylamide in compared with control group. Conclusion: The oral administration of acrylamide in instant soup for 14 days, caused toxic effects in the two doses used.

Detection of *Leptospira* Spp in Cattle in the Laguna Region by RT-PCR.

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In Mexico the consumption of meat products ranked second, above the consumption of poultry. The intake of food of animal origin is used by 15% as part of daily basic diet for humans, so their health control is vital, Mexico allocates 57% of national territory for livestock and rangeland not cultivable. A study published by Egyptian scientists characterized the Leptospirosis as a re-emerging zoonosis, which directly affects cattle, raising the risk of infection in humans by consumption of contaminated meat and direct exposure to polluted soil and water. In cattle, it produces low milk production, spontaneous abortions, mastitis or death. In Mexico in 2014 an investigation was conducted in the Laguna region, which monitoring sera 1146 Holstein cows, of which 93.71% were positive with Leptospirosis. Leaving evidence of their direct association with cases of infectious abortion and infertility presenting this type of cattle now. The aim of this work was to detect *Leptospira* spp. in cattle in the Laguna region by RT-PCR following the guidelines established by the Official Mexican Standard NOM-038-ZOO-1995 and Procedures Manual of Standards for Epidemiological Surveillance of Leptospirosis (PMSESL) established by the Ministry of Health. A total of 220 peripheral blood samples of cattle in farms of the Laguna Region were collected randomly, in order to determine the presence of *Leptospira* ssp according to PMSESL. For molecular detection by RT-PCR Lepto R and Lepto F primers, specific for *Leptospira* spp and a Lepto TaqMan probe were used, which amplified and hybridized respectively a portion of the *rrs* gene. The prevalence of *Leptospira* spp in cattle reported in this study was > 80%. The results are consistent with the manual of the Ministry of Health referring to the RT-PCR technique as the most sensitive for the detection of *Leptospira* spp method.

Keywords: Leptospira ssp, Cattle, RT-PCR.

Validation of the Detection Method of *Brucella abortus* in Dairy Cows by RT-PCR

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Brucellosis is a zoonotic disease that have an impact on the economic environment either dairy cattle due to abortions, decreased milk production, meat and fertility problems, in addition to representing a public health problem. In Mexico, the obligatory official diagnosis is made by serology, these being traditional methods: tests rose bengal card, rivanol and complement fixation, considering the isolation and characterization of *Brucella abortus* as the "gold standard". However, they can give false positive results due to cross reaction with other gram-negative bacteria. Therefore, the use of the technique polymerase chain reaction (PCR) to perform a diagnosis based on molecular analysis of the gene in blood cells infected animals *Brucella abortus* transcriptional profiles. It will improve the diagnostic process with greater sensitivity and reduced detection times. The aim of this work was to establish guidelines for the preparation of the report on the performance evaluation Appendix Regulatory: Reference method for detection of *Brucella abortus* (NOM-041-ZOO-1995) and molecular detection of pathogens by RT -PCR in dairy cattle. 100 blood samples were collected from cattle belonging to three stables with a history of brucellosis located in the Laguna region. The assays were performed in duplicate and repeated under the same conditions, on three consecutive days with two different operators. B4 (5'-TGGCTCGGTTGCCAATATCAA-3 ') and B5 (5'-CGCGCTTGCCTTTCAGGTCTG-3') primers that recognize a region of sequence internal BCSP31 gene (GenBank accession number M20404), of *Brucella abortus*, which were used used to amplify a 223 bp fragment. As the QIAamp Tissue Kit (Qiagen Inc, Valencia, CA) commercial kit following the manufacturer's recommendations. The results show that by applying the PCR method the results are reliable and reproducible, therefore can be used for analyzing the products described in this report.

Keyword: *Brucella abortus*, RT-PCR, Validation.

Presence of Aflatoxin M₁ in Breast Milk Samples of Lactating Mothers in Central Mexico

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Aflatoxin B₁ (AFB₁) is a toxic secondary metabolite produced by *Aspergillus* species in a variety of foods. Aflatoxin M₁ (AFM₁), a hydroxylated metabolite of AFB₁, is excreted into the breast milk of lactating mothers after the ingestion of AFB₁ contaminated food. Exposure of children to AFM₁ is of great concern because this toxin has been classified as a Group 2B carcinogen. Studies conducted in different countries have evidenced the presence of AFM₁ in breast milk. However, in Mexico there are no studies on this regard. Therefore, the aim of this work was to determine the incidence and levels of AFM₁ in breast milk from a group of Mexican lactating mothers in the central region of Mexico, at different periods and stages of lactation. A total of 112 breast milk samples were collected from lactating women who voluntarily attended to a milk-bank located in the northeast of the State of Mexico, during January-August 2014. The participants nursing mothers filled out a socio-demographic questionnaire at the time of breast milk samples donation. Beside, a semi-quantitative food frequency questionnaire was used to determine weekly intake of food groups. Results showed that 89% of breast milk samples contained AFM₁ in a range of 3.01-34.24 ng/L. AFM₁ mean level was significantly higher ($P < 0.05$) in winter (12.78 ng/L) and spring (12.09 ng/L) than summer (7.91 ng/L). No significant differences ($p > 0.05$) were detected regarding the stage of lactation. All the contamination levels recorded were below the legal limits (500 ng/L) allowed for treated milk and dairy products. However, 7% of samples exceeded the European Community regulation (25 ng/L) for milk infant formula. The presence of AFM₁ was significantly associated ($P < 0.05$) to consumption of egg, cola drink and sunflower oil. Conversely, weight-height, study level, socioeconomic status and age of participant did not correlate with the levels of AFM₁ determined. Incidence and levels of AFM₁ detected, as well as the mean AFM₁ estimated daily intake (2.35 ng/kg b.w./day) suggested, for the first time, that breast-fed infants in the central region of Mexico, may be chronically exposed to significant levels of AFM₁ through mother's breast milk.

Keywords: Aflatoxin M₁, Breast milk, Mexican nursing mothers

Inhibition of biofilm formation of *S. aureus* using leaf polyphenol Mexican avocado (*Persea americana* var. *drymifolia*)

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Methicillin-resistant *Staphylococcus aureus* (MRSA) is an important pathogen that is becoming increasingly important in bovine mastitis, causing chronic intramammary infections (IMI) which limit profitable milk production. These pathogens reach us through various ways one of them are dairy products such as fresh cheeses or pasteurization malpractices causing contamination in fresh cheeses easily. In this work the ability to inhibit biofilm formation of *Staphylococcus aureus* by total polyphenols drimifolia Mexican avocado criollo variety was tested. The bacterial strains of this work were obtained from 11 freshly milked Holstein dairy cows with chronic mastitis data as raw milk and the strain $\mu 3$ (methicillin resistant and vancomycin intermediate) as a control. The bactericidal power of total polyphenols was verified by test and the minimum bactericidal concentration (MIC), this being 100g / ml. To test inhibition of biofilm formation was used a microtiter plate 96 wells using gentamicin as positive control and soy broth tripticacine as negative control, the polyphenols was adjusted with a sub-MIC dose of 50 $\mu\text{g}/\text{ml}$ with avocado leaf extract, and was then placed in the incubator for eight hours. The viable cells were removed and the biofilm formation was verified by crystal violet. The results were read at a wavelength of 490nm. To test removal of biofilm already formed a similar procedure with some variants was performed. The microtiter plate was incubated first for four hours without inhibitor to allow biofilm formation were subsequently added total polyphenols at a concentration of 50 $\mu\text{g}/\text{ml}$ and incubated for a period of 24 hours after that time was measured percent inhibition in the same way as for the first test. The results showed that total polyphenols avocado leaf inhibited by 40% to 90% of the formation of new film in the 11 strains isolated from raw milk, and 60% in the control strain of methicillin-resistant *Staphylococcus aureus* $\mu 3$. However, the test removal of biofilm already formed only showed inhibitions ranging from 25% to 59%. With this, we can conclude that the polyphenols Mexican avocado leaf have great potential in inhibiting new films of a pathogen such as *S. aureus*.

Orchard Bioponic: A Strategy for Food Security Family

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Food security is an issue that is considered in all global development plans. However, despite the great efforts in Latin America and the Caribbean there are 52.5 million people hungry. Therefore, it is important to design and implement sustainable agrotechnologies for food production. The orchard bioponic is a system of sustainable production of healthy food of plant and animal origin obtained in small spaces. This work was developed in DAMR facilities, during January to March 2016. The prototype design was developed using available timber and hexagonal mesh. The measures were 1 m² and 1.20 high. It was divided into two levels; the first level was built to a height of 40 cm from the ground and a height of 50 cm, and the second level of 30 cm. At the first level he had capacity for 10 breeding broilers or 5 rabbits. While on the second level different vegetables as cultured: onions (*Allium* sp), radishes (*Raphanus sativus*), lettuce (*Lactuca* sp.), chili (*Capsicum* sp), mint (*Mentha* sp), thyme (*Thymus* sp.), oregano (*Origanum* sp.) and epazote (*Chenopodium* sp.). Pest control was performed with extracts of neem (*Azadirachta indica*) and oregano orejon (*Plectranthus* sp.) Previously prepared. The harvest of peppers, tomatoes, medicinal and aromatic plants began at 90 days after planting. Moreover, the chickens had a higher weight of 2 kg after 60 days of age (10 kg of meat per square meter). Therefore, for a year can produce up to three harvests of vegetables and otherwise obtaining up to 60 kg of meat per square meter. It is concluded that the bioponic orchard can function as a proper sustainable agrotecnia for a family produces and consumes low cost fresh and healthy products for a balanced diet.

Keywords: food education, agro-technologies, fresh food.

Software for identifying information sources in food safety studies, case: organophosphorus into broccoli and cauliflower

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At moment of carrying out risk analysis studies on food safety, it is important to have reliable information associated to hazards and food matrices of interest. On this regard, it is relevant the use of scientific databases to establish which public and private institutions with pertinent information for such study in a specific region. Information that may correspond to reports, research results, epidemiological reports, case studies, newsletters, circulars, work-papers, etc. The computing tool developed possess information associated with 214 institutions and 305 groups of Colombian research and 15 food matrices (meat, dairy, fish, fruits and vegetables, water, salt, low-acid foods, infant foods, cereals, fats and oils, sugar and derivatives, spices, poultry, sauces, eggs, ready foods to eat, and others), and it corresponds to collected information made directly in the regions. For seeking specific data, the tool allows using keywords through information crossings associated to hazards and foods that have often been connected with cases of ETAs in the country, debugging all available data. For evaluating the performance of tool, a test was carried out corresponding to identification of information sources that have information on organophosphate pesticide residues in broccoli and cauliflower in Colombia. The category of fruits and vegetables was crossed with subcategories (hazard class) pesticide residues, environmental contaminants, and waste packaging. It was found that there were 195 records of which 57 were specific to organophosphates. Of those 57 results, 5 corresponded to linked information to research groups, and 52 to existing information in records of public and private institutions. Filtering these records using as subcategory the type of information, it was found that 20 records corresponded to general information, 4 to exposure, 13 to alertness, 5 to monitoring, and 15 to control. Respect to each one records, the software is able to provide information on information sources to which belong, delivering data that allow contact with them facilitating the search, identification and collection of required information for conducting researches on analysis safety risks. Approach that helps to reduce the involved time in this process and to take the first steps in consolidating specific databases for such studies.

Keywords: safety, risk analysis, broccoli, organophosphates, information.

Preparation and Design of Tortilla Chips with Glycotoxins Reduction from the Maillard reaction.

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Nowadays the formation of acrylamide (AA) and hydroxymethylfurfural (HMF) in fried commodities has received great attention of the scientific community because of their high toxicological potential. In this sense, the presented work aims at formulating tortilla chips added with an edible ingredient with antioxidant properties capable of reducing the formation of AA and HMF. For this purpose eight food spices (cloves, cinnamon, anise, basil, bay leaves, cumin, jamaica flower and coriander) were chosen as additive. The resulting spice-tortilla chips were subject to DPPH• antiradical activity determination. The antiradical activity for basil (A), anise (AN), cinnamon (Ca), coriander (Ci), cloves (Cl), cumin (Co), Jamaica (Ja) and bay laurel (La) were 3935, 1268, 52117, 475, 99450, 4763, 7388 and 77033 $\mu\text{mol ET/L}$, respectively. Based on these antioxidant activities, the spices Ca, Ci, Cl, La and a mixture of all of them (4e) were chosen for obtaining five different formulations (M_{Ca}, M_{Ci}, M_{Cl}, M_{La} and M_{4e}). An organoleptic evaluation was carried out for those preparations, finding that M_{Ci} presents greater acceptance in the panel. Also, for the five formulations, the content of total phenolics (CFT) and antioxidant activity (DPPH•, ABTS•+, FRAP, ORAC and chelating activity) were determined. Finding the best values for M_{La} and M_{Ci} with 3954 and 3998 $\mu\text{mol ET/L}$ (DPPH•) respectively as in the others determinations of antioxidant activity. Also authors developed and validated a LC-DAD method for the quantification of HMF in tortilla chips samples. The used mobile phase was 18:81 (Acetonitrile:Water, vol:vol). For sample preparation optimization a fractional factorial design was applied. The validation study indicates that the developed method presented good linearity and is precise, robust and accurate. The content of HMF in M_{Ca}, M_{Ci}, M_{Cl}, M_{La} and M_{4e} were smaller amounts to those found for the limit of detection (3.63 ppm) and quantification (3.66 ppm). This result is consistent and favorable according to the target set in the present work

Keywords: Tortilla chips, Antioxidants, Hidroxymethylfurfural, HPLC-DAD.

Analysis of Pesticide Residues in Matrix Avocado For Export to Japan By QuEChERS Extraction Technique CSN EN 15662, Using Gas And Liquid Chromatography Coupled At Mass Spectrometry

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The commercial relationship between Mexico and Japan has grown considerably in recent years, therefore the requirements to meet safety standards in export agricultural products to Japan are increasingly demanding, as in the case of avocado produced mainly in the state of Michoacan. Two of the main requirements for exporting Mexican avocados to that destination, is compliance with the maximum residue limits (MRLs) for those pesticides that are permitted and on the other hand, ensure that the product is free not permitted pesticides according to the Japanese law. To achieve this, the Servicio Nacional de Sanidad, Inocuidad y Calidad Agroalimentaria (SENASICA) through the National Reference Center of Pesticides and Contaminants, developed a robust methodology for multi-residual pesticide analysis in avocado matrix, using the technique of QuEChERS extraction, referred in the official standard method CSN EN 15662, at which modifications and improvements were made because it is a highly complex matrix, the above in order to achieve detection levels up to 0,005 mg / kg. The methodology was developed by liquid chromatography (UPLC) coupled to mass spectrometry-mass and gas chromatography-mass spectrometry-mass triple quadrupole. The extraction process validation and quantification covered 42 pesticides in avocado, according to the requirements for the target market; it considered the statistical analysis to calculate and ensure compliance with the limits of detection, limits of quantification, recovery rates, linearity and working range, robustness of the method, repeatability, reproducibility and uncertainty. This has considerably reduced rejections Mexican avocado shipments to this major shopping destination.

Study of the Antimicrobial Activity of Rosemary (*Rosmarinus officinalis*) Oil Encapsulated in Microemulsions against *Escherichia coli* and *Listeria monocytogenes*

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Encapsulation by means of emulsification has been recently studied to protect lipidic compounds in a micro- and nano- scale. Different essential oils have demonstrated important antimicrobial activity against bacteria, molds and yeast, due to its components. Particularly, the antimicrobial effect of the rosemary essential oil is attributed to α -pinene, camphor and eucalyptus which are the major components on this. The aim of this study was to evaluate the antimicrobial activity of rosemary essential oil encapsulated in microemulsions, against *Escherichia coli* or *Listeria monocytogenes* in model systems. The rosemary essential oil was encapsulated in microemulsions (O/W), prepared by ultrasonic homogenization at 84 μ m amplitude for 15 minutes. The microemulsions were characterized by measuring the disperse phase particle size, its viscosity, density, color and pH. The antimicrobial activity was determined by the minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) for *Escherichia coli* and *Listeria monocytogenes*. The characterization of the microemulsion was reported with the following data: particle size with a median diameter (D50) of 0.973 μ m, a viscosity of 1.892 \pm 0.070 mPa·s, a density of 0.98 \pm 0.02g/cm³, a pH value of 3.80 \pm 0.35 and the color parameters of L* (105.22 \pm 2.22), a* (-0.81 \pm 0.2) and b* (2.04 \pm 0.04). The result for MIC of pure rosemary essential oil was 50 ppm and the MBC was 75 ppm, for both bacteria. Moreover, the MIC for both bacteria with the rosemary essential oil encapsulated was 15 ppm. The rosemary essential oil encapsulated presented different MBC for the studied bacteria, for *E. coli* the MBC was 30 ppm, while for *L. monocytogenes* was 60 ppm. In conclusion, the MBC was higher than the registered MIC value, for both bacteria in pure essential oil or encapsulated. Besides, the rosemary essential oil encapsulated demonstrated to be more effective against these bacteria, in comparison with the pure essential oil. The results of these study showed that the essential oil encapsulated in microemulsions are an alternative of natural antimicrobials to be used in the food industry, for different applications against the studied microorganisms.

Keywords: rosemary essential oil, encapsulation, microemulsions, antimicrobial activity

Determination of Antibiotic-resistant Fecal Coliforms in an Agricultural Soil Irrigated with Treated Wastewater

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In Mexico, 33% of treated wastewater is used for agricultural irrigation and in Durango, Mexico, 15.6 L/s are intended for such activity due to its fertilizing properties and as an alternative in times of drought. However, this practice is perceived negatively and even more, it could increase the concern about the appearance of antibiotic-resistant strains, which according to FAO is an emerging threat to public health and food safety. The objective of this work was to demonstrate whether irrigation with treated wastewater favors the increase of antibiotic-resistant strains. Two treatments were established, which consisted of agricultural soil from the City of Durango irrigated with treated wastewater (Tc), with well water (Tp), and a control that remained dry (Ts), each with two repetitions in plastic boxes of 30x30x60 cm. They were sampled daily for 5 days and the content of total fecal coliforms (TFC) was quantified as well as antibiotic resistant coliforms using the pour plate technique with Brilliant Green Bile Agar adding antibiotics widely used (ampicillin, AMP; amoxicillin, AMX, trimethoprim-sulfamethoxazole, SXT, amikacin, AMK; gentamicin, GEN, and cefixime, CFM). pH, electrical conductivity and organic matter were also measured. At the end of sampling period, results for TFC were: Ts, 1345 CFU/g; Tp, 4035 CFU/g and Tc, 18830 CFU/g. In Tc, resistant strains to all antibiotics were found except for AMK. Of all strains, 0.76% were resistant to AMP; 14.3% to CFM, 0.27% to AMX, 1.72% to SXT and 1.32% to GEN. Treatments Ts and Tp presented only resistant strains to AMP (Ts, 5.26%; Tp, 0.15%) and to CFM (Ts, 6.66%; Tp, 14.29 %). Evidently, use of treated wastewater for agricultural irrigation increased the content of TFC in the soil, as well as antibiotic-resistant strains, but in this case the resistant strains to AMP, SXT, AMK and GEN were not detectable if the soil was irrigated with well water or if the watering is ceased as recommended by the Reuse of Water Manual published by CONAGUA. We can conclude that the proper use of treated wastewater does not represent an additional risk in agriculture.

Keywords: Treated wastewater, antibiotic-resistant, agricultural irrigation

Remediation and Recovery Measures to Expedite Plant or Replant of Vegetables Following Soil Contamination by *Salmonella enterica*.

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The present study was conducted to remediate *Salmonella* contaminated soil with the following objectives: 1) to identify the persistence of Australian serovars of *Salmonella* in different soil types with different temperatures and moisture regimes under controlled conditions 2) to apply biofumigation in *Salmonella* contaminated soil using different cover crops which are known to have antimicrobial compounds, 3) The application of soil biofumigation and solarisation together in suppressing *Salmonella* contaminated soil. In the controlled study, four different serovars were incubated with different temperature and moisture regime with or without manure amendment. For the field study, a field (sandy and clay soil) was artificially inoculated with *Salmonella enterica* and treated with three cover crops and/or solarisation (using black plastic) to remediate the contaminated soil. Soil sampling was done every week both for the controlled and field studies. Extraction and enumeration of *Salmonella* was performed following cultural methods. Plating and enumeration was done using spiral plater and automatic colony counter respectively. Enrichment was done for all plates with zero-count using enrichment solution to check the presence of residual *Salmonella* cells. Analyse was performed using mixed model function in JMP version11. Because of the large number of treatments, only 2 way interactions between factors manure, soil, temperature, moisture, serovar and the variable time was considered. Tukey's HSD test was performed for multiple comparison testes. For the controlled study, most of the interaction are significant from $p < 0.001$ to $p = 0.0226$. The same model was used to analyse the field data. There was no significant difference among the cover crop treatment in hastening decline of *Salmonella* however; the application of black plastic significantly hastened the decline of *Salmonella* in the field. Generally the decline of *Salmonella* is found to be more in sandy based soil, at higher temperature, with fluctuating moisture and without manure amendment. A difference in survival is also observed among the same species (serovars). Soil biofumigation treatment has been found non-significant but soil solarisation is found to be significant in suppressing *Salmonella* survival in the soil.

Keywords: Food safety, vegetable production, abiotic factors, foodborne pathogens, *Salmonella* survival

Molecular Detection of *Toxoplasma gondii* in Goat Meat Destined for Human Consumption in Northern Mexico

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Toxoplasma gondii is probably the most common protozoal infection agent in humans. Human infection is very common, as indicated by the high prevalence of specific antibodies detected in sero-epidemiological surveys around world. Goats are particularly susceptible to infection by this agent and most adults are asymptomatic, but this disease is recognized as one of the most important causes of abortions, neonatal mortality and reproductive losses. On the other hand, it is important to highlight the role of goat meat consumption represents in transmission and as a source of infection for humans. The objective of this work was to detect *Toxoplasma gondii* genetic material in goat meat in northern Mexico. For detection of *Toxoplasma gondii* DNA a nested PCR technique was developed, using for the first PCR primers N1 and C1, and for the nested one C2 and N2 primers were used in 326 samples of goat meat from four northern states of Mexico. From the tested samples, 10 samples with amplification of the expected fragment 97pb were obtained as a final result, which represents 3.06% of the total. Sampling / positive by town: Durango 62 (0%), Coahuila 35 (0%), Chihuahua 124 (8.06%), Nuevo Leon 105 (0%).

Keywords: molecular, toxoplasma, consumption, meat, goat

Microbial quality of Adobera, a popular crumbly fresh cheese produced in the western part of Mexico

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Cheese consumption is well established in Mexican gastronomy, although it came together from the old-world colonization its use in the native dishes came to stay as part of the culture hybridization. The vast majority of cheeses are made from heat-treated milk, but handcrafted cheeses are also popular among consumers. It is a fact that the most popular cheeses are fresh varieties because of their prestige and sensorial richness. As expected, the first ones render products free of most pathogens as a result of the industry quality control programs; meanwhile traditional fresh varieties are associated to potential public health risk because currently they are made with poor quality raw milk and inadequate manufacture practices. The aim of this work was to study the microbial population of one of the most traditional cheese in the western part of the country: Adobera, to investigate the microbial quality by assessing the incidence of Lactic Acid Bacteria (LAB), *Salmonella*, *Listeria monocytogenes*, *Escherichia coli* and *Staphylococcus aureus* in six brands commonly marketed in Guadalajara metropolitan area. BAL and pathogens were identified using culture techniques and Matrix-assisted laser desorption ionization-time of flight mass spectrometry (MALDI-TOF MS) methods. A pair of each brand was assessed by duplicate. In general, the microbiological quality of cheeses was of acceptable, e.g. *L. monocytogenes* and *Salmonella* sp. were not detected in any samples. However, *E. coli* and *S. aureus* were frequently found in unpasteurized cheeses, sometimes at levels that are of concern, three of the six varieties presented *Staphylococcus aureus* at $10(4)\text{cfu g}^{-1}$ and *Escherichia coli* at $10(3)\text{cfu g}^{-1}$. Other species identified within this group encompassed *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*. Regarding the LAB incidence they were found in $10(6\text{ to }8)\text{cfu g}^{-1}$ and the species found were *Lactobacillus plantarum*, *L. paraplantarum*, *L. fermentum*, *L. rhamnosus*, *L. curvatus*, *L. paracasei* and *Corynebacterium glutamicum*. To improve the safety of traditional Adobera, efforts must be made to raise awareness on hygiene barriers, also by improving raw milk quality and the process control. It also can be suggested the use of starter cultures to reinforce the dominance of native LAB, adding biocontrol to cheese system.

Keywords: cheese, Lactic Acid Bacteria, pathogens, artisanal cheese,



X. RISK ASSESSMENT

Seasonal Abundance of *Vibrio vulnificus* in Raw Oysters (*Crassostrea virginica*) Harvested from Mandinga Lagoon System: A Food Safety Risk

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The seasonal abundance of *Vibrio vulnificus* strains in raw American oysters (*Crassostrea virginica*) was evaluated monthly during a one-year period (January to December) and the risk of exposure was assessed. A total of 80 medium legal-sized (7–8 cm long) live oysters were harvested monthly by divers at oyster beds in two harvesting sites of the Mandinga Lagoon System. After being cleansed, live oyster were analyzed within 2 h of collection. The detection of *V. vulnificus* species-specific hemolysin gene (*vvha*) and genotype gene targets for groups E (Environmental) and C (Clinical) densities was accomplished by MPN–PCR methodology. MPN values counts calculated with 3-tube MPN tables were normalized for appropriate analysis and the significant variations in the seasonal distribution were evaluated by analysis of variance ($P < 0.05$) and Tukey's test. The FDA/FAO/WHO v.2005 software in combination with Microsoft Excel was used to run the simulations. Although no significant differences in density levels among seasons were detected, the highest mean *V. vulnificus* (*vvha*+) densities were observed during summer and fall (1,100 MPN/g) seasons. The highest mean pathogenic *V. vulnificus* (*vvha*+) type C density was found (36.0 MPN/g) during summer season as well; however, no *V. vulnificus* (*vvha*+) type E densities were detected during the sampling period. Considering 10 h of storage out of refrigeration and an intake of 12 oysters (100 g) the model predicted that the higher mean risk per serving associated with the consumption of raw oysters contaminated with *V. vulnificus* (*vvha*+) was 4.0×10^{-5} for both summer and fall seasons. Similarly, the model predicted for *V. vulnificus* (*vvha*+) type C a mean risk per serving of 4.3×10^{-5} and 3.0×10^{-5} during summer and fall seasons, respectively. Although these results suggest that *V. vulnificus* poses a low health risk level, these strains raises important health issues as *V. vulnificus* (*vvha*+) type C are potentially virulent and may imply a risk of infection to the consumers of raw oysters. Hence, the monitoring of these pathogenic strains is crucial to seafood safety.

Keywords: *Vibrio vulnificus*, raw oyster, health risk, seafood safety

Effect of Oregano Essential Oil (*Lippia berlandieri* Schauer) within W/O/W Emulsions on Growth/No-Growth interface of *Aspergillus niger* and *Penicillium expansum*

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Double emulsions, type water-in-oil-in-water (W/O/W), can encapsulate, carry and protect lipid compounds like essential oils; which have antimicrobial properties. The aim of this study was to analyze the antifungal activity of oregano essential oil (*L. berlandieri* Schauer) (OEO) encapsulated in W/O/W double emulsions through the observation of growth/no-growth of *A. niger* and *P. expansum* in model systems. The double emulsions were prepared in a two-step process with homogenization by ultrasound, mechanical or a combination of both types of processes. The double emulsions were formulated containing 0, 1, 5 or 10% OEO. These emulsions were extended (100 μ L) in Petri dishes with PDA agar (pH 5.3) adjusted to 0.98 or 0.99 a_w with NaCl and inoculated in four points. The growth/no-growth of molds was observed for 8 days at 25°C (the experiment was performed twice). For comparison, systems in which the OEO was diluted in corn oil at the same concentrations were prepared. Results demonstrated mold growth of both species in all systems with OEO in which corn oil was used as vehicle, while in the double emulsions, the use of 10% OEO avoided the growth of both molds. *A. niger* was more resistant to the action of OEO emulsions than *P. expansum*. Growth/no-growth data was adjusted to binary logistic regression. The models obtained were properly adjusted to the logit function proposed. The model relates the method of homogenization (categorical variable), water activity (a_w), observation time (day) and concentration of OEO (% OEO) as independent factors. The model of the probability of growth/no growth interface was created including the factors with significant effect, considering $p < 0.15$ for the main effects and $p < 0.05$ for second order interactions of the continuous variables. Concordances of 99.6, for *A. niger*, and 99.8, for *P. expansum*, were obtained with the proposed models. It is concluded that OEO in double emulsions prepared by ultrasonic homogenization was more effective for mold inhibition than using the OEO diluted in corn oil and logistic regression modeling is adequate to describe the growth/no growth interface of molds during storage.

Keywords: essential oil, double emulsions, logistic regression, molds

How to Use Predictive Models for Quantitative Risk Assessment?

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Decisions regarding food safety problems are more and more frequently aided by predictive microbiology software packages. It is a common dilemma of decision makers to what extent they should rely on those predictions. Overestimating the growth potential of pathogenic bacteria can produce food waste and economic loss, while underestimating it can have even more serious health- or reputation-related implications. This presentation focuses on the practical use of predictive models. Having generated a prediction (an expected outcome of a process, or a value for a microbial response variable) based on a set of observations, is it really this expected value that decision makers should “bet on”? It is well-known that conservative (cautious) bets are useful when the price of the error is high. We show here, via examples, that in fact predictive models should be used in combination with a cost-benefit assessment: what is the cost of (however small) deviations between predictions and actual outcomes? We demonstrate the above points using publicly available data on the one hand (such as from the ComBase database, www.combase.cc), and newly generated data on the other. We point out two main problems why decision making is not equivalent to generating predictions: i) the chosen measure of dissimilarity between prediction and real outcome hugely affects the decision; ii) in food safety problems, the cost and benefit measures frequently move on different scales which makes their combined optimization difficult.

Keywords: risk assessment, modelling, optimization

XI. FOODBORNE PATHOGENS

Prevalence of *Campylobacter* and Associated Risk Factors in Three Levels of the Poultry Chain in Costa Rica

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Campylobacter spp. is one of the main bacteria that cause foodborne illness, and its occurrence remains high in chicken meat. Between March and July 2015, a cross-sectional study of the national prevalence of *Campylobacter* spp. and the species *C. jejuni* and *C. coli* in broilers for human consumption was conducted. This study used a simultaneous sampling design in three levels of the Costa Rican poultry production chain. For this research, 152 samples of cecal content (CC) (87 farms), 104 samples of carcass rinse after chiller (CA) (six processing plants), and 96 carcass rinses in the same amount of retail stores (PV) were collected. The samples were analyzed by microbiological culture and PCR specific species. Questionnaires of variables associated with the management in plants (CC and CA) and PV were developed. The overall prevalence for *Campylobacter* spp. obtained was 59.37% (209/352, 95% CI 54.24%-64.51%), for *C. jejuni* 42.59% (95% CI 37.45%-48.26%), for *C. coli* 3.09% (95% CI 1.21%-5.00%), and 8.64% (95% CI 5.62%-11.77%) for contamination from both species. The prevalence of *Campylobacter* spp. in CC was 57.23% (95% CI 49.37%-65.10%), in CA was 61.53% (95% CI 52.19%-70.89%) and 60.42% (95% CI 50.63%-70.20%) for PV. A positive association was determined between the outcome of CC and plants classified by volume ($p = 0.017$) (PR = 1.53 (95% CI 1.0597 to 2.2146), also for the association between type of area of PV and positive for *Campylobacter* spp. ($p = 0.0001$) (PR = 2.24, 95% CI 1.2303-4.0963). Identified as risk factors were: resting period of live animals in platform > 60 minutes (PR= 2.28, 5% CI 1.23 to 4.21), processing speed <120 birds/min (PR = 1.51, 95% 1.0928-2.1044), chiller water temperature $\leq 0.5^{\circ}\text{C}$ (RP 1.60, 95% CI 1.1804-2.1723), no physical separation between different animal matrices in PV (PR = 1.78, 95% CI 1.4323-2.2066), and price PV ≤ 2000 colones/kg chicken (PR = 1.73, 95% CI 1.2110-2.4619). The prevalence of *Campylobacter* spp. is high, and represents a hazard to public health in Costa Rica. Specific preventive measures for this agent are inadequate, thus leading to high levels of contamination.

Keywords: *Campylobacter*, poultry, risk factors

Brucellosis among Hospitalized Febrile Patients in Veracruz City, México: Food Safety Implications

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Human brucellosis remains a major public health problem in México, being the intake of contaminated dairy products or direct contact with infected animals the mayor modes of transmission. As *Brucella mellitensis* and *B. abortus* strains have been isolated in milk and artisanal cheese produced in Veracruz, the aim of this study was to explore different factors affecting brucellosis prevalence among humans living in urban and suburban areas of Veracruz, México. Two hundred serum samples were collected from 2012 to 2014 from febrile patients hospitalized at two public hospitals located in Veracruz City. All individuals had fever for at least 2 days or temperature on admission of $\geq 38.5^{\circ}\text{C}$ and were clinically diagnosed with dengue fever. Blood serum samples were screened for the presence of antibodies against *Brucella* using the rose Bengal plate test. Positive and suspected sera were further tested using the serum *Brucella* agglutination test with a single reciprocal titer $\geq 1:20$ for 2-mercaptoethanol according to NOM-022-SSA2-2002. The Chi-square test was used for all the univariate analyses, and Odds ratios (ORs) and 95% confidence intervals were estimated using Win Episcopo v.2.0. Among 200 patients studied 70/130 were confirmed dengue fever, of these 4/70 showed evidence for combined brucellosis infection and other 10/130 patients were confirmed brucellosis. Brucellosis prevalence was higher in women (9/14, 9.1%, $\text{CI}_{95\%}=4.5-16.9$) with an age range 13-59 years (4.35%, $\text{CI}_{95\%}=0.2-23.8$). The analysis identified the age group 41-50 years (OR 4.3, $\text{CI}_{95\%}=1.3-13.9$) and living in suburban areas (4/14) (OR 5.72, $\text{CI}_{95\%}=1.78-18.35$) as risk factors for *Brucella* seropositivity. No food consumption or occupational data were collected in clinical records. Nevertheless, as we previously reported, shops and markets in Veracruz sell unpasteurized dairy products that owners may obtain directly or indirectly from farmers located in endemic areas, representing the major risk factor for contracting brucellosis in urban areas. These results showed that the serological screening provided an effective means for the early diagnosis in this region. The collection of food-consumption and specific demographic data to detect risk groups and routes of transmission, and the strictly enforcement of dairy products pasteurization are urgently required to prevent infection and brucellosis spread.

Keywords: *Brucellosis*, urban area, health risk, dengue fever

Essential Oils and Ultrasound Disinfection Treatments and its Effect on *E. coli* Inoculated on Tomato (*Solanum lycopersicum*) Fruits.

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Fresh produce often harbors a great number of microorganisms; hence, its growing demand may constitute a risk for consumers. The aim of this study was to evaluate the efficacy of several disinfection procedures against enterotoxigenic *Escherichia coli* (ETEC) inoculated on tomato fruits. Fruits were immersed in oregano or thyme essential oil dispersions (5, 10 ppm), with or without ultrasound treatment. The most efficient disinfectant treatments showing significant differences ($P \leq .05$) between the reductions \log_{10} CFU/g (S) of ETEC were those using 10 ppm oregano for 10 min, with S reductions =3,05 in individual treatments and S = 4.03 in mixed treatments. The results of this study encourage interest in the search for new alternatives for post-harvest treatment of tomato, that consider together the antimicrobial properties of treatments with essential oils of some plants, assisted by sonication.

Keywords: Essential oils; Ultrasound; Tomato; *Escherichia coli*; Assisted disinfection

Conditions for Adherence and Internalization of *E. coli* (ETEC) on Different Spinach Tissues

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Several pre and post-harvest factors could contribute to the presence of microbial pathogens on fresh produce; these factors include irrigation water, soil, feces, insects and human handling. The outbreaks of *Escherichia coli* infections due to consumption of spinach leaves reaffirmed the importance and challenge of produce microbial safety. The aim of the present study was to show the presence on the surface (M1 method) and internalization (M2 method) of *Escherichia coli* (ETEC) on different spinach tissues (leaves, stem and root) (*Spinacia oleracea*), when this pathogen is added to irrigation water. Population of *E. coli* was enumerated after 0 h (day of inoculation with 10^7 CFU/g), 72, 360 and 720 h of storage. The samples for M1 were placed into a polyethylene bag containing 50 mL of sterile 0.1% peptone water and rubbed by hand with firm pressure for 1 min. For M2, twenty-five grams of spinach leaves were macerated in 225 mL 0.1% (w/v) sterile peptone water for 2 min with a stomacher blender. The samples were serially diluted in peptone water, plated (100 μ L in triplicate) on eosin blue agar (EMB, Difco Laboratories) containing 50 μ g/mL nalidixic acid, and incubated at 37 °C for 24 h before enumeration. The number of *E. coli* cells attached (M1) after 720 hours was $7.12 \pm 0.493 \text{ Log}_{10}\text{UFC/g}$. A similar trend was observed with M2 although populations were $7.58 \pm 0.044 \text{ Log}_{10}\text{UFC/g}$. The colonization of *E. coli* was revealed for scanning electron microscopy and the internalization samples were examined with immunofluorescence and confocal microscopy. These results reinforce the importance of the internalization and adherences of *E. coli* due the conventional disinfection treatments are not sufficient to minimize the growth.

Keywords: *E. coli* , Spinach, survival mechanisms, irrigation water

Carbon Source Utilization Distinguishes Phenotypic Differences of *Salmonella* Oranienburg and Saintpaul Isolated From River Water

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Long-term exposure to river water by non-indigenous microorganisms such as *Salmonella* may exert selective pressure on metabolic adaptation to carbon sources. The survival and establishment of certain serotypes as well as differences in metabolic activity among just released strains from host cells may derive from such adaptation. This study was conducted to determine differences in carbon source utilization of *Salmonella* Oranienburg and *Salmonella* Saintpaul isolated from tropical river water as well as the control strain *Salmonella* Typhimurium exposed to laboratory, river water and host cell Hep-2 growth conditions. Results showed that *Salmonella* Oranienburg and *Salmonella* Saintpaul showed better carbon source utilization under the three growth conditions evaluated, however S. Oranienburg showed the fastest and highest utilization rate at different carbon sources, including D-Glucosaminic acid, N-acetyl-D-Glucosamine, Glucose-1-phosphate and D-Galactonic acid, while *Salmonella* Saintpaul and S. Typhimurium showed a limited number and rate of carbon source utilization. In conclusion, this study reveals that environmental *Salmonella* strains have better survival and adapting abilities to external environments than the control strain.

Keywords. – *Salmonella* survival, Carbon source utilization, Environmental isolates, Metabolism, River water.

Carbon Source Distribution and Metabolic Activity of *Salmonella* Oranienburg and *Salmonella* Saintpaul in River Water

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In this study, physico-chemical parameters (turbidity, total dissolved solids, biochemical oxygen demand, temperature and pH) and the concentration of carbohydrates (monosaccharides and polysaccharides) of water from Tamazula and Culiacán rivers were determined. Similarly, the metabolic profile and metabolic substrates of environmental serotypes: *S. Oranienburg* and *S. Saintpaul*, and the reference serotype: *S. Typhimurium*, was determined. Carbohydrate concentration was determined in the laboratory using the TPTZ spectrophotometric method. For determining the metabolic profile, Ecoplates containing 31 substrates commonly found in the environment were used. The results on the characterization showed that water from the Culiacan Rivers have physico-chemical conditions and carbohydrate content that favor the prevalence of the bacteria. Similarly, the bacteria metabolic profile was found to possess distinct patterns of consumption despite the common origin. *S. Typhimurium* presented great diversity of carbon source utilization but in small proportions, while the diversity *S. Oranienburg* showed less substrate utilization but with intensive consumption. The results in this study showed that *S. Oranienburg* has greater metabolic activity than *S. Typhimurium* and *S. Saintpaul*.

Keywords: Salmonella, Metabolic Activity, River Water.

Prevalence of diarrheagenic *Escherichia coli* strains in river, dike, dam and irrigation water at northwest of Mexico

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Sinaloa is located in the irrigated region of Mexico, a farming system that covers large tracts of arid lands across the northern and central parts of the country. The state has eleven rivers and dams that are responsible for the irrigation of their farming valleys and the main producers of export-oriented products such as tomato, cucumber, mango, and pickle. There is increasing evidence of the contribution of surface water in the contamination of produce leading to subsequent outbreaks of foodborne illness. Therefore, in the present study, surface water samples (n=472) collected from rivers (n=29), dikes (n=5), dams (n=9) and irrigation canals (n=429) were analyzed for the presence of thermotolerant coliforms (also known as fecal coliforms) and diarrheagenic *Escherichia coli* (DEC) by PCR from January to December 2014. Thermotolerant coliforms and *E. coli* were detected by conventional bacteriology above permissive levels for human consumption in 47% (222/472) and 43.6% (206/472) of water samples, respectively. Among 206 *E. coli* isolates, 14% (29/206) belonged to DEC strains. Rivers samples (10.3%; 3/29) and Irrigation water (6.06%; 26/429) were the most samples contaminated with DEC, while DEC strains were not detected in dike and dam samples. These bacteria were isolated from different locations. The pathogenic *E. coli* type most commonly isolated was EAEC (34.4%), followed by EPEC (31%), DAEC (27.5%) and ETEC (6.8%). EHEC and EIEC strains were not detected. The prevalence of atypical variants of EPEC or EAEC strains was 10%, or 30%, respectively; they did not adhere to in vitro cultures of HEp-2 cells. Among isolated DEC strains, 88% showed resistance to at least one commonly prescribed antibiotic. In conclusion, the presence of potential diarrheagenic *E. coli* (DEC) and antibiotic resistance could pose a potential threat to human and animal health. Routine monitoring of DEC in surface water should be considered at northwest of Mexico.

Keywords: water contamination, diarrheagenic *E. coli*, EAEC, EPEC, DEAC, ETEC

Effect of Ferulic Acid Encapsulated in Chitosan Matrices in Aflatoxin Production by *Aspergillus parasiticus*

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Aflatoxins are a group of mycotoxins produced by members of the fungal genus *Aspergillus*. They have been detected in food and feed causing economical losses and affecting human and animal health. To protect food from fungal contamination, chemical fungicides are frequently applied. Actually, the use of natural bioactive substances for the control of post-harvest fungal infections has gained attention. Compounds such as flavonoids and phenolics have been reported to inhibit aflatoxin biosynthesis. Ferulic acid (FA), which is a natural compound with low toxicity exhibit antifungal properties. However, its use for controlling toxigenic fungi is limited by its fast oxidation in the environment. For this reason, the aim of this study was to immobilize FA in chitosan-tripolyphosphate (CS/TPP) matrices and to evaluate their structural properties, and the effects on the growth and aflatoxin production by *Aspergillus parasiticus*. Three types of CS-TPP matrices with FA were prepared by ionotropic gelation. The incorporation of FA in the matrices was demonstrated by FT-IR. Evaluation of the FA released from the nanoparticles and the ability of released FA to inhibit free radical DPPH were measured. Radial growth of *A. parasiticus* in Czapek medium was recorded. Spore and hyphae were morphometrically evaluated. Statistics on a completely randomized design was determined using the one-way ANOVA. The microparticles showed high FA immobilization efficiency compared with microcapsules and nanoparticles; however, in the microcapsules the release was more efficient. The FA incorporation in nanoparticles and microparticles enhanced the fungistatic activity. Radial growth at 168 h was 28.46 ± 1.01 and 28.84 ± 1.36 for nanoparticles and microparticles, and the spore germination inhibition at 30 h was 57.44 ± 0.22 and 55.74 ± 2.19 , respectively. Abnormalities in the mycelium morphology and low sporulation were observed. Furthermore, evident effects were detected in hyphae and spores by the particles interaction with the fungus and aflatoxin production was affected. Reactive oxygen species were detected and the superoxide dismutase was inhibited. In conclusion the effects by nano and microparticles is attributed to the increase in the zeta potential, to the particle size, to the presence and release of FA, and to interactions among chitosan, sodium tripolyphosphate, and FA with components of the fungal membrane.

Assessment of Bacteriocin Application Isolated from *Lactobacillus rhamnosus* HN001 in Beef.

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Bacteriocins are antimicrobial peptides produced by bacteria, which can kill or inhibit bacterial strains closely-related or non-related to produced bacteria, bacteriocin have attracted attention due to come from a natural resource, and being stable to heat. These characteristics and their mode of action make them attractive to be used in food. The present work refers the assessment of bacteriocin application, obtained from *Lactobacillus rhamnosus* HN001 growth on a modified MRS broth. Bacteriocin was ultrafiltered employing 1 and 10 kDa membranes. The Units of bacteriocin were quantified by serial dilutions in saline solution, aliquots of 20 μ L from each dilution were placed in wells in plates seeded with an indicator strain and a well diffusion assay procedure was applied. The plates were incubated at 37 °C for 18 h and examined for the presence of clear zones of inhibition around the wells. A Unit of bacteriocin was defined as the reciprocal of the highest dilution showing inhibition of the indicator bacteria and was expressed in activity units per ml (AU/ml). In order to assess the application of bacteriocin, portions of beef steak of approximately 10 g were obtained. At the beginning of the experiment, one portion of the steak was used to determine microbial concentration according to official Mexican norms. Briefly, 1 mL of partially purified bacteriocin with 1,600 UA/mL, was placed on samples of steak over the surface and maintaining during 14 days at 4 °C. One sample was taken at 7 days and another at day 14, both samples were used to assess reduction on bacteria concentration, taking as reference sample of steak without bacteriocin. The bigger reduction (2 log cycles) was observed for *Salmonella* at day 7 of bacteriocin application, in coliforms a reduction of 1.9 log cycles was observed at day 7, at 14 days the biggest reduction was observed in *Salmonella* and *Shigella* (1.62 log cycles). Presence of yeast and molds were not observed in beef steak. Despite the bacteriocin do not showed a significant bacterial reduction, this represent a good attempt in bacterial control in not processed or minimally processed food.

Keywords: bacteriocin, application, beef.

Pathogenic Capacity of *Salmonella* Oranienburg and *Salmonella* Saintpaul Isolated From Surface Water In Culiacán, Sinaloa

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Salmonella is a major cause of gastrointestinal diseases worldwide. This bacterium performs most of its life cycle in the host, which is completed in external environments, mostly in aquatic environments. Outside the host, *Salmonella* is exposed to stress conditions that may affect its pathogenicity. To this end, adhesion, invasion, intracellular survival and damage to host cells induced by *S. Oranienburg* and *S. Saintpaul*, isolated from surface water in the valley of Culiacán Sinaloa, were evaluated in cell lines and compared to *S. infantis* and *S. Oranienburg* isolated from clinical samples. *S. Oranienburg* and *S. Saintpaul* isolated from the environment showed no differences in the adhesion capacity to HEp-2 and Caco-2 cell lines compared to clinic *S. Infantis* and *S. Oranienburg* and the control, *S. Typhimurium* ATCC 14028 ($p=0.074$); however they showed lower invasive capacity compared to *S. Typhimurium* ATCC 14028 ($p=0.000$). Intracellular survival kinetics in macrophages RAW 264.7 showed increased *S. Oranienburg* concentration after 48 h post-infection (pi) (9.67×10^4 CFU/mL) similar to *S. Infantis* (9.62×10^4 CFU/mL); on the contrary, *S. Saintpaul* exhibited the lowest intracellular survival capacity (1.94×10^4 CFU/mL). The evaluation of epithelial cells and macrophages viability 24 h and 48 h pi, respectively, revealed no differences between all serotypes ($p=0.067$ and $p=0.619$, respectively). The results of this research suggest that the origin of *Salmonella* isolates does not affect adhesion, invasion and cell damage capacity; moreover, the ability of environmental *S. Oranienburg* and clinic *S. Infantis* to survive intracellularly could be intensified in environments under stress conditions.

Keywords: *Salmonella*, adhesion, invasion, intracellular survival, cell viability.

Ozone as Disinfection Alternative in Municipal Wastewater treatment plant and its effect on indicators of viral surrogate

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Agriculture is the main economic activity in Sinaloa, but water availability has been insufficient to meet its demand, therefore it has been considered the use of regenerated water. The wastewater treatment plants use chlorine to reduce the microbial load, including pathogenic bacteria and viruses. The use of chlorine generates Trihalometanes (THMs), which are known to be potential carcinogenic compounds to humans. Ozone is considered a suitable disinfection alternative for eliminating microbial pathogens without generating disinfection by-products. Phages are surrogates of pathogenic viruses such as Hepatitis A. Consequently, this work proposes to determine *in vitro* the ozone concentrations and contact time (CT) necessary to reduce at least 3 log₁₀ PFU/mL of a viral surrogate. The Costa Rica Wastewater Treatment Plant (WWTP) located in Culiacan, Sinaloa, was selected as a case study, using Coliphage MS-2 ATCC®-15597TM as viral surrogate. For CT values, a sample of 10 L of clarified water from the WWTP was taken, and transported to LANIIA-CIAD. Two-liter volume of clarified water was sterilized and inoculated with a known concentration of MS-2 to obtain 1x10⁷ PFU/mL. Approximately 70 mg/L gaseous ozone was injected to sample to an oxygen flow rate of 0.5 L/min, taking readings of residual ozone and sampling at 3, 4, 5, 6, 7 and 8 minutes contact time. The Coliphages were detected using the double agar overlay technique. The bacterial host used was *E. coli* ATCC® 15597-B1TM. The reduction of 3 log₁₀ PFU/mL was given at 6 minutes with a CT of 0.18 mg/L*min. The results demonstrate that ozone is an appropriate disinfection method for wastewater reuse, as the CT value was confirmed satisfactorily in the EPA parameters for viral reduction by ozone.

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Keywords: treated wastewater, Agriculture, Coliphages

Effect of bioactive compounds from *Melipona beecheii* honey on hemolytic activity and virulence genes from *E.coli* O157:H7

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Current studies, based on ethnographic knowledge, have reported that honey from *Melipona beecheii*, a stingless bee from Yucatan, has antibacterial activity against numerous pathogens. The main objective of this work was to evaluate the effect of bioactive compounds from *Melipona beecheii* honey on pathogenicity from *E. coli* O157:H7. Recent outbreaks of hemorrhagic colitis and hemolytic uremic syndrome caused by this pathogen were strongly related with contaminations in food, mainly meat and vegetables, and the emerging of antibiotic resistance could make future outbreaks difficult to manage. Also, *E. coli* O157:H7 has different mechanisms of infection that are related to the colonization of digestive cells. Methods: The protein extracts (PE) were obtained by ultrafiltration and phenolic extracts (PhE) were extracted using Amberlite X-2. The antimicrobial potential of Melipona honey, PE and PhE were determined by disk diffusion and micro-dilution methods. The anti-hemolytic activity of Melipona honey and both extracts were determined according to Seong et al 2010. On the other hand, primers were designed and tested to detect housekeeping and virulence genes of *E.coli* O157:H7. Results: Melipona honey, PE and PhE showed antibacterial effect inhibiting the growth of *E.coli* O157:H7. The MICs of Melipona honey, PE and PhE for *E.coli* O157:H7 were 17% (v/v), 55 µg/mL and 180 µg/mL, respectively. The Melipona honey was able to diminish the hemolytic activity of the O157:H7 strain up to 94.3% compared to control. Similarly, relevant results were obtained using PE and PhE; both extracts inhibited the hemolytic activity of *E.coli* O157:H7 up to 98.5% and 96.9% respectively. On the other hand, virulence genes were detected using PCR standard protocols to confirm that the hemorrhagic strain was employed in this study. Conclusion: Melipona honey, PE and PhE inhibited the growth of *E.coli* O157:H7. Also, PE and PhE reduced the hemolytic activity of this pathogen. Further investigation is needed for the isolation and structure elucidation of bioactive protein and phenolic compounds in *Melipona beecheii* honey.

Keywords: hemolytic activity, honey, antimicrobial

Virulence and Antimicrobial Resistance Profiles of Shiga Toxin-Producing *Escherichia coli*. Recovered from Domestic Farm Animals in Culiacan, Sinaloa

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Shiga toxin-producing *Escherichia coli* (STEC) are zoonotic enteric pathogens associated with human gastroenteritis worldwide. STEC strains have been isolated from a variety of animals. Cattle are considered to be the major animal reservoir, followed by sheep, goats, and other domestic and wild animals. In our study, we characterized the genotypic diversity, virulence profiles, and antimicrobial resistance of O157 and non-O157 STEC strains, recovered from domestic farm animals, raised in small rural communities within the agricultural Culiacan Valley in Sinaloa. By using a selective enrichment and isolation protocol, serotype O157:H7 strains were identified in 40% (26/65) of the recovered strains from cattle, sheep and chicken feces. The clinically-relevant non-O157 serotypes O8:H19, O75:H8, O111:H8 and O146:H21 represented 35.4% (23/65) of the strains, mostly from sheep. Furthermore, the genetic relatedness of the strains was analyzed by the genotyping methods pulse-field gel electrophoresis and multiple-locus variable-number tandem repeat analysis to obtain a better understanding of the diversity of zoonotic STEC in the region. Analysis of the allelic diversity indicated that the O157:H7 strains were highly related but a greater genotypic diversity was observed in the non-O157 strains. Genotyping assays revealed the presence of virulence genes coding for adhesins, cytotoxins, effectors, and Shiga toxin (Stx) subtypes in the tested strains. To examine the relative toxicities of the STEC strains, a fluorescent Vero cell-based assay was employed to measure the inhibition of protein synthesis by Stx. Non-O157 strains with serotypes O8:H19 O75:H8 and O146:H8 were found to have an enhanced ability to inhibit protein synthesis in Vero cells while a reduced cytotoxicity was observed for all O157:H7 strains. Antimicrobial resistance in STEC strains were tested using the Kirby-Bauer disk diffusion method to test 15 antimicrobials, representing 11 distinct classes of antimicrobials. The STEC strains exhibited antimicrobial resistance to aminoglycosides, tetracyclines, cephalosporins and penicillin, which are commonly used in Mexico. In conclusion, zoonotic STEC with virulent genotypes are present in animals on small farms in the Culiacan Valley, and these findings emphasize the need for the development of control measures and surveillance of antimicrobial resistance in an important agricultural region in Northwestern Mexico.

Keywords: Zoonosis, cytotoxicity, STEC, antimicrobial resistance, genotyping

Detection of numerous *Vibrio parahaemolyticus* serotypes with toxigenic genes and antibiotic resistance from raw oyster in Pacific Northwest coast of Mexico

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Vibrio parahaemolyticus is one of the most important seafood-borne bacterial in recent years and is the leading causal agent of human acute gastroenteritis, primarily following the consumption of raw, undercooked or mishandled marine products. In Mexico, since 2004 pandemic *V. parahaemolyticus* strain O3:K6 has endemically established in the Pacific Coast of Mexico. In the present study an evaluation of the serotypes by using a commercially available *V. parahaemolyticus* antiserum, distribution of virulence genes (*tdh* and *trh*) and presence of pandemic O3:K6 strains (*tdh*, *toxRS/new*, and *orf8*) by PCR, and antibiotic resistance of most commonly used were investigated in oyster samples from 2012 to 2014. In the present study, 105 (n=33, 2012; n=35, 2013; and n=37, 2014) oyster samples were collected from Pacific coast and analyzed for the presence of *V. parahaemolyticus*. In overall, 55.23% (58/105) belonged to *V. parahaemolyticus* in oyster samples, detecting 51.5% (17/33), 57.1% (20/35) and 56.75% (21/37) in 2012, 2013 and 2014 respectively. In serotyping we identified 10 serovars, with the predominantly serotype OUT:KUT with 27.58% (16/58). New serotypes O4:K13 and O8:K22 were found, who were not previously reported in our investigations conducted in clinical, shrimp, seawater and sediment samples from 2004 to 2013. Whereas 17.24% (10/58) belonged to toxigenic clones (*tdh* and/or *trh* positive), no pandemic (*tdh*, *toxRS/new*, and *orf8*) traits were detected. Among *V. parahaemolyticus* strains isolated, 86.2% showed resistance to at least one commonly prescribed antibiotic, and all the strains had resistance to ampicillin with 100% and high susceptibility was obtained from tetracycline (96.6%), nalidixic acid (91.4%), which can be used as an alternative antibiotic therapy. In conclusion, we detected in oyster a high proportion of *V. parahaemolyticus*, with a great diversity of serotypes and high antibiotic resistance to commonly therapy used. Thus, the presence of pathogenic strains in seafood (oysters) and antibiotic resistance are a matter of concern for public health authorities, as the potential of outbreaks along the northern Mexican coastline of the Pacific Ocean is now well established. Routine monitoring of seafood and shellfish should be established in northwest of Mexico.

Characterization of Phenotypic, Genotypic Resistance and Serogroups of *Salmonella* Isolated From Food Items in Northwestern Mexico.

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Salmonella is one of the main causative agents of foodborne disease worldwide especially in developing countries as Mexico, their pathogenic potential and abilities to harbor and spread resistance have tremendous medical, public health and economic problems affecting animals and humans. The present work was aimed to determine the prevalence, antimicrobial resistance and genes conferring resistance to the main antibiotics used in *Salmonella* strains isolated from food samples. In this study, we conducted a large microbiological survey to determine the prevalence of *Salmonella* in 2,651 food items and beverages consumed throughout Sinaloa state during 2011 to 2014. All the *Salmonella* strains were identified by conventional bacteriology methods and PCR assays, serogroups were determined with hyperimmune sera, antimicrobial susceptibility for the main antibiotics was evaluated using the disk diffusion tests and antimicrobial resistance genes were screened by PCR. The overall percentage of *Salmonella* prevalence detected was 2.71% (72/2,651) in food items. Prepared food and meat products were the most contaminated with *Salmonella* (5.97 and 2.04%; respectively), however, in fruits and vegetables samples were not detected. Among these isolates, *Salmonella* serogroup E and B were most common identified and more than 72% were resistant to at least one commonly prescribed antibiotic and were more resistant to cefotaxime, ceftazidime and tetracycline. Furthermore, the results revealed that more than 56% of *Salmonella* isolates were multi-drug resistance (MDR) and three strains were resistant to seven of nine antibiotic tested. Isolates carrying plasmid were 91.6% and had 1–4 plasmids whose size ranged between 1.0 and 10 kb. Thirteen plasmid DNA profile was found in all strains. Approximately, 67% of *Salmonella* harbored single or multiple antimicrobial resistance genes. The principal genes conferring resistance to aminoglycosides and trimethoprim were *aadB* and *drfA12* in all the resistant *Salmonella* strains. Likewise, the β -lactamase encoding gene *bla_{CTX-M-15}* and *sul-2* for sulfonamides were detected in 95% and 66% respectively. Moreover, two or more resistance encoding genes co-existed in a single *Salmonella* isolate and found a strain that contained eight different gene cassettes for antibiotic resistance. This study highlights the emergence of *Salmonella* resistance and MDR that posing a threat to public health.

Keywords: *Salmonella*, Food, Multi-drug resistance, gene.

***Salmonella* and *Listeria monocytogenes* behavior In Ranchero Cheese (Fresh Cheese)
At Dynamic Temperature conditions.**

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Ranchero cheese is a high consumed food in México. Cheese sale in public markets is frequently without refrigeration storage during several hours. That condition could favor microbial growth, spoilage food and to increase risk for the consumer. The objective of this work was investigate *Salmonella* and *Listeria monocytogenes* behavior in ranchero cheese stored at dynamic temperature condition. Rifampicin-resistant pathogens strains were independently inoculated in commercial ranchero cheese portions (10g and 3 LogCFU/g) and stored at sequential temperature conditions (4-7°/12h, 22°C/8h, and 30°C/4h). Periodically, three cheese portions were taken for pathogens enumeration by the spread plate in tripticase soy agar added with rifampicin (200ppm). All plates were incubated at 35°C for 24 h. Additionally, non inoculated cheese portions were included to pH and acidity measure and lactic acid bacteria (LAB) enumeration. The study were performed 3 times. Some colonies from enumeration plates were confirmed by biochemical tests. *Salmonella* showed ability to grow in ranchero cheese, from 3.8 to 6 Log CFU/g. In contrast *L. monocytogenes* at the same conditions showed an inactivation trend; this behavior could be associated to LAB activity. LAB concentration in cheese started at 6.8 LogCFU/g and finished at 8.1 Log CFU/g. Also, pH level decreased from 7.0 to 5.9, and acidity cheese increased from 0.14 to 0.4 % of lactic acid. Other authors have been reported *L. monocytogenes* growth in a similar cheese; research about the influence of cheese composition, Aw and microbiota on pathogens behavior is needed to design effective control measures to improve fresh cheese safety.

Keywords: Ranchero cheese, *Salmonella*, *Listeria monocytogenes*, dynamic temperature conditions

Genomics and Phylogeographic of *Salmonella* in Mexico

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Salmonellosis is a foodborne disease, quite common and widespread, which causes tens of millions of cases worldwide every year. Since the 1990s *Salmonella* strains resistant to antibiotics have been appearing and it is currently a serious public health problem. National and Regional surveillance systems are important for early detection of *Salmonella* and other intestinal infections, with the aim to prevent its further spreading. Thus the aim of the study is to analyze the phylogeographic distribution of *Salmonella* to implement it as an analysis tool focused on understanding and preventing the effects of ETAs. Up to now, whole genome of 417 *Salmonella* strains have been sequenced in SENASICA, which were isolated for the National Public Health Laboratories Network (RNLSP). The first step was the implementation of a phylogeographic data base for registration, issuance and reporting of results to statesmen. In the second stage and based on genomic data that were obtained, we built a phylogeny of all serotypes that was formed using molecular markers, with these results we observed a correlation with the metadata of the phylogeographical analysis and predominant serotype, all of which was based on the design of molecular markers, using the Phylomark free software. In addition, it was possible to perform the detection of antibiotic resistance genes using the program SRST2 (Short Read Sequence Typing for Bacterial Pathogens) and it was concluded that the *Salmonella* sequenced have a tendency to be grouped according to geographic region, indicating a possible the similar distribution, so this type of study can help discern the introduction of foreign serotypes and continental spread. In addition, major antibiotics which the sequenced strains offer resistance to are aminoglycosides, tetracyclines and streptomycins. Serotypes with a greater number of antimicrobial resistance genes are Typhimurium, Agona and Anatum. Through resistance genes it was possible to observe a geographical grouping, which is possible due to strains of the same region with the same genomic diversity. Phylogeographical analysis provides a framework for monitoring and overall management of ETAs and bacterial antibiotic resistance.



ADDENDUM

Influence of Extraction Method on Antioxidant Activity and Phenolic Profile of 4 Plant Materials

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Several extraction methods are used in the recuperation and isolation of plant antioxidant compounds. However, parameters like extract yield and antioxidant activities of the extracts are significantly different, mainly due to the applied technology, chemical characteristics of extracts and the solubility of extract in a particular solvent. The aim of this work was to analyze the antioxidant properties of plant extracts obtained by different technologies (conventionals and emergings) and characterize the phenolic profile. The plant materials used were pomegranate peel (PP), walnut shell (WS), and moringa (ML) and hojasen leaves (HL). Extraction of polyphenolic compounds was carried out using water as extraction agent, and subjecting the material to conventional (maceration and decoction) and emerging (microwave and ultrasound assisted extraction) extraction processes. In the resultant extracts it was evaluated the total polyphenolic content (TPC) and antioxidant activities by DPPH, ABTS, reducing power (FRAP), and lipid-peroxidation assays. Finally, the characterization of the phenolic profile was performed using UPLC (Ultra Performance Liquid Chromatography). MS spectra were acquired in negative mode using electrospray ionization (ESI). The highest values of total polyphenolic content in all plant samples were obtained with microwave-assisted extraction (EAM): PP ($378.46 \mu\text{g mL}^{-1}$), ML ($303.83 \mu\text{g mL}^{-1}$), HL ($227.27 \mu\text{g mL}^{-1}$) and WS ($180.57 \mu\text{g mL}^{-1}$). In addition, it was observed a high antioxidant activity (data not shown) in all extracts, which may be due to the high content of bioactive substances native from each plant material. In PP were identified dihydrocaffeic acid (phenolic acid), HHDP-hexoside (ellagitannin) and punicalin (ellagitannin). Quercetin 3-O-glucuronide, 3-caffeoylquinic acid (phenolic acid), and miricetin 3-O-arabinoside were abundant in moringa extracts (ML). Hojasen extracts (HL) had the presence of cinnamic acid (phenolic acid), caffeoyl tartaric acid (phenolic acid) and apigenin 7-O-glucoside (flavone). Finally, in WS were found compounds such as juglone (quinone) and 3-o-peonidin galactoside (anthocyanin). Microwave extraction provides greater technological efficiency in the extraction of polyphenolic compounds with high antioxidant capacity compared with other technologies. Through the UPLC characterization for different plant extracts it can be established that the extraction technology influences the release of various polyphenolic compounds.

Keywords: polyphenolic compounds, extraction, technology, effect

Optimization of Extraction of Oleoresins from Jalapeño Pepper.

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Pepper is one of the main crops in Chihuahua, but the ripe fruit is not fully employed due to the low cost that farmers sell the red Jalapeño Pepper. The mature fruit is rich in groups of compounds as capsaicinoids and carotenoids. The purpose of this work is to optimize the extraction process of oleoresin from green and red Jalapeño Peppers, to give added value to red Jalapeño. The oleoresins have various applications among the most important are: replacement of artificial colorings in foods and as flavorings, having a broad market. The extraction process of oleoresin from green and red Jalapeño Peppers was optimized in 2 presentations: fresh and dehydrated. For dehydrated Pepper it was washed, dried and ground to a particle size < 0.5 mm. The experiments where carrier change the ethanol concentration and the solvent ratio Pepper was varied was held for 1h and extraction time at 23° C, the pungency of peppers measured by HPLC-DAD with a C18 column, with a 48:52 mobil phase 0.5% water acidified with TFA and acetonitrile. Turn a study of total phenols was also performed by the Folin Ciocalteu. The information collected was evaluated by a central composite design for two factors using the Minitab 17 software and design expert. In the extraction processes and Folin fresh red and green Jalapeño Peppers lack of fit are nonsignificant ($p > 0.5$) and the effect of factors are significant ($p < 0.5$). For dehydrated red and green chili a cubic model was used for the lack of fit test. The pungency obtained was 18000 SHU for fresh green Jalapeño Pepper, 35000 SHU for fresh red Jalapeño Pepper, 143000 for dehydrated green Jalapeño Pepper, and 118000 SHU for dehydrated red Jalapeño Pepper. Total phenols values were found at 20 to 50 milligrams per gram of oleoresin of fresh peppers and 40 to 85 milligrams per gram of oleoresin of dehydrated pepper.