food structure design

# İÇİNDEKİLER

food structure design

2nd Congress

# Food Structure Design

26-28 OCTOBER 2016 - ANTALYA , TURKEY

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# CHAIRS'S MESSAGE

I would like to thank you for your interest in the 2nd Food Structure Design Congress held in Antalya, Turkey on 26-28 October 2016. This congress series was started firstly in Porto, Portugal in 2014 as a continuation of COST Action FA1001 which is completed in 2014.

The main aim of the Food Structure Design Congress is to strengthen the understanding of food product design engineering and help to accelerate the development progress of innovative food products. It is also aimed to share knowledge and technologies among scientists and food industry for design of healthy and functional food products. Hence, the main topics of this congress are design of health supporting food products with improved food structure and the increase bioavailability of nutrients in complex real multiphase structured foods with acceptable sensorial quality.

We have had 142 presentations from 28 different countries, including Turkey. I hope that the congress helps you to get a recognition of current state of research and the challenges to future discovery, present your latest research, meet with colleagues from all around the world and also explore beauties of Antalya in your free time. Some of our willing participants will have a visit to the Aspendos antique theater and botanic EXPO2016 within the social program of the congress and hopefully they will enjoy.

All abstracts, presentation slides, photographs and video recordings, which is received permission, will be published at the webpage of congress after the event, so please keep following our official webpage, www.fsd2016.org

I would like to express my thankfulness to the members of the Organizing Committee for all their hard work and to the members of the Scientific Committee for their great efforts in evaluating many of the abstracts. I also would like to thank to all participants, speakers, session chairs, sponsors and Leon Congress who helped the congress happen.

I hope to see you again in Antalya, Turkey in the future.

Sincerely Yours,

Assoc. Prof. Dr. Mustafa ERBAŞ
Chair of Congress

Akdeniz University
Food Engineering Department.

Antalya, Turkey

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# CONGRESS SCHEDULE

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| OCTOBER 26, 2016 WEDNESDAY | | |
|---|---|---|
| 09:00 – 09:45 | Registration | |
| 10:00 – 10:20 | Opening Ceremony – Mustafa ERBAS | |
| 10:20 – 11:00 | **Keynote Lecture of Conference – Gustavo V. Barbosa-Cánovas "High pressure effects on the structure of selected food products"** | |
| 11:00 – 11:30 | Coffee Break | |
| **Opening Chair: Laura Piazza, Milano University, Italy** | | |
| 11:30 – 11:50 | **Lisa Michelle Zychowski** *Teagasc Food Research Center, Fermoy, Ireland* | The Use of Synchrotron X-ray Scattering in Designing Functional Food Matrices with Improved Bioavailability |
| 11:50 – 12:10 | **Pedro Bouchon** *Pontificia Universidad Catolica de Chile, Chile* | Enhancing micro-CT methods to quantify oil content and porosity in 3D-microstructure of starch-gluten matrices. |
| 12:15 – 13:30 | LUNCH (Main Restaurant) | |
| **SESSION 1** **Chair: Prof. Lidia Zander, Olsztyn University of Warmia and Mazury, Poland** | | |
| 13:40 – 14:10 | **Invited Speaker – Antonio Vicente** *University of Minho, Portugal* | Micro/nanostructures in foods. |
| 14:10 – 14:30 | **Li Yoke Ho** *Monash University, Malaysia* | Encapsulation of Xanthone As A Model To Enhanced Aqueous Solubility Of α-Mangostin |
| 14:30 – 14:50 | **Dilhun Keriman Arserim Ucar** İzmir Institute of Technology, Turkey | Eugenol Encapsulated Poly(lactic acid) (PLA) Active Fibers for Controlling Postharvest Diseases of Table Grapes |
| 14:50 – 15:10 | **Ilyes Dammak** *FZEA, University of Sao Paulo, Brazil* | Encapsulation of Antioxidants in Biopolymeric Emulsion-Based Edible Films |
| 15:10 – 16:00 | Poster Session 1 – Poster Room & Coffee Break | |
| **SESSION 2** **Chair: Prof. Song Miao, Teagasc Food Research Centre, Ireland** | | |
| 16:00 – 16:20 | **Birol Kilic** *Suleyman Demirel University, Turkey* | Improving storage stability of cooked beef patties with encapsulated phosphate incorporation |
| 16:20 – 16:40 | **Mohammed Loudiyi** *VetAgro Sup, France* | Study of salt and heating effects of model cheeses by Synchronous Fluorescence and Rheology coupled with chemometrics tools |
| 16:40 – 17:00 | **Baris Yalinkilic** *Igdir University, Turkey* | The Effects of Sodium, Potassium, Calcium, and Magnesium Chloride Salts on The Physico-Chemical, Microbiological, and Sensory Properties of Pastırma |
| 17:00 – 17:20 | **Kurnia Ramadhan** *The University of Nottingham, United Kingdom* | Effects of Ball Milling on the Selected Properties of High Protein Oat Bran Powder and Slurry |
| | | |
| 18:30 – 19:30 | DINNER (Main Restaurant) | |
| 19:30 – 21:30 | Welcome Cocktail at Sailors Lounge in Porto Bello Hotel | |

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| OCTOBER 27, 2016 THURSDAY | | |
|---|---|---|
| **SESSION 3**<br>**Chair: Prof. Zoltan Gyori, University of Debrecen, Hungary** | | |
| 09:00 – 09:30 | **Natasa Poklar Ulrih**<br>*University of Ljubljana, Biotechnical Faculty, Slovenia* | Encapsulation of (-)-epigallocatechin gallate into liposomes and into alginate or citosan microparticles reinforced with liposomes |
| 09:30 – 09:50 | **Niloofar Ashtari Larki**<br>*German Institute of Food Technologies, Germany* | Physical properties and structure of insect-based meat analogs with high-moisture extrusion cooking |
| 09:50 – 10:10 | **Mehmet Koc**<br>*Adnan Menderes University, Turkey* | Influence of Vacuum Frying Conditions on Oil uptake, Textural and Microstructural Properties of French Fries |
| 10:10 – 11:00 | Poster Session 2 – Poster Room & Coffee Break | |
| **SESSION 4**<br>**Chair: Prof. Drazenka Komes, University of Zagreb, Crotia** | | |
| 11:00 – 11:30 | **Invited Speaker - Laura Piazza**<br>*University of Milano, Italy* | Design of new generation green food ingredients: natural structuring with cell wall materials |
| 11:30 – 11:50 | **Hulya Cakmak**<br>*Ege University, Turkey* | Effect of electrosprayed edible coatings on shelf-life stability of fresh-cut apple slices |
| 11:50 – 12:10 | **Artur J. Martins**<br>*University of Minho, Portugal* | Impact of β-carotene fortification on rheological, oxidative and physical properties of beeswax oleogels |
| 12:15 – 13:30 | LUNCH (Main Restaurant) | |
| **SESSION 5**<br>**Chair: Prof. Ayhan Topuz, Akdeniz University, Turkey** | | |
| 13:45 – 14:15 | **Invited Speaker – Ferruh Erdogdu**<br>*Ankara University, Turkey* | Food structure effects for process design and mathematical modeling |
| 14:15 – 14:35 | **Aicha Jelled**<br>Universite de Monastir, Tunusie | Protective effect of ginger on hematological, biochemical, and genotoxic alterations in dimethoate exposed rats |
| 14:35 – 14:55 | **Emin Burcin Ozvural**<br>*Cankiri Karatekin University, Turkey* | The effects of cooking method, cooking severity and digestion time on chemical and structural characteristics of frankfurters during in vitro gastric digestion. |
| 15:00 – 16:00 | Poster Session 3 – Poster Room & Coffee Break | |
| **SESSION 6**<br>**Chair: Prof. Hüseyin Erten, Çukurova University, Turkey** | | |
| 16:00 – 16:30 | **Nurcan Koca**<br>*Ege University, Turkey* | The physical and reconstitution properties related to chemical and sensory properties of spray-dried white cheese powder packaged in different materials |
| 16:30 – 16:50 | **Abdorreza Mohammadi Nafchi**<br>Islamic Azad University, Iran | Mechanical, Physicochemical, and Antimicrobial-Antioxidant Properties of CMC based films incorporated of lemon verbena essential oil |
| 16:50 – 17:10 | **Elif Akbas**<br>Izmir Institute of Technology, Turkey | Effect of homogenization type on the formation of capsaicin-loaded nanoemulsions |
| 17:10 – 17:30 | Poster Presentation Voting and Counting | |
| 19:30 – 23:30 | GALA DINNER - Porto Bello Hotel Colombus Restaurant | |

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| OCTOBER 28, 2016 FRIDAY | | |
|---|---|---|
| **SESSION 7**<br>**Chair: Prof. Natasha Poklar Ulrih, University of Ljubljana, Slovenia** | | |
| 09:00 – 09:30 | **Invited Speaker – Olga M. Belloso**<br>*University of Lleida, Spain* | Advantages of the nanoscale in engineering safer and healthier foods. |
| 09:30 – 09:50 | **Bernard Rwubatse**<br>*University of Rwanda, Rwanda* | Effect of drying methods on physical and sensory characteristics of biscuit made from wheat flour supplemented with the flour of orange fruit (citrus sinensis) peels. |
| 09:50 – 10:10 | **Elif Tugce Aksun**<br>*Cukurova University, Turkey* | Combination effects of cell-free supernatant of lactobacillus plantarum and pediococcus acidophilus and plant extract (thyme and laurel) on textural properties of fermented sardine. |
| 10:10 – 10:25 | Coffee Break | |
| **SESSION 8**<br>**Chair: Gustavo V. Barbosa-Cánovas, Washington State University, USA** | | |
| 10:25 – 10:45 | **Ebru Deniz**<br>*Ankara University, Turkey* | Protein secondary structures by fourier transform infrared spectroscopy to identify fraudulent meat mixtures. |
| 10:45 – 11:05 | **Guy Jones**<br>*Stable Micro Systems, United Kingdom* | New trends on texture analyses equipments. |
| 11:05 – 11:15 | Oral Presentation Voting and Counting | |
| 11:15 – 11:30 | **Evaluation Speech by Conference Chair** | **Award Ceremony** |
| 11:30 – 12:00 | **Hotel Check/outs** | |
| 12:00 – 13:00 | LUNCH | |
| 13:00 – 18:00 | **Social Program**<br>• Aspendos Antique Theatre Antalya Trip (1 hour)<br>• EXPO 2016 Antalya Trip (3 hours) | |

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# INVITED SPEAKER PRESENTATIONS

# INTIVED SPEAKER PRESENTATION LIST

I-01 High pressure effects on the structure of selected food products. Gustavo Victor Barbosa-Canovas

I-02 Micro- and nano-structures in foods. Antonio Vicente

I-03 Design of new generation green food ingredients: natural structuring with cell wall materials. Laura Piazza

I-04 Food structure effects for process design and mathematical modelling. Ferruh Erdogdu

I-05 Advantages of the nanoscale in engineering safer and healthier food products. Olga Martín-Belloso

**I-01**

# High pressure effects on the structure of selected food products

Gustavo Victor Barbosa-Canovas

High pressure processing (HPP) of food has positively impacted the food research circles as well as the food industry. Pressures of 300 MPa and above promote significant changes on the physical properties of food constituents. The freezing point of water goes down, the crystals generated under these elevated pressures differs from those attained at the atmospheric. The structure of foods changes due to high pressure processing are very significant. These changes in structure, in many cases, bring positive outcomes such as the reduction of syneresis in yogurts, better yields at the time of processing a variety of cheeses, excellent quality of fruit based products such as jams and jellies. At the same time, some deleterious effects take place which make high pressure processing questionable for some applications. This bird-eye view presentation covers some of the highlights of the changes induced by HPP on selected food products emphasizing structural/microstructural aspects.

**Keywords:** High pressure effect, microstructure

**I-02**

# Micro- and Nano-structures in Foods

António A. Vicente

CEB - Centre of Biological Engineering, University of Minho, 4710-057, Braga, Portugal

The development of bio-based nanostructures out of food-grade ingredients for diverse applications has been a hot topic in food, pharmaceutical and packaging fields. Their potential for these specific applications lays in the fact that they can be entirely composed of biocompatible and non-toxic materials, together with their improved/new properties stemming from their nano-size, which could change significantly their behavior.

The main challenges in the development of such nanostructures are posed at two levels: 1) their construction from food-grade ingredients - mostly proteins, polysaccharides and lipids - which often do not have the ideal properties to be used as building blocks for this type of structures; and 2) their characterization - which needs to be made with special care due to the small dimensions of the systems under study - followed by the understanding of the consequences of their properties in their performance once incorporated in a material or once in contact with living systems, being this crucial to understand e.g. their potential toxicological effects.

This presentation will focus on the main achievements of our group regarding these two main challenges, together with our view of future developments.

**Keywords:** Nanolaminates, nanohydrogels, micro and nanoencapsules

**I-03**

# Design of New Generation Green Food Ingredients: Natural Structuring with Cell Wall Materials

Laura Piazza

DEFENS - Università Degli Studi di Milano, Italy

In product formulation engineering, there is a growing interest toward second-generation carbohydrate food ingredients delivering multi-functional properties.

The use in food formulations of single biopolymers extracted from plant cell walls is recognised since long: in particular several groups of these polymers are found to play a role as food thickeners, stabilizers, and emulsifiers. In recent years a new approach based on solvent extraction from vegetal sources has allowed to obtain a new family of multicomposite ingredients, which maintain the intrinsic supramolecular organization. Cell Wall Materials (CWM) can be described as a self-assembled network of cellulose microfibers embedded in a matrix of pectin and hemicellulose and this particular organization imparts them peculiar technological performances, other than a recognized nutritional role. Indeed these structures have been optimized by Nature through years of evolution in order to reply to specific necessities of living beings. In particular, one of the main advantages of biological systems in situ is multifunctionality that is their ability to perform multiple tasks contextually.

Through rheological studies, the formation of an interconnected gel-like network, once CWMs are hydrated, has been evidenced. The rehydration of dried CWM ingredient can transform the system to a viscoelastic soft solid. CWMs show striking self-healing properties, that means these materials are able to recover their original mechanical behaviour following the perturbation of the structure (miming food processing stresses), likely as a consequence of a structural rearrangement of macromolecules. These findings provide a premise to the use of CWMs to modulate food texture. On the other hand, the knowledge about diffusion phenomena through cell walls is limited mainly to investigations of gas phases migration targeted to a better understanding of plant physiology. Once extracted CWMs can be considered as an assemble of small porous ‘boxes’. Thus, understanding the diffusion mechanisms across the self-assembled CWM structure opens perspectives of use CWM as a micro-reactor, so fulfilling the criterion of “second generation” food ingredients. Current knowledge on the structural character of these hydrogels suggests a wide spectrum of application in food formulation, in view of use as water-binding, fat-binding, thickening agents, and stabilizers in foods.
Moreover, using appropriate plant tissue (eg. food waste) as CWM source, would be desirable for the food industry in terms of sustainability and environmental impact.

**Keywords:** Green food ingredients

I-04

# Food Structure Effects for Process Design and Mathematical Modeling

Ferruh Erdogdu

Ankara University, Department of Food Engineering, Ankara, Turkey

Merriam-Webster dictionary defines structure as `something arranged in a definite pattern` or `arrangement of particles or parts in a substance`. Food structure with this definition starts from molecular to larger bulk scale and plays a significant challenge for food process innovation. With emerging technologies, re-designing food processes using modeling approaches for process innovation – control purposes started for safer, more convenient and healthier products while food structure was recognized to affect quality. Therefore, the objective of this presentation is to demonstrate food structure effect for better process design by highlighting mathematical modeling and innovative approaches of infrared and radio frequency and food packaging - storage processes.

Infrared is used for surface pasteurization of food commodities, and transmitted energy is attenuated exponentially with penetration distance while its intensity decreases. Knowing penetration thickness helps process design, and food structure is one significant parameter for this purpose. For spices, penetration depth changes with porosity and arrangement of grain structure, and this should be considered for process design. Radio frequency is utilized for various food processes, and non-uniform temperature thorough the product due to geometrical structure is a major challenge. Bulk volume or arrangement pattern for industrial use are possible effects leading to reduced quality. Mathematical analysis of various patterns for geometrical arrangements might help overcome this challenge. Storing fruits after harvest under controlled atmosphere at low temperature is another process to possibly innovate using the food micro-structure. Determining optimal gas concentration is critical to prevent fermentation problems and browning disorders. In the fruit tissue, intercellular space affects gas exchange, and therefore including the micro-scale mechanism of gas exchange in the tissue to determine the concentration within the volume is significant. Therefore, Fick diffusion models based on average diffusion coefficient value becomes obsolete while structural modeling would better predict this multiphase exchange.

Process modeling approaches might be a certain way to overcome the challenges coming from the food structure, and they are required for better design including food structure effects. Besides the given examples at a level of macro- and micro-scale, there are still areas where modeling approaches have not yet played a role like structural changes in the food components (e.g. changes in the protein structure – denaturation). Including these structural changes into a mathematical description in a molecular level might give a certain benefit to better understand and suggest innovations to food industries.

**Keywords:** Food structure, process design**,** mathematical modelling

## I-05

# Advantages of the Nanoscale in Engineering Safer and Healthier Food Products

Olga Martín-Belloso, Alejandra Acevedo-Fani & Robert Soliva-Fortuny

University of Lleida, Spain

Nanotechnology is showing promising advantages for the food industry. Namely, the design of food-grade nanostructured systems are currently studied to enhance the encapsulation and delivery of active ingredients, such as antimicrobials or nutraceuticals, to food products. There are a number of positive attributes associated to the use of delivery systems that have been produced by controlling their characteristics at the nanometer scale. Enhanced physicochemical stability, higher bioavailability or controlled release of active food ingredients are among the properties mostly explored. Nanostructured emulsion-based systems represent outstanding candidates for encapsulating lipophilic active ingredients, which normally are poor-water soluble, highly unstable to stressing conditions and have low bioavailability. On the other hand, nanolaminates, defined as stratified thin films obtained by the assembly of oppositely charged biopolymers, might also act as reservoirs of either hydrophilic or lipophilic active substances, providing protection and controlled released of the encapsulated compounds. Interestingly, these nanostructured systems can be applied as edible films or coatings on the surface of solid foods, representing a potential alternative to enhance the quality, safety or even functionality of such food products.

**Keywords:** Food-grade nanostructured systems

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# ORAL PRESENTATIONS

# ORAL PRESENTATION LIST

O-01 The use of synchrotron x-ray scattering in designing functional food matrices with improved bioavailability. Lisa Zychowski, Amy Logan, Mary Ann Augustin, Ben Boyd, Alan L. Kelly, Alexandru Zabara, Seamus A. O'Mahony, Tamar Greaves, Charlotte Conn, Mark A.E. Auty

O-02 Enhancing micro-CT methods to quantify oil content and porosity in 3D-microstructure of starch-gluten matrices. Ingrid Contardo, Pedro Bouchon

O-03 Encapsulation of xanthone as a model to enhanced aqueous solubility of α-mangostin. Li-Yoke Ho, Yau-Yan Lim, Chin-Ping Tan, Lee-Fong Siow

O-04 Eugenol encapsulated poly(lactic acid) (PLA) active fibers for controlling postharvest diseases of table grapes. D. Keriman Arserim Ucar, Ana M. M. Sousa, Figen Korel, Linshu Liu, Kit L. Yam

O-05 Properties of gelatin films incorporated with rutin-loaded nanoemulsions. Ilyes Dammak, Paulo José do Amaral Sobral

O-06 Improving storage stability of cooked beef patties with encapsulated phosphate incorporation. Birol Kilic, Azim Simsek, James R. Claus, Esra Karaca, Damla Bilecen

O-07 Study of salt and heating effects of model cheeses by synchronous fluorescence and rheology coupled with chemometrics tools. M. Loudiyi, R. Karoui, D.N. Rutledge, R. Lavigne, M-C. Montel, A. Aït-Kaddour

O-08 The effects of sodium, potassium, calcium, and magnesium chloride salts on the physico-chemical, microbiological, and sensory properties of pastırma. Baris Yalinkilic, Guzin Kaban, Mukerrem Kaya

O-09 Effects of ball milling on the selected properties of high protein oat bran powder and slurry. Kurnia Ramadhan, Timothy J. Foster

O-10 Encapsulation of (–)-epigallocatechin gallate into liposomes and into alginate or chitosan microparticles reinforced with

liposomes. Katja Istenič, Romana Cerc Korošec, Nataša Poklar Ulrih

O-11 Physical properties and structure of insect-based meat analogs with high-moisture extrusion cooking. Niloofar Ashtari Larki, Sergiy Smetana, Habil Marc Birringer, Stefan Töpfl

O-12 Influence of vacuum frying conditions on oil uptake, textural and microstructural properties of french fries**.** Esra Devseren, Dilara Tomruk, Mehmet Koc, Ozgul Ozdestan-Ocak, Haluk Karatas , Figen Kaymak-Ertekin

O-13 Effect of electrosprayed edible coatings on shelf-life stability of fresh-cut apple slices. Hulya Cakmak, Seher Kumcuoglu, Sebnem Tavman

O-14 Impact of B-carotene fortification on rheological, oxidative and physical properties of beeswax oleogels. Artur J. Martins, Miguel A. Cerqueira, Rosiane L. Cunha, António A. Vicente

O-15 Protective effect of ginger on hematological, biochemical, and genotoxic alterations in dimethoate exposed rats. Aicha Jelled, Amira Thouri, Jihene Ben Lamine, Tesnim Ajina, Zohra Haouas, Mariem Mahdi, Lotfi Achour, Hassen Ben Cheikh

O-16 The effects of cooking method, cooking severity and digestion time on chemical and structural characteristics of frankfurters during in vitro gastric digestion. Emin Burcin Ozvural, Gail Bornhorst

O-17 The physical and reconstitution properties related to chemical and sensory properties of spray-dried white cheese powder packaged in different materials. Candan Sahin, Nurcan Koca

O-18 Mechanical, physicochemical, and antimicrobial-antioxidant properties of CMC based films incorporated of lemon verbena essential oil. Ameneh Rezai, Abdorreza Mohammadi Nafchi

O-19 Effect of homogenization type on the formation of capsaicin-loaded nanoemulsions. Elif Akbas, Betul Soyler, Mecit Halil Oztop

O-20 Effect of drying methods on physical and sensory characteristics of biscuit made from wheat flour supplemented with the flour of orange fruit (*Citrus sinensis*) peels. Bernard Rwubatse, Peter Issah Akubor

O-21 Combination effects of cell-free supernatant of *Lactobacillus plantarum* and *Pediococcus acidophilus* and plant extract (thyme and laurel) on textural properties of fermented sardine. Elif Tugce Aksun, Esmeray Kuley Boga, Fatih Ozogul

O-22 Protein secondary structures by fourier transform infrared spectroscopy to identify fraudulent meat mixtures. Ebru Deniz, Evrim Gunes Altuntas, Beycan Ayhan, Duygu Ozel Demiralp, Kezban Candogan

O-23 Stable Micro Systems. Guy Jones

**O-01**

# The Use of Synchrotron X-ray Scattering in Designing Functional Food Matrices with Improved Bioavailability

Lisa Zychowski[1, 2, 3, 4], Amy Logan[3], Mary Ann Augustin[3], Ben Boyd[5], Alan L. Kelly[2], Alexandru Zabara[4], Seamus A. O'Mahony[2], Tamar Greaves[4], Charlotte Conn[4], Mark A.E. Auty[1]

[1]Teagasc Food Research Centre, Fermoy, Ireland
[2]University College Cork, Cork, Ireland
[3]CSIRO Food and Nutrition, Werribee, Australia
[4]RMIT University, Melbourne, Australia
[5]Monash University, Parkville, Australia

Particle accelerating synchrotrons are primarily used in fields such as physics, soft matter, and pharmaceuticals, but not extensively in food science. The presented work highlights the potential for synchrotron application in functional foods by utilizing three different types of synchrotron sample stages on a bioactive-enriched triacylglycerol emulsion system. Phytosterols are natural plant compounds which can lower low-density lipoprotein (LDL) cholesterol levels in blood, but have high melting points, making them difficult to incorporate into functional food products. Phytosterol bioavailability is dependent upon the degree of crystallinity within the carrier matrix. Thus to improve phytosterol efficacy within the presented food emulsion, this study investigated how phytosterols crystallisation occurs, how it can be prevented, and how this influences *in-vitro* digestibility through the use of Synchrotron small-angle/wide-angle x-ray scattering (SAXS/WAXS).

Triacylglycerol-based emulsions were enriched with phytosterols and studied using a single-capillary temperature-controlled stage to understand the mechanism of phytosterol crystallisation. SAXS/WAXS data demonstrated that phytosterols can integrate within a triacylglycerol network and expand the lamellar layers. In order to control phytosterol crystallisation and potentially improve bioavailability different surfactants and processing techniques were examined. High-throughput synchrotron analysis was conducted on various formulation parameters using a multi-capillary temperature controlled stage. Results showed that the combination of phospholipids and high-pressure homogenization can effectively limit phytosterol crystallisation within dispersed systems after storage. Phytosterol-enriched emulsions were further tested using an *in-vitro* human digestion model in combination with SAXS as a function of time. SAXS diffraction patterns demonstrated that the solubility of phytosterols within 200 nm emulsion droplets was higher than that of 1 µm droplets. The employment of these types of synchrotron setups highlights how this type of approach can be used to characterise the structure and functionality of food matrices. Such knowledge can lead to innovative new

bioactive-fortified functional food products, with improved bioaccessibility for human absorption.

**Keywords:** Phytosterols, plant sterols, synchrotron, crystallization, emulsion, delivery systems, bioactive, functional foods

**O-02**

# Enhancing Micro-CT Methods to Quantify Oil Content and Porosity in 3D-Microstructure of Starch-Gluten Matrices

Ingrid Contardo, Pedro Bouchon

Pontificia Universidad Católica de Chile, Santiago, Chile

Fried starch-gluten matrices have a complex and irregular three-dimensional geometry, which still is not well understood but can be attributed to several factors. Among them we can account for the pores and their connection (open or closed), the starch-gluten network generated during processing that is not uniform, and the shape and degree of swelling of starch granules, which varies depending on processing conditions. The frying process of starchy food involves irreversible events related to gelatinization where starch granules are transformed morphologically and physically, having a direct influence on the final properties of the food. X-ray microcomputed tomography (micro-CT) has been introduced as an innovative and advantageous non-destructive method to study the internal structure of foods based on the differences in density (atomic number) of the constituents of the matrix. The discrimination of certain components with low X-ray attenuation within a food matrix such as starch, protein and oil becomes a challenge when is used micro-CT. The objective of this study was to explore the potential application of different stains to modify the attenuation of components using micro-CT to analyze 3D microstructures of fried dough, and quantify the oil content and the porosity non-invasively.

Laminated dough was prepared using starch (88% db.), gluten (12% db.), and distilled water. Four samples were used (dough, dough stained with Lugol solution 25%, dough stained with Nile Red, and dough stained with both Lugol and Nile Red). Samples were fried under atmospheric conditions up to bubble-end point. In order to improve contrast of oil inside the fried matrix, the oil was previously stained with Nile Red (0.05 g/L). Oil content and total porosity of fried matrices were determined using analytical methods (Soxhlet and pycnometer) and image analysis (by micro-CT). Samples stained with Nile Red showed a very good relationship between analytical results of oil content (19.88 g oil/g de-fatted solids) and total porosity (43 %) and those obtained by image analysis (18.48 and 41, respectively). These last values were close to their counterparts without staining (18.95 and 43.58, respectively). Results showed that micro-CT has a great potential to estimate oil content and total porosity in food matrices, and that Nile Red may be used to improve attenuation among the oil, the matrix, and the pores. This work highlights the benefits of stain incorporation in micro-CT examination to improve the attenuation and subsequent visualization of fine details in food matrices.

**Keywords:** Oil content, porosity, 3D-microstructure, micro-CT, Nile red, starch

**O-03**

# Encapsulation of Xanthone as a Model to Enhanced Aqueous Solubility of α-Mangostin

Li-Yoke Ho[1], Yau-Yan Lim[1], Chin-Ping Tan[2], Lee-Fong Siow[1]

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Xanthones, particularly α-mangostin is the most abundant and commonly found in mangosteen rind. α-mangostin is rich in antioxidant and pharmacological properties. However its low water-solubility limits its application in food and pharmaceutical industries. Coacervation is a microencapsulation technique that has been reported to preserve and enhance aqueous solubility of bioactive materials, isolate or control the release of a given substance. Several studies have tried to improve the aqueous solubility of xanthones using organic solvents and synthetic polymers. The aim of this study was to use natural hydrocolloids to optimize the coacervation of xanthone followed by freeze-drying. In the current study, xanthone is used as a model to study the aqueous solubility of α-mangostin. Xanthone was encapsulated by complex coacervation using gelatin and gum Arabic. The complex coacervation process conditions were optimized using Box–Behnken design by varying pH (3.5-5.0), ratio of core-to-wall (RCW) (1:6-1:10) and stirring speed (100-400 rpm). Result shows that pH 4.5, RCW of 1:7.0 and stirring speed of 200 rpm is optimal to produce xanthone coacervates. Among the three independent variables, stirring speed had the greatest effect on encapsulation efficiency, whereas pH had the greatest effect on aqueous solubility. The current characterization study confirmed successful xanthone encapsulation with 76.0 % encapsulation efficiency, maintained chemical stability and approximately 2-fold increase in aqueous solubility of xanthone. Based on the optimized conditions for xanthone, 10% of α-mangostin was dissolved in canola oil and the emulsion was subjected to complex coacervation. Results show that α-mangostin was successfully encapsulated with 74.6 % encapsulation efficiency, maintained chemical stability and roughly 7-fold increase in aqueous solubility. Complex coacervation using natural hydrocolloids were able to improve the aqueous solubility of xanthone and α-mangostin, thus increasing their potential use as a functional food ingredient and in pharmaceutical applications. The current study serves as a model to improve aqueous solubility of other xanthone derivatives.

**Keywords:** Encapsulation, aqueous solubility, xanthones, alpha-mangostin, coacervation

**O-04**

# Eugenol Encapsulated Poly(lactic acid) (PLA) Active Fibers for Controlling Postharvest Diseases of Table Grapes

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Active ultrafine polymer fibers were obtained by electrospinning technique which is a suitable method for encapsulating of thermolabile bioactive substances. Poly(lactic acid) (PLA) fibers, formulated with bacterial cellulose nanocrystals, eugenol essential oil, and LA(Lauric Argiante) emulsions (BCNCs emulsion) were produced and spun onto PLA cast films. The formation of a bilayer fiber-grafted film composed of uniform sub-micron fibers encapsulating BCNCs emulsions spun onto the surface of the PLA cast film. The films were examined by scanning electron microscopy (SEM). The objectives of this study were to determine the feasibility of the active release of eugenol and the antimicrobial effect of the films on *Botrytis cinerea* on agar media and table grapes. Table grapes were artificially inoculated with *Botrytis cinerea,* and table grapes were placed in plastic containers with PLA films containing emulsions kept at simulated market conditions (20 °C and 90% RH). Samples without films were used as controls. Fruit decay was evaluated visually and assessed by stereo microscope. The release potency of encapsulated eugenol oil vapors from the films was confirmed by in vitro test. Films were able to inhibit and/or decrease the microbial load of *Botrytis cinerea* on agar media. The insertion of films inside the package significantly leads to reduction of decay (*Botrytis cinerea* contaminated*)* fruits. PLA fiber-grafted films promise a novel delivery system for the active release of eugenol gaseous compound as smart packaging. These films may be promising to replace synthetic fungicides used to prevent the decay of postharvest fruits and vegetables caused by *B.cinerea* at storage under marketing conditions.

**Keywords:** Electrospinning, emulsions, eugenol, bacterial cellulose, antimicrobial packaging, table grapes, *Botrytis cinerea*
**Acknowledgements:** ARSERIM-UCAR D.K. would like to thank Scientific and Technological Research Council of Turkey (TUBITAK) – 2214/A International Doctoral Research Fellowship Program. The authors thank Dr.Paul Takhistov from Rutgers University for his valuable contributions to this project.

## O-05

# Properties of Gelatin Films Incorporated with Rutin-loaded Nanoemulsions

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Application of natural antioxidants directly into food (neither in active packaging nor encapsulated form) is associated with loss of antioxidant activity due to deactivation in complex food systems. Therefore, the incorporation of antioxidants into active food packaging is currently under development as an innovative way to preserve fresh foods.

The aim of this work was to prepare gelatin-based composite films by incorporating rutin loaded nanoemulsions into the film forming gelatin solution, and to evaluate the mechanical, barrier, and microstructural properties.

Nanoemulsions of rutin (as model antioxidant) were prepared using tween and span 80, as emulsifiers, by microfluidization at 1000 MPa with 3 cycles to generates an averages droplets size of 150 nm with 85% encapsulation efficiency. Film-forming solutions were prepared using pig skin gelatin powder (5 wt%) with glycerol added as plasticizer (30/100g of the gelatin powder). Prepared nanoemulsions of rutin were added to the film-forming solutions at different concentrations, and the resulting solutions were homogenized at 10,000 rpm using a rotor-stator homogenizer for 5 min. Films were obtained by casting into polystyrene Petri dishes and dried at 30°C for 12 h. Before characterization, all the film samples were conditioned at 25°C and 58% of relative humidity, for 7 days.

The results showed that all the gelatin/rutin nanoemulsion films did not show significant differences in thickness, color, brightness and transparency. The addition of nanoemulsion causes interactions with the film matrix, inducing changes in the film hydrophobicity and water absorption flux from one side to another. The results showed that all the gelatin/rutin nanoemulsion films displayed higher tensile strength and higher elongation at break than native gelatin film. For interpreting the increase of tensile strength, we have suggested the bonding of dihydroxyphenolic group of rutin with hydrophobic domains of gelatin. The structural properties evaluated by FTIR showed that the rutin nanoemulsion achieved complete miscibility within the gelatin matrix. All the gelatin/nanoemulsion films exhibited compact and homogenous microstructure. In addition, these films showed high antioxidant activities monitored by DPPH radical scavenging and reducing power activities. The Korsmeyer-Peppas model described well the rutin release data. Rutin release was mainly governed by Fickian diffusion with simultaneous interfering swelling and disintegration phenomena. This study on the relative encapsulation of active compound by the O/W nanoemulsions and incorporation into gelatin matrix leads to promising potential applications of biodegradable emulsion-based films in the food industry.

**Keywords:** Active packaging, edible film, nanoemulsion

**O-06**

# Improving Storage Stability of Cooked Beef Patties with Encapsulated Phosphate Incorporation

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The use of polyphosphates (PP) is a common in the meat industry. PP are very effective for inhibiting lipid oxidation. However, the ability to inhibit lipid oxidation by added PP in cooked meat is reduced by phosphatases, which are found in meat. Phosphatases in raw meats hydrolyze PP. Although phosphatases are inactivated by cooking, most of the added PP is lost by the time meat is cooked. Therefore, encapsulation technology was applied to PP to protect them from phosphatases to accomplish effective lipid oxidation inhibition.

The influence of added encapsulated (e) PP (Sodium tripolyphosphate, STP; sodium pyrophosphate, SPP) levels combined with cohort unencapsulated (u) PP on improving storage stability of beef patties during 120 days storage at 4°C was investigated. Cooked patties analyzed for pH, thiobarbituric acid reactive substances (TBARS), lipid hydroperoxide (LPO) and color during storage. Samples were analyzed once for cooking loss (CL), moisture, protein, fat, ash, texture and fatty acid profile after manufacturing.

Results indicated that the use of STP led to lower ($p<0.05$) CL than that of SPP which had similar CL with control patties. Levels of added ePP combined with cohort uPP (T) did not have a significant impact on CL for both PP types. pH of the patties was affected by PP type ($p<0.05$). Although T did not control pH on manufacturing day, it affected pH at the end of storage ($p<0.05$). The SPP incorporated patties had lower ($p<0.05$) TBARS and LPO than those treated with STP, regardless of T and storage time. Using 0.25% or 0.5% ePP in formulation significantly ($p<0.05$) reduced TBARS and LPO formation for both PP types. There were no significant differences among groups regarding color, moisture, protein, fat, ash, texture and fatty acid profile.

**Keywords:** Encapsulated polyphosphate, lipid oxidation, beef, hamburger patty

Appreciation is expressed to TUBITAK for providing financial support for this work (Project no: 111O261).

**O-07**

# Study of Salt and Heating Effects of Model Cheeses by Synchronous Fluorescence and Rheology Coupled with Chemometrics Tools

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In addition to attributing a salty taste, NaCl is important for physicochemical, microbiological, and sensory characteristics of cheese. However, due to its adverse health effects, great demand exists to reduce its level in cheese. Reducing its amount represents a great challenge for the industry, since NaCl exerts specific functions (flavor, shelf life extension, functional and texture properties). Meltability is one of the most important physical properties of cheeses at high temperature. Cheese texture is a reflection of its structure at the microscopic and molecular levels, and textural properties play a key role in consumer acceptance of cheese. To better understand the properties of cheeses and their evolution when heated, this study investigate the reliability of dynamic testing rheology and synchronous fluorescence spectroscopies (SFS) coupled with chemometric methods to evaluate the influence of NaCl levels and its substitution by KCl on cheese behavior during heating.

In this study, 10 model uncooked pressed cheeses types with different salts contents (A: 0.5% NaCl, B: 1% NaCl, C: 2% NaCl, D: 0.5% KCl/1.5% NaCl, E: 1% NaCl/1% KCl) and ripened for 5 days (RH: 96% and θ: 9°C) were investigated. Two cheeses per formulation were used for measurements. SFS in combination with independent components analysis (ICA) was used to investigate, during cheese heating from 20 to 60°C, the effect of NaCl reduction and its partial substitution with KCl on the molecular structure of cheeses. The spectra were recorded with a FluoroMax-4 (Jobin–Yvon) in the 250-550 nm excitation wavelength range using six offsets (20, 40, 60, 80, 100, and 120 nm). The dynamic rheology measurements (G', G'', tan δ) were performed with a Malvern Kinexus instrument (0.5N, 1Hz, 20 mm diameter plate) from 20 to 60°C to investigate the effect of salts on cheeses texture.

The results showed that each technique provided relevant information. SFS showed that the NaCl addition in cheese modifies the intensity, width and/or position of the different fluorescence bands (e.g. tryptophan and riboflavin). ICA applied to SFS allowed to identify the fat melting temperatures of cheeses and ANOVA test identified significant differences between the control cheese (C: 2% NaCl) and the other cheeses (A, B, D, and E). Moreover, similar temperatures were obtained with the SFS and rheology tests confirming a high relationship between the structure of the cheese at the molecular level, as investigated by SFS and the texture assessed using dynamic rheology test.

**Keywords:** Fluorescence, texture, cheese, NaCl, KCl, chemometrics

**O-08**

# The Effects of Sodium, Potassium, Calcium, and Magnesium Chloride Salts on the Physico-Chemical, Microbiological, and Sensory Properties of Pastırma

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The aim of this study was to investigate the effects of different chloride salts on the chemical, physicochemical, microbiological, and sensory properties of pastırma (a traditional Turkish dry-cured meat product) with volatile profile. For this purpose, pastırma samples were produced according to the traditional method using four different salt mixtures (I: 100% NaCl, 2: 50% NaCl+50% KCl, 3: 40% NaCl+40% KCl+20% $CaCl_2$, 4: 30% NaCl+40% KCl+20% $CaCl_2$+10% $MgCl_2$). Mean water activity values were lower than 0.90 in all pastırma groups. The use of different chloride salts had no statistically significant effect on lactic acid bacteria, *Micrococcus/Staphylococcus*, Enterobacteriaceae, and mold-yeast counts of the final product. Divalent chloride salts significantly decreased the pH values of the samples, but similar affect was not observed with the NaCl/NaCl+KCl treatments. Furthermore, residual nitrite levels were not affected by different salts. Different chloride salts were effective on all color parameters except for the L* value. In terms of sensory parameters, the lowest scores were obtained in groups containing $CaCl_2$, and $CaCl_2$/$MgCl_2$. No statistically significant difference was observed between the NaCl and NaCl/KCl groups with respect to sensory scores. Forty-five volatile compounds, including 14 aldehydes, 6 ketones, 4 alcohols, 4 esters, 1 furan, 1 terpen, 2 aromatic hydrocarbons, 7 aliphatic hydrocarbons, and 6 sulphur compounds were identified in the samples. Hexanal had the highest peak within all identified volatiles. In addition, 18 volatile compounds were significantly affected by different chloride salt treatments.

**Keywords:** Pastırma, chloride salts, physico-chemical properties, volatile compounds, sensory profile

**O-09**

# Effects of Ball Milling on the Selected Properties of High Protein Oat Bran Powder and Slurry

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This study aims to evaluate the selected properties of high protein oat bran (HPOB) powder and slurry, i.e. particle size distribution, chemical, thermal, and rheological properties, as affected by different speeds of ball milling. The medians of particle sizes decreased from 128.4 μm to 37.76, 12.48, and 7.20 μm after ball milling at 300, 500, and 800 rpm respectively. Particle size distribution curve altered from nearly unimodal into multimodal with a broader size range. Fourier Transform Infrared (FTIR) spectra showed a peak intensity increase in protein associated bands of ball milled HPOB. Gaussian curve fitting of amide I spectra region showed an escalation of random coil protein secondary structure as the beta-sheet structure declined, which confirmed protein denaturation. Contrariwise, a weaker peak intensity in carbohydrate associated bands indicated the loss of crystallinity. Scanning calorimetric studies revealed a reduced protein thermal stability of ball milled HPOB, shown by increment on heat capacity and shifting on onset and melting temperatures. Disruptive effects of ball milling significantly lowered the storage and loss modulus of HPOB slurry.

**Keywords:** Oat bran, ball milling, particle size, FTIR, rheology

## O-10

# Encapsulation of (–)-Epigallocatechin Gallate into Liposomes and into Alginate or Chitosan Microparticles Reinforced with Liposomes

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(–)-Epigallocatechin gallate (EGCG) was encapsulated into liposomes that were further incorporated into alginate and chitosan microparticles. Stability of free and encapsulated EGCG in all the three systems was evaluated at different pH and in fruit nectar. Furthermore, the interactions between EGCG and the compounds of the microparticles were studied using Fourier transform infrared spectroscopy and differential scanning calorimetry.

All the three encapsulation systems showed high encapsulation efficiency (>97%) and sustained release; in 14 days no more than 15% of EGCG was released. The encapsulation systems successfully protected EGCG against degradation at alkaline pH. For non-encapsulated EGCG, >70% was degraded after 14 days, while there was no significant degradation of the encapsulated EGCG in these three systems. In fruit nectar, >30% of non-encapsulated EGCG was degraded in 14 days, while only 6% of EGCG encapsulated into liposomes or chitosan microparticles reinforced with liposomes was degraded at the same time. The DSC and FTIR analyses showed that the main interactions occurred between the liposomes and the EGCG.

This study demonstrates that liposomes as well as alginate and chitosan microparticles reinforced with liposomes have the potential to enhance EGCG stability in food products during storage.

**Keywords:** Encapsulation, (–)-epigallocatechin gallate, liposomes, alginate, chitosan

**O-11**

# Physical Properties and Structure of Insect-based Meat Analogs with High-moisture Extrusion Cooking

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Meat plays an essential role in the consumption patterns and a daily diet of humans. The future protein supply from conventional food sources is continuously predicted to be insufficient. Insects have a high amount of protein (50% to 70% in dry weight), which makes them a potential 'novel' source of proteins for feed and food consumption. High moisture extrusion cooking is a great emerging and promising technology for generating meat analog products with vegetable proteins. This research targeted the development of insect-based meat substitutes for human consumptions. Therefore, insects protein concentrates (*Alphitobius diaperinus*) and soy protein concentrate were combined into fibrous meat analogs by twin-screw extrusion at high moisture content (>40%). The composition of soy and insect protein at ratio 6:4, and with soy fiber (ratios 5.5:4:0.5 and 5:4:1) were extruded at 40, 45, and 50% moisture content and 150, 160 and 170$^{o}$C cooking temperatures. The cutting and compression strength were determined using the TA-XT2i instrument (at DIL e.v., Germany) (25-kg load cell and a 30×0.16 mm diameter test sample). Extrusion at 160 $^{o}$C cooking temperature and at low moisture content (40%), resulted in tougher, more cohesive, more fibrous, and more layered structure (similar to standard samples 100% soy proteins concentrate). In another hand, there was a high correlation between measured pressure during the process and cutting force of extruded products. Also, the results indicated that at given temperatures, the increase of moisture content would slightly increase the overall protein water solubility. Further research will concentrate on human sensory acceptance and additional safety trials, which will ensure insect-based meat substitute progression on the market.

**Keywords:** Lesser mealworm (*Alphitobius diaperinus*) protein, soy protein concentrate, rheological properties

**O-12**

# Influence of Vacuum Frying Conditions on Oil uptake, Textural and Microstructural Properties of French Fries

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Vacuum frying is carried out under pressures well below atmospheric levels, preferably around of 1.33 to 27.5 kPa. Depending of low pressure, the boiling points both of the oil and the moisture in the foods are lowered. Due to the low frying temperature and oxygen content, vacuum frying process is superior to atmospheric frying. Heat and mass transfer involved in the frying process cause significant microstructural changes, which play a key role in oil uptake and textural characteristics of the food matrix.

The objective of this study was to determine the effect of vacuum and atmospheric frying conditions on microstructure, oil uptake and firmness of French fries. This being the case, a vacuum cooking equipment prototype being able to work at atmospheric pressure or under vacuum was developed for deep-fat frying process. The pressure of all vacuum frying experiments was kept constant at 13.3 kPa. Vacuum frying was carried out at 120-150°C for 5-15 min according to Central Composite Rotatable Design (CCRD). French fries were also fried at atmospheric pressure at 165°C and 180°C for 5, 7.5, 10 and 15 min. The effects of frying method and conditions on French fries were determined with X-ray micro Ct (microstructure), oil uptake and texture analysis.

The results of vacuum frying experiments showed that oil uptake of French fries increased with increasing frying temperature and time until 10 min. When frying time exceed 10 min, oil uptake of French fries did not change with frying time. Therefore, the maximum oil uptake (%23.1) were determined at the highest temperature (150°C) for 10 min. Compared to atmospheric frying, vacuum frying caused an increase in oil uptake. The firmness of French fries increased for long processing time and this was true for both frying methods. In order to determine the microstructure of French fries, X-ray micro-computed tomography was used. The images of French fries were taken and average pore size was calculated. Average pore sizes of French fries increased with frying time, however no significant changes were determined with frying temperature for both frying methods. The average pore size of French fries is highly correlated with oil uptake (r=0.79) and firmness (r=0.80) for vacuum frying.

**Keywords:** Vacuum frying, French fries, oil uptake, microstructure, texture

**Acknowledgements:** Funding provided by Ministry of Science, Industry and Technology, Republic of Turkey (Project no: 0724.STZ.2014) and one of the Turkey's best white goods company Arçelik A.Ş are appreciated.

**O-13**

# Effect of Electrosprayed Edible Coatings on Shelf-life Stability of Fresh-cut Apple Slices

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Fruits and vegetables are consumed for their health benefits due to the dietary fiber, vitamins, minerals and antioxidant materials. However around 40% of the production is wasted during harvesting and post-harvest handling and storage. Edible coatings and films are used for fresh-cut fruits and vegetables to minimize these losses and extending the shelf life as well as keeping the quality of fruit that is coated.

In this study, w/o premix emulsions were used as coating material. Golden Delicious type apple slices were coated by electrospraying and dipping method for comparison of coating efficiency and material uptake. Coated and control apple slices were stored at 5°C and 80% RH for 14 days and coating efficiency was measured as weight loss %/ g emulsion during the storage period. In electrospraying of emulsion (A) having higher viscosity (157.5±0.6 cP) and lower electrical conductivity (527.5±1.3 pS/m) higher voltage was applied (15 kV) for obtaining stable cone-jet geometry. However, for the emulsion (B) having higher electrical conductivity (>2000 pS/m) and lower viscosity (113.7±0.5 cP), lower voltage (12 kV) was required for stable jet formation. Material uptake of apple slices dipped into emulsion A and B was 0.056±0.004 g emulsion/g apple and 0.061±0.004 g emulsion/g apple, although the material uptake with electrospraying was 0.398±0.046 mg emulsion/g apple and 0.041±0.001 mg emulsion/g apple, respectively. Apples coated with electrospraying method had comparably lower weight loss than control and dip-coated samples during storage, although they were coated with much less coating material. Also total color change of electrospray coated samples were closer to the control sample, however drastic color change was observed for dip-coated samples due to higher changes in yellowness (b*) and brightness (L*) values. In conclusion, electrospraying for edible coating production is a promising technique with low material use and efficient coating.

**Keywords:** Electrospraying, edible coating, fresh-cut

**O-14**

# Impact of β-Carotene Fortification on Rheological, Oxidative and Physical Properties of Beeswax Oleogels

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In this work the role of beeswax as structurant in addition with β-carotene was evaluated in the rheological, oxidative and physical properties of oleogels. The aim was understanding how beeswax oleogels fortified by the incorporation of small concentration of β-carotene (0.01%) behave in order to develop complex oleogels. Rheological assessment suggested an increase of the rheological parameters for all oleogels with β-carotene in its composition when comparing with oleogels without β-carotene. Small Angle X-Ray Scattering analysis demonstrated that the lamellar crystal structure of complex oleogels exposed regular *d*-spacing values for all concentrations. This fact was combined with lower radius of gyration ($R_g$) values in this type of oleogels for all concentrations, strengthening the samples. $R_g$ values for complex-BW oleogels were in the range of 33.20 to 38.50 Å, as for the values of simple-BW oleogels they were comprised between to 29.10 to 33.50 Å. In parallel, the oxidative profile and colour of complex oleogels was studied; such parameters suffered alterations (oleogels with 2% of BW presented values of 10-15% lower than 4, 6 and 8% BW) by means of the more structured gel network provided by the beeswax action as a multipart in the presence of the bioactive. The oil binding capacity was also affected and proved to be higher for complex-beeswax oleogels, enhancing their ability to retain the oil phase within the crystalline network. This investigation showed the possibility of tailoring the properties of these oleogels, which can serve the purpose of incorporation in food as structurants and fat replacers. Oleogels can provide, as well, the delivery of bioactives thus adding value to food products.

**Keywords:** Oleogelation; beeswax; rheology; small angle X-ray scattering (SAXS)

**O-15**

# Protective Effect of Ginger on Hematological, Biochemical, and Genotoxic Alterations in Dimethoate Exposed Rats

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Many residual amounts of pesticide compounds have been found in the vegetables, grains, soil and water inducing many toxic manifestations. In this context, our study aimed to evaluate, for the first time, the ability of ginger (*Zingiber officinale* ) decoction, used in traditional and modern medicine, to decrease the rats' hematological and hematopoietic alternations induced by an organo-phosphoreous pesticide: dimethoate (Dim) in peripheral blood and bone morrow. Animals were divided in four groups: The first group served as a control, the second group is exposed to Dim (0.2g/L) in freely accessible drinking water. The third group received the same concentration of Dim in water and force fed with 200 mg/ml of ginger decoction by intragastric instillation. The fourth group of rats received only the ginger decoction (positive control). Our study showed that Dimethoate induced body weight loss and food intake reduction in intoxicated rats. It seems that Dim induced metabolic disorder and that it was responsible for observed anorexia. In addition, after 30 days, the exposure to dimethoate significantly changed many red and white blood cell related parameters and increased hepatic enzymes activities of in rats' serum compared to control groups. Also the genotoxicity levels, measured by two tests (micronucleus test in bone morrow cells and comet assay in peripheral blood) increased significantly with comparison to control groups. Curiously, ginger fed to rats simultaneously was able to significantly reduce observed hematological and biochemical alterations and to prevent DNA fragmentation caused by this insecticide. Our Work proved a protective effect of ginger against many alterations caused by dimethoate in blood and bone morrow cells and encourage using such medicinal preparations to protect human health from numerous xenobiotics.

**Keywords:** Ginger decoction, haematological parameters, genotoxicity, dimethoate, comet assay, micronucleus test

**O-16**

# The Effects of Cooking Method, Cooking Severity and Digestion Time on Chemical and Structural Characteristics of Frankfurters during In Vitro Gastric Digestion

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Digestion plays an important role in uptake of food nutrients into the body. In digestion process, initial structure of food material and digestion time are fundamental factors which affect the structural changes in the product. Frankfurters are popular and widely consumed products in fast food industry, but they are not regarded as quite nutritious due to their high fat and moisture content. It is considered that cooking method, cooking time (severity) and digestion time probably affect the bioaccessibility and bioavailability of the nutrients in frankfurter and other foods.

In this study, beef frankfurters were boiled (3, 6, 9, 12 and 15 mins) and fried (3, 6 and 9 mins), and the effects of cooking method, cooking severity and digestion time on moisture, pH and texture (hardness) values of raw sample and cooked treatments were examined. In gastric digestion process, frankfurters were cut into cubes and digested in salivary and stomach conditions for 240 mins. ANOVA was used to compare the results obtained during digestion. SEM analyses were performed to examine the structural differences in the treatments before and after digestion. According to the results, cooking method, severity and digestion time significantly influenced the moisture and pH values ($p<0.05$). Effective diffusivities of moisture and acidity generally give an idea about the nutrient mass transfer, so the diffusivity values of the treatments were determined by using Fick's second law in MATLAB software. The parameters used in the study (cooking method, severity and digestion time) also had significant effects on texture of frankfurters ($p<0.05$). Cooking severity lowered the hardness values ($p<0.05$) and the values of all the treatments decreased at certain percentages after digestion of 240 mins.

**Keywords:** Digestion, boiled, fried, frankfurter, texture

**O-17**

# The Physical and Reconstitution Properties Related to Chemical and Sensory Properties of Spray-dried White Cheese Powder Packaged in Different Materials

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Increasing the safety and shelf life of the food products with the minimum changes in their sensory and nutritional properties during storage is very important for the manufacturer and consumer. Therefore, the type and properties of the packaging material are very critical for especially dairy powders having high fat content and long shelf life. The expectation of packaging materials are to protect dairy powders from exposure of moisture, oxygen and external environmental factors in order to keep their physical characteristics including reconstitution properties as well as chemical and sensory qualities during storage. Cheese powder, a dairy powder, is used as an ingredient for the manufacturing of many food products such as biscuits, snacks, bakery, sauces, dressing, ready meals and processed cheese.

The usability of different packages for the storage of cheese powder was aimed. The white cheese powder was produced at pre-determined process conditions using a pilot scale spray drier and stored in PET/Al-foil/LDPE (15/9/70 micron), PET/Metallized PET/LDPE (10/10/50 micron) and OPP (44 micron) packages at 20 ºC and 40 to 50 % relative humidity for 12 months. Moisture contents and water activities, powder densities (bulk, tapped, particle), reconstitution properties (wettability, dispersibility, solubility), hydroxymethylfurfural values and sensory properties of samples were determined every 3 months of storage. The microstructure of powder was examined by scanning electron microscopy.

The highest increase in moisture content and water activity was found in samples stored in OPP, but this increase was still under critical values for dairy powders. Bulk and tapped densities of all samples were stable during storage while particle density increased especially in samples stored in OPP, associated to moisture increase. Although the wettability values were significantly decreased in all samples during storage, this decrease was very remarkable in samples packaged in OPP (from 139, 60 to 7,70 second). However, the changes in dispersibility and solubility values were not significant. The wrinkled and irregularly structured particles were observed by scanning electron microscopy. In all samples, hydroxymethylfurfural values were increased during storage, having the highest values in samples in OPP. Its tendency among the packages was found similar with the tendency of moisture and wettability values. Moreover, the sensorial acceptability scores of samples in OPP was lower compared the others, but yet they were still acceptable by the panellist. As a result, all studied packaging materials can be chosen for the storage of cheese powder depending on the preference of time and cost.

**Keywords:** Physical properties, reconstitution properties, hydroxymethylfurfural, cheese powder

**O-18**

# Mechanical, Physicochemical, and Antimicrobial-antioxidant Properties of CMC Based Films Incorporated of Lemon Verbena Essential Oil

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Carboxymethylcellulose (CMC) based films incorporated with lemon verbena (*Aloysia citrodora*) essential oil (LVEO) at 1, 2 and 3% v/w were prepared to examine their antibacterial, antioxidant, physical, and mechanical properties. The physical and mechanical properties were determined in accordance with the ASTM standard methods. Addition of LVEO affected the oxygen and water vapor permeability of the films. Incorporating LVEO, increased color parameters and decreased lightness of films. A decrease of young modulus (YM) and tensile strength (TS) accompanied with an increase in elongation at break (%EB) was observed with increasing LVEO concentration. These films exhibited some antioxidant activity, which was significantly improved by the addition of the essential oil. This incorporation influenced antimicrobial, antioxidant, physical, mechanical, barrier, microstructure and color properties of the films. The films prepared with LV essential oil exhibited highest inhibition against *E.coli* and were more effective against Gram-negative bacteria (*E.coli*) than Gram-positive bacteria (*S.aureus*).The results pointed out that the incorporation of LVEO as a natural antibacterial agent has potential for using the developed film as an active packaging.

**Keywords:** Antimicrobial properties, lemon verbena, active packaging, antioxidant properties

**O-19**

# Effect of Homogenization Type on the Formation of Capsaicin-loaded Nanoemulsions

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In recent years, nanoemulsion based systems have been increasingly used in food applications as potential carrier systems for lipophilic substances such as nutraceuticals, drugs, flavorings, antioxidants or antimicrobial agents. Nanoemulsions can be obtained mostly by using high energy homogenization methods. In this study, effect of microfluidization and ultrasonication as high energy methods were investigated on the properties of capsaicin-loaded nanoemulsions. Capsaicin (trans-8-methyl-N-vanillyl-6- nonenamide) is a lipophilic substance, showing good antimicrobial and antioxidant properties. Its characteristic pungent taste and low water solubility can cause problems for designing water based food products. Using emulsifier Tween 80, nanoemulsions were prepared at two different pH (7.4 and 3.8). Also, effect of glycerol addition to the formulation was investigated. The mean droplet size of nanoemulsions changed between 31-80 nm. Ultrasonication resulted in smaller size droplets with an increase in L* (lightness) and b* (yellow) parameters at 75% amplitude for 5 min. Almost transparent nanoemulsions with higher than 79 % of encapsulation efficiencies were obtained with microfluidization at 1.400 bar pressure for 5 passes. NMR Relaxometry was also used as a characterization technique and longest T2 times were observed with ultrasonication. Highest antioxidant activity was found for ultrasonicated nanoemulsions with 0.85 mg DPPH/L while it was microfluidized nanoemulsions with 0.12 mM Fe(II)/L with respect to FRAP assay at pH 3.8 in the presence of glycerol. Microfluidized nanoemulsions reduced Gram (+) *Staphylococcus aureus* population up to 5.89 log after 2 hours of contact time at pH 7.4 with the presence of glycerol and Gram (-) *Escherichia coli* population up to 2.79 log after 15 min of contact time at pH 7.4. Adding glycerol to the continuous phase resulted in clear, almost transparent, bright red colored nanoemulsions due to refractive index changes. Therefore, capsaicin-loaded nanoemulsions with an enhanced antimicrobial and antioxidant activity could be obtained by microfluidization, whereas ultrasonication mostly helped to improve physical properties such as particle size and color.

**Keywords:** Capsaicin, nanoemulsion, NMR relaxometry, antimicrobial, antioxidant activity

**O-20**

# Effect of Drying Methods On Physical and Sensory Characteristics of Biscuit Made from Wheat Flour Supplemented with the Flour of Orange Fruit (Citrus sinensis) Peels

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The reduction of sweet orange fruit (*Citrus sinensis*) peel waste can be enhanced in Rwanda by processing these peels into value added foods. In this regard, the peels were dried to constant weight using oven (50 ± 1 $^{o}$C), solar (38.5 ± 8.6 $^{o}$C) and sun (16. 57 ± 5.5 $^{o}$C) drying methods. The dried peels were processed into flours and used to substitute 10, 20 and 30 % commercial wheat flour in biscuits. The biscuits prepared from wheat flour without orange fruit peel flour (WF), the biscuit from wheat flour supplemented with sun dried orange fruit peel flour (SDOFPF), with solar dried orange fruit peel flour (SOFPF) and oven dried orange fruit peel flour (ODOFPF) were evaluated for physical and sensory characteristics. The density (1.17 g/ml) and the thickness (7.79 mm) of 30 % SDOFPF based biscuits were higher than those of the 100% WF biscuit, while the weight (51.87 g) of the 10 % SOFPF biscuit, volume (46.20 ml) and break strength (1999.05 g) of 10 % ODOFPF biscuit were lower than those of the 100 % WF biscuit. The texture and appearance scores generally decreased gradually with increase in the level of the orange peel flours in the biscuits. The score for texture (6.6) was the same for the 10 % ODOFPF, 30 % SOFPF and 20 % SDOFPF biscuits, while the appearance score (6.8) was not different for the 10 %, 30% ODOFPF and 20 % SOFPF biscuits. The scores for overall acceptability were not significantly ($p > 0.05$) different for all the biscuits. However, the score of 8.0 for the 100 % WF biscuit was the highest and followed by 7.1 for the biscuit containing 10 % SDOFPF. The overall acceptability score (5.5) for biscuit containing 30 % ODOFPF was the lowest. This study showed that the reduction in the physical characteristics such as weight and volume caused by the supplementation of wheat flour with oven dried orange fruit peel flours would facilitate packaging and transportation for manufacturers, sellers and buyers of the supplemented biscuits. The preference for the biscuits by panelists was associated with the low level of supplementation due to the bitterness generated by orange fruit peel flour.

**Keywords:** Biscuit, drying methods, orange fruit peel flour, physical and sensory characteristics

**O-21**

# Combination Effects of Cell-Free Supernatant of *Lactobacillus Plantarum* and *Pediococcus Acidophilus* and Plant Extract (Thyme and Laurel) on Textural Properties of Fermented Sardine

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Fish fermentation is one of the most common methods of seafood preservation, which has many benefits. Fermentation could be used as a low-cost appropriate technique for the preservation of fish muscle, improving the organoleptic qualities of fish and increasing the nutritional value and/or digestibility of the raw material. Nowadays, fish fermentation is generally combine with different plant extract and food additives. Therefore, in this study, combination effects of cell-free supernatant of *Lactobacillus plantarum* and *Pediococcus acidophilus* and plant extract (thyme and laurel) on textural properties of fermented sardine have been investigated during 8 week of refrigerated storage ($3\pm1^{o}C$).

Sardine fillets were divided into 7 groups which are control group (C) without any cell free supernatant and thyme/laurel extract addition, LP and PA group with cell free supernatant of *Lb. plantarum* (LP) and *Pd. acidophilus* (PA) at doses of 8%, TPA and TLP group with thyme at doses of 0.5% and cell-free supernatant of *Lb. plantarum* and *Pd. acidophilus* at doses of 8%, and LPA and LLP group with 0.5% laurel and cell-free supernatant of *Lb. plantarum* and *Pd. acidophilus* at doses of 8%, respectively. Texture profile analyses in all fermented groups were performed using Texture Analyzer. Hardness, cohesiveness, springiness and chewiness of fish fillets were calculated from the resulting force deformation curve.

Results of texture measurement of fermented groups showed that textural deterioration increased with storage time. Hardness, resilience and chewiness values of LPA group were significantly higher ($p < 0.05$) than the other groups, while textural properties such as springiness and cohesiveness in fermented fish were similar ($p > 0.05$) among groups except for LP and PA group. In LPA group, initial and final mean values of hardness found to be 46.1 N and 62.8 N, respectively. Consequently using cell-free supernatant of *Pediococcus acidophilus* is more effective than the other bacterial supernatant and laurel is most favourable extract with combination of *L. plantarum* and *Pd. acidophilus* supernatant comparing to thyme extract conjunction with texture properties of vacuum packaged sardine.

**Keywords:** Sardine, *L. plantarum, Pd. Acidophilus,* texture properties, plant extract

**O-22**

# Protein Secondary Structures by Fourier Transform Infrared Spectroscopy to Identify Fraudulent Meat Mixtures

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Fourier Transform Infrared Spectroscopy (FT-IR) is a new powerful tool to characterize differences in the structures of proteins and this could be used to determine authenticity in meat formulations because protein expression in raw meat shows species-specific differences. In this study, FT-IR spectra of meat mixtures from different species were derivatized to assess the differences in the secondary structures of proteins using the region between 1700 and 1600 $cm^{-1}$ wavenumbers. Beef was mixed with chicken, turkey, sheep or goat meat where the beef content by weight was either 100%, 95%, 90% or 0%. The band corresponding to antiparallel β-sheet structure with the wavenumbers around 1689-1690 $cm^{-1}$ showed a shift to the right for 100% chicken and goat meat samples in the FT-IR spectra. A significant increase in the relative intensity of these bands were observed for all adulterated meat ratios in beef when compared to 100% beef sample ($p<0.05$). Relative intensity values of α-helix structure exhibited significant differences between 100% beef and 100% adulterants (chicken, turkey, sheep and goat meats). These differences were generally proportional to the adulterant percentage indicating that the relative intensity values of α-helix structure could be effectively used in establishing meat authenticity. Furthermore, the relative intensity values of β-sheet structure gave also applicable results. The results obtained from this study revealed that determination of relative species-specific changes in protein secondary structure of animal tissue proteins from derivatized FT-IR spectra is a promising technique for the identification of fraudulent substitution of different meat species in raw meat mixtures.

**Keywords:** Proteins secondary structure, meat proteins, FT-IR spectroscopy

This work was supported by Scientific and Technological Research Council of Turkey (TÜBİTAK-project 214O182).

# O-23

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Guy Jones

Stable Micro Systems, United Kingdom

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**P-001**

# Crystal Structure of Lipid in Palm Stearin Emulsions Treated with High Hydrostatic Pressure

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Emulsions are widely used in food systems. Although the rheological properties of emulsions are very important for food industry, the new trend is using emulsions for encapsulation of functional compounds (i.e., antioxidants, flavors, etc.). Emulsion is a thermodynamically unstable system that combines two immiscible fluids and disperses one fluid in the other one. Physical properties of emulsions such as appearance, texture and stability interact very closely with the polymorphic structure of the oil phase. High hydrostatic pressure (HHP) processing is a novel processing technique generally used for pasteurization of foods since during conventional pasteurization, heat may cause a loss of nutrition or quality. However, in HHP, pressure and medium temperature have a direct effect rather than high temperature so the final product remains very similar to the raw material or fresh product. Recent studies have shown that HHP can also initiate or accelerate crystallization in lipids. However, some studies claim that the effect of HHP on lipid crystallization can be neglected. This contradiction is caused either by lack of sufficient research or differentiation of products in these studies.

In this study, the effect of HHP on lipid crystallization was examined. Emulsion samples were prepared with palm stearin as the oil phase and sodium caseinate as the emulsifier and they were pressurized at 100 and 500 MPa at 10, 20 and 40°C for 15 min. In order to determine the crystal structure of the emulsions, differential scanning calorimeter (DSC) was used and the change in the quantity of crystal types during 28 day-storage was observed. Also, particle size analysis was conducted to observe the stability of pressurized emulsion samples during storage. Results showed that pressure and storage time had significant effects on emulsions' crystal structures.

**Keywords:** High hydrostatic pressure, lipid crystallization

**P-002**

# Microstructural Properties of Reduced-salt Chicken Meat Myofibrillar Protein Gels Containing Kappa-carrageenan

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Salt is one of the most essential ingredients influencing functional properties of meat products. However, there has been a great deal of research on reducing salt content in meat products due to its association with development of some health issues such as hypertension. Reducing NaCl content decreases salt soluble myofibrillar protein (SSMP) extractability, and thus, changes functional properties of proteins in meat systems. One of the approaches in reducing salt content in meat products is to replace it with other chloride salts and to include hydrocolloids in the formulation. KCl is the most common NaCl alternative without causing major changes in sensory, textural and nutritional properties of the product when used in proper portions in meat systems. Kappa-carrageenan is one of the food hydrocolloids which has been used to enhance the functional properties of meat products. Meat gel systems have three dimensional cross-linked network structures. Image analysis gives opportunity to characterize the three dimensional network of SSMP gels and to understand the functional properties of meat gels. This study focused on determining the effect of partially substituting of NaCl with KCl (1:1 portions) in the presence of kappa-carrageenan on microstructure of the gels produced from SSMP. SSMP was extracted from chicken breast meat and divided into six random groups one of which was used as blind control-treatment (T1). The other groups were formulated with the addition of 0.5% kappa-carrageenan (T2); 1.5% NaCl+1.5% KCl (T3); 1.5% NaCl+1.5% KCl + 0.5% kappa-carrageenan (T4); 3%NaCl (T5) or 3% NaCl + 0.5% kappa-carrageenan (T6). The control gel (T1) showed open structure which demonstrated weak gel formation. Carrageenan addition to SSMP (T2) barely increased the gel compactness. However, using NaCl and KCl (T3 and T5) increased the gel compactness in comparison to control gel (T1). The more compact gels were obtained with the use of kappa-carrageenan when NaCl was used alone and in combination with KCl (T6 and T4, respectively). NaCl and KCl addition in presence of kappa-carrageenan decreased the size of pores within the gel structure indicating formation of firm gels. Nevertheless, T6 exhibited more uniform gel network with smaller pore sizes than T4. The results from the present study demonstrated that KCl could be used as an alternative salt substitute in presence of kappa-carrageenan in reduced-salt meat products with slight changes in the myofibrillar protein gel structure.

**Keywords:** Myofibrillar chicken meat protein gels, microstructure, sodium chloride, potassium chloride, carrageenan

**P-003**

## Assessment of Cheese Texture Attributes Variability During Ripening

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The objective of this study was to monitor the textural changes of the Dutch-type cheese in the course of ripening in the industrial conditions. The paper presents the variability of 5 cheese texture attributes – i.e. hardness (HD), springiness (SP), cohesiveness (CO), guminess (GU) and resilience (RE) after 1st, 5th and 10th week of ripening. These magnitudes have been extracted from the results of double compression test (TPA) of the cubic samples (20×20×20 mm) cut off the center of cheese slabs. Tests have been performed at the head speed of 0.1 mm/s using *Texture Analyzer* TA-XT2 with P/25 probe. Basic chemical composition of cheeses also has been evaluated instrumentally using *FoodScan* (Foss) equipment. Altogether 90 cheese slabs have been analyzed over the range of 10 weeks of ripening.

The chemical composition of cheeses tested was very stable – the average coefficient of variability was 2.14%, which is very good result for this kind of product. However, slight but statistically significant (p=0.05) trend to decrease water and increase mineral components content with ripening time was observed.

The variability of textural attributes was distinctly greater, thus it was subjected to detailed statistical analyze. Many of the particular magnitudes were linearly correlated, so the multivariate principal components analysis (PCA) has been applied. Two principal components PC1 and PC2 were chosen for further assessment. Factors corresponding to first two largest eigenvalues accounted 92.3, 83.5 and 74.9% of total variability of collected data after 1st, 5th and 10th week of cheese ripening respectively. The contribution of particular magnitudes to the factors PC1 and PC2 varied with cheese ripening. Primary the PC1 was correlated with HD, GU and SP (for the 1st week), meanwhile with the ripening progress (after 5th and 10th week) SP became insignificant and PC1 comprised HD and GU only. On the other hand the main variable for PC2 at the beginning was CO, 5 weeks later PC2 comprised additionally RE and after 10th week resilience (RE) was taken into account only. The results indicate possibility to follow cheese ripeness by applying TPA and PCA analyses.

**Keywords:** Cheese ripening, texture, TPA test, PCA

**P-004**

## New Value-added Apricot Products Designed by Vacuum Impregnation Technique

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Enhancing of fruits with bioactive component containing foods has been emphasized in many works in food industry. Development of new fruit products, with suitable changes in structure, may be of great advantage, and can be improved using techniques such as vacuum impregnation. In order to generate the value-added intermediate moisture apricots (cv. Hacıhaliloğlu and cv. Kabaaşı), immersing citric acid or sucrose solutions and also some solutions prepared by some plants including rose hip pulp (*Rosa canina* L.), roselle extract (*Hibiscus sabdariffa* L.) and rhubarb juice (*Rheum ribes* L.) were employed in the present study using vacuum impregnation process. Subsequently, impregnated apricots were subjected to sun drying treatment and stored 4 months at +4 °C. Textural and sensorial properties of apricots were evaluated during storage in terms of hardness, adhesive force, chewiness and stiffness.

Texture profile of intermediate moisture apricots were affected moisture contents of samples. At the beginning of the storage, hardness and adhesive force values of sugar impregnated samples of cv. Hacıhaliloğlu were higher than others. Moreover, roselle and rose hip impregnated cv. Hacıhaliloğlu took the first place of chewiness and stiffness, respectively. For the cv. Kabaaşı, rhubarb juice impregnated samples were determined the hardest apricots, while sugar impregnated samples showed soft profile during storage. With vacuum impregnation process, some differences were observed among cultivars and impregnation solutions. Thus, rose hip and citric acid impregnation were more suitable for cv. Hacıhaliloğlu and cv. Kabaaşı, respectively.

The most appreciated apricots with regard to sensorial properties were obtained by citric acid and sucrose impregnation. However, citric acid impregnated cv. Hacıhaliloğlu and roselle impregnated cv. Kabaaşı were scored with the low values by the panelists.

**Keywords:** Vacuum impregnation, apricot, rose hip, rhubarb

**P-005**

# Properties of Gelatin Based-films Added with Chitosan Coated Microparticles

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The development of edible films in the food industry using biopolymers shows great potential for developing new food packaging systems. Although there are many suggested benefits of developing new composite active films, with potential incorporation of active compounds due to the possibility of specific mass transfer migrating into foodstuffs and the function of carrying and preserving active compounds.

The aim of the present study was to improve understanding on the influence of adding microparticles coated with chitosan, on the composition and the properties of the gelatin-based film and therefore on its capacity to safeguard encapsulated active compounds.

Microparticles coated with chitosan and loaded with rutin were prepared using soy-lecithin and chitosan using rotor-stator homogenizer, to generate an average size of 520 nm with 75% encapsulation efficiency. Film-forming solutions were prepared using pig skin gelatin powder (5 wt%) with glycerol added as plasticizer (30/100g of the gelatin powder). Prepared microparticles solutions were added to the film-forming solutions, and the resulting solutions were homogenized at 10,000 rpm using a rotor-stator homogenizer for 5 min. Films were obtained by casting into polystyrene Petri dishes and dried at 30°C for 12 h. Before characterization, all the film samples were conditioned at 25°C and 58% of relative humidity, for 7 days.

For the obtained films, the results showed that different physicochemical properties, including barrier (water vapor permeability), color and transparency (200-700 nm) remained similar to native gelatin films. The microstructure studies done by scanning electron microscopes, revealed different pores embedded with rutin resulting from chitosan particles in gelatin matrix. Indeed, the chitosan layer brings efficient protection against the water vapor transfer because the rutin remains unaffected in the presence of high permeability. This was strengthened by FTIR analysis which displays any oxidized rutin characteristic. The structural studies in connection with the water barrier properties allowed a better understanding of the mechanisms and the interactions between the film

components.

This study brings new understanding on the influence of stabilizing nanoemulsions with solid layer using chitosan on the structure and dispersibility of matrix of films on their barrier properties and thus on their capacity to protect encapsulated active compounds.

**Keywords:** Active packaging, chitosan, microparticles

**P-006**

# The Effect of Extraction Methods on the Textural Structure of Gelatin from Frigate Mackerel (*Auxis thazard*) Skins

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Gelatine is obtained by hydrolyzing the collagen present in the bones or/ and skin generated as waste during animal slaughtering and processing. F Fish resources are important, due to fish processing wastes after filleting can account for as much as 75% of the total catch weight. The skin yield is highly variable according to processing steps, fish species and fish mass. Conversion of these wastes into value-added products such as gelatin to yield additional profit has both economic and waste management benefits for the fish industry. Therefore, in this study, the effect of extraction methods on the textural structure of gelatine from frigate mackerel(Auxis thazard) skins have been investigated.

Previously frozen Frigate mackerel *(Auxis thazard*) skins divided into 4 groups, which are applied different extraction methods. Skins were treated with alkali and either HCl, acetic or citric acid. After extraction of gelatin solutions were ultra filtrated and lyophilized. To determine gelatins bloom strength was determined according to the method described by GME, 2000 and tested using a TA-XT2 texture analyzer. The maximum force reading as resistance to penetration was obtained and is the Bloom strength (g) of the gel. The analysis was done in triplicate and Bloom value of the frigate mackerel gelatin gels was compared to a commercial standard. Comparison of extraction methods on gelatin bloom strength; extraction with citric acid, provide high bloom value was found 328. Other groups bloom value were changing 290-310 g. and commercial fish gelatin bloom value 280.different types of gelatins have changeable thermal and rheological properties such as bloom strength based on many factor s such as pH, molecular weight distribution and amino acid content. The gel strength of fish gelatin has been reported in a wide range of 124–426 bloom, compared to 200–300 bloom for bovine or porcine gelatin.

**Keywords:** Gelatine, frigate mackerel, fish gelatine, bloom strength

**P-007**

# The Influence of Microwave Drying on Microstructural Properties of Beef *Semimembranosus* Muscle

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One of the most ancient methods for meat preservation is drying. Hot air drying is the most common method used for manufacturing of dried meat products for years. Alternative energy efficient new drying technologies have been replacing the traditional hot air drying due to its disadvantages such as non-homogenous heat transfer, consumption of high amounts of energy, and some undesirable changes in physical, chemical and nutritional properties of the final product. Microwave application has become an important technique used in processing of various food products in recent years in the industry due to its rapid heating nature, efficient process control, high protection of nutritional quality. There are a few studies conducted on microwave drying of meats which reported some drawbacks of this technique. Therefore, application of microwave drying in combination with some other drying techniques to overcome these problems might be a solution. The objective of the present study, was to determine the effect of hot air and microwave drying combination on rehydration ratio and microstructural properties by scanning electron microscope (SEM) of dried beef *semimembranosus* muscle. Beef muscle was cut into cubes and dried up to equilibrium moisture content (<0.10% dry basis) using three different drying techniques 1) Hot air drying at 80$^{o}$C, 2) Microwave drying, and 3) Combination of hot air drying and microwave drying. SEM image of the dried beef indicated that microwave drying resulted in shrunk muscle fibers. Also, image of muscle fibers were wider in the hot air dried beef than microwave dried ones. Furthermore, damage and muscle breakdown were observed in the microstructure of hot air dried fiber while microwave dried muscle fibers were unbroken. However, the illustration of combined microwave and hot air dried beef muscle showed unbroken structure with slight damage in the fiber structure. Rehydration ratio of dried muscles supported the SEM results. While, hot air dried samples resulted in higher rehydration ratio microwave treated samples had lower rehydration ratio, likely due to the fact that shrinkage of muscles resulting from microwave treatment prevented the water intake. Combination of hot air drying and microwave drying increased the rehydration ratio when compared to microwave dried samples. The higher rehydration ratio in hot air dried samples could also be resulted from the breakdown of the muscle fibers which creates spaces for water. Further research should focus on the detailed structural analysis of the bundle of dried muscle fibers using different drying techniques.

**Keywords:** Beef, hot air drying, microwave drying, SEM, rehydration ratio

**P-008**

## PVPP Polymer Adsorption of Phenolic Compounds: Alternative for Evaluate and Concentrate the Antioxidant Content of Grape Pomace Extracts from Chile to Future Applications in Food Chemistry

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Grape pomace (GP) is a by-product of wine industry and consists mainly of stems, seeds and skins. Correspond to a 20-25% of the weight of the grape crushed for winemaking. However in Chile the large quantity of GP produced was dumped and resulted in environmental waste; only a small amount of GP was used as soil fertilizer. Antocyanins, catechins, procyanidins, flavonol glycosides, phenolic acids and stilbenes are the principal phenolic constituents found in GP. The composition of GP and their biological and functional properties postulate to GP as source of functional food ingredient or pharmaceutical compounds. However, the production of purified phenolic extract is usually costly, and organic solvents are usually used. The use of organic solvent generates new environmental problems and healt impact on the workers.

In this study we obtained ethanolic extracts by milling and maceration of cabernet sauvignon, cabernet franc, cabernet rose, merlot, syrah, carmenere and sauvignon blanc pomaces. Their antioxidant capacities were determinated by ORAC assay and their PC contents were measured by Folin Ciocalteu (FC) assay with and without PVPP adsorption in etanolic, aqueous and pH controlled solution. The results showed an average adsorption PC of 36.46, 70.66 and 76.30% respectively. This method was correlated to the study of the adsorption of a matrix of PCs such as gallic acid, 4-methylcatechol, resveratrol, hesperetin, catechin, genistein, epigallocatechin gallate, quercetin, and butylated hydroxyanisole in the presence of ascorbic acid on Polyvinylpolypyrrolidone (PVPP) that is quantified by HPLC-DAD.

These results point to potential uses of the proposed polymer to concentrate and determine the PC contribution without interference by the FC assay in complex matrices such as antioxidant-containing food products or antioxidant extracts.

**Keywords:** Grape pomace, polimers, adsorption, antioxidants

Acknowledgements to FONDECYT for the project 11140256

**P-009**

# Effect of Drying on Physical Properties of Orange Peel

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One of the most widely favored fruit around the world is orange. Every year, the fruit juice industry generates a large amount of orange peel during the short harvesting period. This leads to storage and spoilage problems. Therefore, it is necessary to dry these by-products quickly to utilize them effectively. In this study, it was aimed to determine the effects of different air temperatures (40, 50 and 60°C) and air velocities (1 and 2 m/s) on shrinkage, porosity, pore size distribution, color and microstructure of orange peel. Empirical models were also proposed to predict shrinkage and porosity as a function of moisture. A strong negative correlation was determined between moisture and shrinkage. Air temperature had no significant impact on the final shrinkage and porosity values. During drying, porosity of the samples first increased until a critical value, at which point further decrease in moisture resulted in collapse of pores. Pore size distribution curve of raw sample showed two major peaks (at around 19.8 and 7.18 μm). After drying, the peaks became shorter and the curve shifted to the left, indicating that the amount of pores and their diameter decreased. At extreme process conditions, it was observed that the orange peel surface was cracked and the characteristic distribution of the waxy components was obstructed.

**Keywords:** Orange peel, drying, shrinkage, porosity, pore size distribution

**P-010**

# Oleuropein Content, Antioxidant Activity and Consumer Liking of Herbal Tea Made from Hot Air- and Freeze-Dried Olive Tree Leaves

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Olive tree (*Olea europaea* L.) leaves are of great interest due to their nutraceutically valuable raw material which contains high amount phenolic phytochemicals, especially oleuropein. Turkey is an olive producing Mediterranean country and has a significant potential to commercialize this raw material in herbal tea as a hot or cold served functional beverage. In this study, two different drying methods (hot air drying and freeze-drying) were applied to leaves from two different cultivars of olive trees (Edremit and Ladolia) and the wild type (*Olea oleaster)* olive tree. Then, herbal teas were made from fine powder of the dried olive leaves by infusion at 80ºC for 10 min. Major effects of the drying methods on bioactive compounds and antioxidant potentials of olive leaf teas were investigated. Drying methods did not have any significant effects on total phenolic and total flavonoid contents of the teas ($P>0.05$), while oleuropein content of the teas made from freeze-dried leaf powder reduced, approximately 50%. Other identified phenolics in teas such as rutin, luteolin 7- glucoside and apigenin 7-glucoside did not change the contents significantly ($P>0.05$). Bioactive compounds (total phenolic, total flavonoid and oleuropein contents) of the tea from wild type was the highest followed by the tea from Ladolia. The trolox equivalent antioxidant capacity of tea products also did not change in terms of drying methods ($P>0.05$) and the wild type had the highest TEAC values as 6.81 µmol trolox/mL tea from air-dried leaves and 7.53 µmol trolox/mL tea from freeze-dried leaves. Sensory acceptance of olive leaf teas were considered as well. The teas used were plain tea and lemon, bergamot or peach aromatized tea. Consumer liking test based on the 7 point hedonic scale was carried out with 57 people. Plain tea had the lowest score as 2.8 because of the bitterness. Aromatization of the plain tea with lemon, bergamot and peach aromas developed the liking scores highly positive.

**Keywords:** Olive leaf tea, bioactive compounds, sensory acceptance

**P-011**

# Effect of Ascorbyl Palmitate on Oxidative Stability of Sunflower Oil

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In this study the effects of temperature (40, 60 and 80°C), time (0, 7, 14, 21 and 28 days) and different concentrations of ascorbyl palmitate (0, 200, 400, 600, 800 and 1000 ppm) on parameters such as peroxide value, conjugated diene and triene fatty acids and hexanal contents of sunflower oil under accelerated oxidation condition (Schaal Oven Method) have been investigated. Peroxide value, conjugated diene and triene acids are indicators of primary oxidation products and hexanal have been used as an indicator of secondary oxidative deterioration.

The results showed that the temperature and time increased the peroxide values and ascorbyl palmitate decreased the peroxide values of samples under accelerated oxidation condition. Increasing temperature from 40 to 60 and 80°C significantly increased ($P$<0.05) the peroxide values of samples. The peroxide values of samples without ascorbyl palmitate kept at 40, 60 and 80°C increased from an initial value of 1.2 meq $O_2$/kg oil to 144.4, 160.2 and 249.6, respectively after 28 days storage. The peroxide values of samples with 0, 200, 400, 600, 800 and 1000 ppm ascorbyl palmitate kept at 80°C were found to be 249.6, 157.4, 153.8, 149.6, 141.8 and 121.0 meq $O_2$/kg oil, respectively. Samples with 1000 ppm ascorbyl palmitate kept at 40°C showed the lowest peroxide values. Ascorbyl palmitate did not effectively decreased the conjugated diene acids formation in samples kept at 80°C. Ascorbyl palmitate did not significantly affect the conjugated triene acids formation in sunflower oil. Increasing the temperature also increased the hexanal contents of samples during 28 days storage. The hexanal contents of samples without ascorbyl palmitate increased from 0.05 to 3.18 ppm after 28 days storage at 40°C. The hexanal contents of samples effectively decreased as their ascorbyl palmitate concentrations increased. While the hexanal contents of samples without ascorbyl palmitate increased from 0.05 ppm to 9.19 ppm after 28 days storage at 80°C, the hexanal contents of their counterparts with 1000 ppm ascorbyl palmitate increased from 0.05 ppm to 0.98 ppm.

According to the reducing effect of ascorbyl palmitate on peroxide values and hexanal contents of the samples, it was concluded that ascorbyl palmitate could be used as an effective antioxidant for preserving of sunflower oil.

**Keywords:** Ascorbyl palmitate, hexanal

**P-012**

## Effect of Spray-drying Conditions on the Amount of Hydroxymethylfurfural (HMF) Content of White Cheese Powder

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Hydroxymethylfurfural (HMF) is evaluated as potentially carcinogenic compound which is mainly formed through non-enzymatic browning reaction called as Maillard reaction at high temperature process and during storage period of foods. Therefore, HMF can be considered as a specific indicator of the heat treatment applied to dairy powders. Spray drying is a well-known processing technique for drying fluid foods, especially in the dairy industry. Cheese powder, produced by drying of cheese, is widely used as an ingredient for the manufacturing of many food products such as biscuits, snacks, bakery, sauces, dressing, ready meals and processed cheese.

The objective of the study was to investigate HMF level of white cheese powder which was produced using a pilot scale spray drier under different process conditions. Drying experiments were carried out at different inlet air temperatures (160, 195 and $230^0$ C), outlet air temperatures (60, 80 and $100^0$ C), and atomization pressures (294, 441 and 588 kPa). Two drying parameters were kept constant while other parameter was changed. The effect of spray drying conditions on the HMF values of samples was determined by spectrophotometric method. The results showed that HMF level of white cheese powders varied from 6,79 to 50,32 µM/100 g, and the highest level was found at high outlet air temperature while the lowest level was found at low outlet temperature. Regarding the inlet air temperature, higher inlet air temperature ($230^0$ C) significantly increased the HMF level whereas other inlet air temperatures (160 and $195^0$ C) did not have any increasing effect on the levels ($p>0,05$). In conclusion, it was considered that in spray drying process, higher inlet and outlet air temperatures caused an increased HMF level and atomization pressure did not significantly affect HMF levels of cheese powders.

**Keywords:** Hydroxymethylfurfural, cheese powder

**P-013**

# Investigation of *eps* Genes, Biofilm Formation and Analysis of Sugar Compositon in Exopolysaccharides Producing Lactic Acid Bacteria

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Lactic acid bacteria (LAB) are industrially important organisms used for the production of milk products. LAB has attracted interest for their ability to secrete extracellular polysaccharides. These exopolysaccharides (EPS) have commercial value because of their industrially useful physico-chemical properties. In nature, bacteria have developed a variety of mechanisms for resistance to environmental stresses. The biofilm formation by some LAB species has been reported. The purpose of this study was to determine the EPS production and biofilm formation of selected probiotic LAB.

In this study, twenty *Lactobacillus plantarum*, fifteen *L. fermentum*, nineteen *Enterococcus faecium* strains along with one *E. durans* strain which were previously isolated from human fecal samples were used. These strains were previously identified by 16S rRNA and examined for probiotic properties. The efficiency of EPS production was screened for *eps* genes by PCR. Selected twenty strains according to the amounts of sugar production were analyzed by HPLC and biofilm formation was measured by optical density at 590 nm in three different media.

It was found that 25 of all *Lactobacillus* species were fructansucrase positive and 18 of all *Enterococcus* species were glycosyltransferase positive. According to the results, 6 *L. plantarum* strains, 8 *L. fermentum* strains and 6 *E. faecium* stains were used in the analysis of high production of sugar and biomass. Mean values of rhamnose, fructose, mannose, glucose, galactose and sucrose were 104.58 µg/g, 18.26 µg/g, 8.05 µg/g, 21.05 µg/g, 15.81 µg/g and 16.56 µg/g, respectively. The abilitiy of biofilm forming strains was affected by different environmental conditions. Only *E. faecium* strain was unable to produce

biofilm in three different medium. *E. faecium* BK9-42, *L*. *fermentum* BB19-90 and *L. fermentum* BK10-44 showed the highest biofilm formation.

**Keywords:** Exopolysaccharide, biofilm, *eps* genes

The study was supported by Coordinatorship of Scientific Research Projects of Mehmet Akif Ersoy University under the Project number of 0239-YL-14.

**P-014**

## Soybean Lecithin as Natural Gelator: Role of Phosphatidilcholine Content, Solvent and Primers on Oleogels Formation

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Organogels are self-assembled soft materials that show ability to structure fats, based on a three-dimensional low molecular weight gelators network. Lecithin, a natural phospholipid, can form spherical or ellipsoidal reverse micelles when dispersed in oil, which can aggregate, thus structuring the solvent. Lecithins with different phosphatidilcholine (PC) content (Epikuron® 20-27%- EPI; Phospholipon® 96.9%- PHO; Phosal®35SB 34.4%- POS; Lipoid® S45 45%- S45) were mixed with hexadecane (HEX), sunflower oil (SFO) or medium-chain triglycerides (MCT), with water solubilities of 0.0515±0.083, 1.0789±0.1337 and 2.4490±0.0464 mg/g respectively. Organogels were prepared with 20% (w/w) of gelator. In the case of SFO and MCT, the gelator was too soluble in the solvent, and then a solution was formed instead of a gel. Only the pair HEX (the most nonpolar solvent used in this work) and the lecithin with higher PC content (PHO-corresponding to L20 formulation), was able to form a transparent, isotropic and viscoelastic gel-like system. These results highlight the importance of solvent quality, since it can change the micellar interactions, phase behavior and rheology of the systems made from it. The only successfully gelled pair, L20, showed that the balance of solubility and insolubility between solvent and gelator must be accurate: while these two chemical species must be relatively insoluble in order to self-assemble to form structures, they must also be relatively soluble to allow interaction with solvent molecules. Organogels (PHO-HEX) were also prepared with addition of traces of water (0.5%- w/w), and citric acid (1.5%- w/w) aiming at manipulating gel strength. Rheological and structural evaluation showed that addition of water promoted a different structural organization from

that achieved with the addition of the organic acid. Lecithin and primers (water and citric acid) are edible and biocompatible, with promising applications in the food industry, but a nonpolar solvent is necessary to allow forming gels.

**Keywords:** Self-assembly, organogel, viscoelastic

**P-015**

# Novel Approach for Immobilization of Dandelion Polyphenols: Implementation of Green Coffee to Alginate Delivery Systems

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Recently, due to the low bioavailability and high instability of polyphenols, scientific community, as well as industry put much effort to find adequate solutions for polyphenolics protection, and revealed encapsulation technique as the most effective.

Since bioactive profile of dandelion (*Taraxacum officinale* L.) is still insufficiently investigated, and data about its encapsulation are limited, the aim of this study was to characterize and immobilize dandelion leaves polyphenols in different alginate-based delivery systems using ionic gelation. In order to enhance the properties of alginate hydrogels, alginate (A) was combined with whey protein isolates (WPI), and green coffee (GC), which as material for delivery of bioactives has not been used before. Also, the influence of alginate concentration (4% and 5%) on the encapsulation efficiency of dandelion polyphenols was examined.

Polyphenolic profile of dandelion leaves was determined using spectrophotometric and HPLC analyses. Obtained hydrogel particles were scanned for physico-chemical and morphological properties. Encapsulation efficiency was evaluated in terms of total polyphenols (TP) and hydroxycinnamic acids (HCA), while release kinetics of polyphenols was observed in simulated gastrointestinal conditions.

HPLC analysis showed chicoric acid as dominant hydroxycinnamic acid in dandelion leaves (6.14 mg/g), followed by caftaric, chlorogenic and caffeic acids. Beads produced with lower concentration of alginate (4%) were characterized with smaller size, less hardness and lower elasticity. In general, the addition of additional coating to alginate increased particle size, where hydrogel beads produced with GC were the largest (2.66 and 2.80 mm). Morphology analysis revealed more spherical shape of hydrogels when higher concentration of alginate (5%) was used, where plain alginate beads were scanned as ones with the most regular shape. Encapsulation efficiency (EE) of TP and HCA was markedly enhanced after the reinforcement of alginate with WPI and GC. HCA of dandelion leaves were immobilized in a high content, where system A-WPI had the highest EE (98.99%), followed by A-GC (79.09%), when lower alginate concentration was used. The slowest

release of HCA from formulated beads showed system enriched with GC (5%A), with continuously release during 140 min, up to 2.9 mg caffeic acid/g of bead.

Implementation of green coffee to alginate, besides improving bioactive profile of obtained beads, showed very high potential for entrapment of dandelion polyphenols. These results encourage introduction of new, unused materials into delivery systems for encapsulation purposes.

**Keywords:** Alginate, dandelion, green coffee, hydroxycinnamic acids, ionic gelation

**P-016**

# Effect of Ultrasound Pre-treatment on Rehydration Properties of Beef Tenderloin Meat

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The objective of this study was to discover the effect of ultrasound pre-treatment on rehydration properties of beef tenderloin meat. For this purpose, ultrasonic probe with 20 kHz frequency was used for pre-treatment. Ultrasound pre-treatment applications were made in water with 100 % amplitude during 5 and 10 minutes to the vacuum packed cubes of beef tenderloin meat. After ultrasound pre-treatment drying was performed by hot air. Drying was performed at 0.3 m/s air velocity and at two different air temperatures of 50°C and 80°C. Rehydration of the samples were carried out by immersing the into samples distilled water at 80°C. The weight of the meat samples was measured at definite time intervals during the rehydration. Rehydration ratio was estimated from the ratio of the sample weight after rehydration to the sample weight before rehydration. Water holding capacity of the rehydrated samples was determined by centrifugation at 4000 rpm and at 5°C for 10 minutes. Peleg model was used for the modeling of rehydration curves and experimental data were represented successfully by the model ($R^2 > 0.99$, RMSE < 0.0095 and $\chi^2 < 0.0011$). Rehydration ratio of the samples were between 1.44 - 1.54 for the samples dried at 50°C and 1.64 – 1.65 for the samples dried at 80°C. Although the rehydration ratio values of the samples were affected significantly from the drying temperature they were not affected significantly from ultrasound pre-treatment ($P<0.05$). The water holding capacity of the samples were found between 55.75 – 71.88 for the samples dried at 50°C and 68.54 – 72.33 for the samples dried at 80°C. Although the water holding capacity of the samples dried at 80°C were not affected from ultrasound pre-treatment, 10 min ultrasound pre-treatment increased significantly the water holding capacity at 50°C ($P<0.05$).

**Keywords:** Ultrasound pre-treatment, drying, rehydration, meat

**P-017**

# Production of Monodisperse Liposomes by Microfluidic Devices

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Liposomes are colloidal nanovesicles formed by the self-assembling of amphiphilic lipids, generally phospholipids that in excess of water aggregate forming lipid bilayers and enclosing aqueous compartments. Liposomes have great potential for food applications because of their biocompatibility, sustained release potential, ability to vehicle both hydrophobic and hydrophilic compounds and utilization of natural food-grade ingredients. The production of liposomes by the microfluidics approach is based on the hydrodynamic flow-focusing method in microfluidic devices with cross-shaped geometry. Thus, the objective of this work was to develop and to evaluate a microfluidic platform of hydrodynamic flow-focusing to obtain liposomes in different process operational conditions. Rectangular microdevices (50×100 μm) were prepared with polydimethylsiloxane by soft photolithography technique. The liposomes were produced by introducing organic phase containing lecithin and ethanol through central channel and subsequent compression of this phase by two adjacent aqueous streams. The solutions were introduced through a glass syringe, and its flow rate controlled by a syringe pump. The influence of lecithin concentration, total flow rate and flow rate ratio on the hydrodynamic diameter, particle size distribution, polydispersity index and morphology aspects were evaluated. A significant increase in average hydrodynamic diameter as a function of increasing lecithin concentration was observed, but significant differences were not observed in the polydispersity index of the obtained liposomal systems. Hydrodynamic diameter and polydispersity index remained constant when total flow rate varied at constant flow rate ratio equal 10. The increase of flow rate ratio from 5 to 30 led to a significative reduction of liposomes hydrodynamic diameter. Microfluidic devices allowed to produce liposomes with size and structural aspect similar to liposomes obtained by conventional techniques, but with lower polydispersity. Thus, the development of a microfluidic plataform with continuous operation at high flow rate is an important tool to achieve parallel devices to industrial application.

**Keywords:** Nanovesicles, phospholipid, microchannels, lecithin

**P-018**

# Quality Characteristics of Beef Burger Containing Quinoa Flour

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The objective of this work was to assess the performance of quinoa flour in the improving the quality characteristics of beef burger. The effects of quinoa flour addition on proximate composition, pH, cook loss, dimensional changes, color and lipid oxidation of beef burgers were evaluated. Five formulation of burger were produced in three replicates as follows; one control using 7% bread crumbs and four treatments 3, 5, 7 and 10% of quinoa flour, respectively. Cooked burger samples were vacuum packaged and stored at -18°C for 3 months.

The groups containing quinoa flour had the highest ash and protein contents ($P<0.05$). The cooking yield and reduction in diameter and thickness of beef burgers improved by the addition of quinoa flour. pH values decreased depending on the amount of quinoa flour in the formulation, which shows the addition of quinoa flour in burger reduces the pH level ($P<0.05$). The results indicated that TBARS values gradually increased during storage period in all treatment groups ($p<0.05$). However, addition of quinoa flour significantly decreased TBARS values compared to control group during storage period ($p<0.05$). Furthermore, texture analysis showed that with the addition of quinoa flour, hardness values of burger increased and adhesiveness values decreased ($p<0.05$). All treatment groups showed similar L*, a* and b* values. On the other hand, L* values gradually increased during storage period in all treatment groups ($p<0.05$).

It is concluded that replacement of bread crumbs with quinoa flour had no negative effects on quality parameters of burger and enhanced reduction of oxidation rate. Additionally, the use of quinoa flour in burger manufacture may have nutritionally positive effects due to increased protein content.

**Keywords:** Beef burger; quinoa flour; oxidation, texture, quality

**P-019**

# Production of Heteroaggregated Droplets Coated with Sodium Caseinate and Lactoferrin

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Formation and characterization of heteroaggregates of droplets was investigated by mixing two emulsions previously stabilized by proteins oppositely charged. Emulsions were composed of 5 vol. % of sunflower oil and 95 vol. % of sodium caseinate or lactoferrin aqueous solutions. They were produced using ultrasound with a fixed power (300 W) and sonication time (6 min). Droplets size, microstructure and creaming stability of emulsions were evaluated. Interfacial tension between protein solutions and oil phase was also measured. Different volume ratios (0-100%) of sodium caseinate-stabilized emulsion (droplets diameter around 1.75 μm) and lactoferrin-stabilized emulsion (droplets diameter around 1.55 μm) were mixed under conditions that both proteins showed oppositely charged (pH 7). Creaming stability, zeta potential, microstructure, mean particle diameter and rheological properties of the heteroaggregates mixture were measured. These properties depended on the volume ratio (0-100 %) of sodium caseinate to lactoferrin-stabilized emulsion (C:L). Different zeta potential values were obtained, but improved rheological properties and the largest heteroaggregates were formed at higher content of lactoferrin-stabilized emulsion (60-80%). The heteroaggregates produced may be useful functional agents for texture modification and controlled release since different rheological properties and sizes could be achieved.

**Keywords:** Emulsion, sodium caseinate, lactoferrin, heteroaggregation, electrostatic interactions

**P-020**

# Determination of Reactive Groups and Rheological Properties of Tuna Myofibrillar Protein during Frozen Storage

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Understanding physicochemical characteristics is of utmost importance as it is directly related to the quality of products like tuna sashimi. The purpose of the present study was to investigate the biochemical changes as well as the rheological properties of big-eye tuna *(Thunnus Obesus)* myofibrillar protein(MP) during frozen storage at -18°C and -30°C. Reactive Groups of MP were monitored during 30 days of storage at -18°C and -30°C. Results showed that $Ca^{2+}$-ATPase activity of MP storage at both temperature decreased continuously during storage ($P<0.05$). A decrease in sulfhydryl group(SH) content was observed during the storage ($P<0.05$). Effects of different storage conditions on viscosity of myofibrillar protein solutions were also investigated. Myofibrillar protein solutions exhibited a pseudoplastic fluid behavior. The shear-thinning behavior was fitted well into the Power law model (with a satisfying correlation of $R^2 > 0.979$). Viscosity decreased with the increase of temperature and storage time. Oscillatory rheology analyses showed that MP at -18°C showed higher storage modulus (G') than -30°C. The loss of free sulphydryls could result in an ascent in the storage modulus (G').Results indicated that rheological properties were highly correlated with storage temperature. Storage temperature showed significant impact on protein denaturation, including changes of SH contents and disulfide bonds which may damage the structure of heavy meromyosin. Rheological properties of myofibrillar proteins depended heavily on the physiological function of myosin.

**Keywords:** Frozen denaturation, myofibril, Ca2+-ATPase activity, sulfhydryl, rheological property

**P-021**

# Phytochemical Composition and Hematological Effect of *Ephedra alata* Decoction in Alloxan-Induced Diabetic Rats

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*Ephedra* spices had been used by the Chinese for over 5000 years, it was considered as the oldest drug used in different treatment. It has gained widespread popularity as an ergogenic supplement. This study aims to evaluate the hematological parameters in alloxan-induced diabetic rats after an oral administration of *Ephedra alata* areal part decoction. A phytochemical analysis was also investigated in this study by a spectrophotometric essay.

The colorimetric essay shoed an interesting content in Total Phenolic and in Total Flavonoids with respectively 10.49 ± 0.08 mg GAEq / g extract and 41.84 ± 0.48 mg CEq / g extract.

Decoction was orally administrated once a day for 28 days to diabetic rats by three different doses (100 mg/kg CW, 200 mg/kg CW and 300 mg/kg CW). The levels of RBC, HCT, MCV, MCH, MCHC, PLT, PCT, MPV, PDW, WBC, lymphocyte and granulocyte were evaluated in blood. There was significant reduction in RBC and HCT levels in the treatment groups especially in group of 300 mg/kg with significant increases in their MCV and MCH levels when compared with the diabetic control group. The treatment groups showed significant reduction in their WBC and lymphocyte levels while significant increase in granulocyte levels was noted in the treatment group of dose 300 mg/kg when compared with diabetic control group. In conclusion, *Ephedra* decoction proved to have anti-infective property and showed capabilities to boost the immune system.

**Keywords:** Decoction, phytochemical composition, hematological parameters, diabetic rats.

**P-022**

# Production of Colored Lemonade and Effect of Heat Pasteurization on Quality Parameters

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Recently, researchers have shown an increased interest in bioactive enriched food and drinks. In this study, colored lemonade were produced by using pomegranate, black carrot and sour cherry concentrates and effects of pasteurization on the properties of produced lemonades were determined by applying various analyses (pH, titration acidity, brix, color, browning index, monomeric anthocyanin contents, anthocyanin compounds, organic acid compounds, antioxidant activity, total phenolic, hydroxyl methyl furfural and furfural contents and sensory analysis). According to results, the lowest antioxidant activity (55.92%) was determined in control lemonade (without any concentrate) while the highest (85.9%) was in colored lemonades which involved in 3% pomegranate concentrate. The total phenolic compound values were ranged between 126.7 and 538.3 mg/L for the samples. The monomeric anthocyanin contents were determined between 4.0 and 101.4 mg/L. These values were lowest for samples colored with pomegranate as compared the black carrot and sour cherry concentrates. The most abundant anthocyanin compounds were cyanidin-3,5-diglucosid, cyanidin-3-xylosyl-glucosyl-galactoside-ferulic acid, and cyanidin-3-glucosyl-rutinoside for samples colored with pomegranate, black carrot and sour cherry concentrates, respectively. The L*, a* and b* values of control lemonade were 74.52, 0.59 and 53.4, respectively. Further, depending on the concentrate types, L* values decreased, while both a* and b* values increased remarkably. However, the pasteurization process was not effect on the color values. Additionally, the main organic acid compound was detected as citric acid for all samples with range of 1816.7-2755.8 mg/100mL. After pasteurization treatment, HMF contents increased slightly, whereas furfural contents increased remarkably as compared to fresh lemonade samples. The sensory analysis results showed that the type and concentration of concentrates had significant effect on preference of the samples. According to sensorial evaluation, the samples involved in 1% sour cherry concentrate took higher points than other colored samples.

**Keywords:** Lemonade, colored lemonade, anthocyanin compounds, heat pasteurization, HMF and furfural

**P-023**

# Effect of Thermal Process on Seafood Gelatine Textural Structure

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Gelatine is a mixture of peptides and protein obtained from collagen by partial thermal hydrolysis. It is an essential and functional biopolymer that has broad applications in the food, pharmacy and photography industries. Most commercial gelatins are generally sourced from pig skin and bones, beef bone and hide. In recent years, fish gelatin received increasing interest as an alternative to land animal gelatin by reason of spiritual restrictions and health matter associated some contaminant. Both Judaism and Islam forbid the consumption of any pork-related products and non-religiously slaughtered beefs. One of the most important parameters of gelatin quality is textural property. Different types of gelatines have changing by thermal process as rheological properties such as bloom strength, melting and gelling temperatures. These properties are regulated by factors such as chain length or molecular weight allocation, amino acid structure and hydrophobicity. Thermal process is necessary for gelatin extraction but extended time and increasing temperature damage to gelatin structure and properties.

Apparently, this review has emphasized that effect of different thermal process as melting, freezing, heating and cooling on seafood gelatine textural structure.

**Keywords:** Thermal processing, seafood, gelatine, textural properties

**P-024**

# Effect of Soluble Solid Concentration and Temperature on Physical and Rheological Properties of Pekmez

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Pekmez is produced for centuries in Anatolia, by concentration of juices of different types of fruits. Grape and mulberry are main raw materials for the production of pekmez. Grape or mulberry juice is concentrated by evaporation to decrease water content 80% to 30% for pekmez production.

During pekmez production both soluble solid concentration and temperature of fruit juice are increasing. Physical and rheological properties of pekmez are primarily dependent on soluble solid concentration and temperature. The point of this study are determination of density, electrical conductivity and rheological properties of grape and mulberry pekmez samples at different brix (20, 30, 40, 50, 60, 70°) and temperatures (20, 40, 60, 80°C). The outcomes of this study could be useful for equipment design and process optimization of pekmez production with conventional and ohmic heating method.

Density of both grape and mulberry pekmez samples decreased with increasing temperature and increased with decreasing Brix°. Electrical conductivity of grape and mulberry pekmez samples were increased with an increase in temperature and decreased with increased Brix°. Electrical conductivity values of grape pekmez were higher than mulberry pekmez in all temperature and Brix° values. Viscosity of grape and mulberry pekmez samples were measured with rheometer (Anton Paar MCR 102, Germany) equipped with a parallel plate geometry (diameter 35 mm) and 1 mm gap. Apparent viscosity values (50 $s^{-1}$) of pekmez samples were investigated. Grape pekmez has higher apparent viscosity than mulberry pekmez. Apparent viscosity of both pekmez samples increased with increasing Brix° values and decreased with increasing temperature. Both grape and mulberry pekmez samples showed pseudo-plastic behavior during measurements.

**Keywords:** Pekmez, rheology, density, electrical conductivity

**P-025**

# Investigation of Pore Size Distribution and Some Physical Properties of Different Formulated Microwave Baked Cakes by Image Analysis

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In this study, it was aimed to produce microwave baked gluten-free cakes by mixing buckwheat flour and rice flour at different concentrations. Two different gum types (xanthan and guar gum) with a white layer cake recipe were used in the experiments. Three different ratios of buckwheat flour to rice flour (20:80%, 30:70%, 40:60%) were employed during preparation of the batter. The batters were baked in microwave oven at different microwave powers (540 W, 450 W, 360 W) and during different baking times (3 min, 3.5 min, 4 min). The effect of microwave power, baking time and buckwheat flour concentration on weight loss, porosity and specific volume were investigated by Response Surface Methodology. It was found that microwave power and baking time were positively effective on weight loss, specific volume and porosity of the buckwheat-rice cakes with both guar and xanthan gum. For porosity and pore area distribution determination, image analysis was performed. The significant correlation between porosity and specific volume of cakes showed that image analysis is a promising method to investigate pore area and pore size distribution of cakes. Pore size distribution of optimum formulated and optimum baked cakes with different gum types were found to be different. It was observed that the cakes prepared with guar gum had similar pore size distribution with control cakes.

**Keywords:** Microwave baking, buckwheat flour, image analysis, pore area distribution

**P-026**

# Effects of Using Fresh and Dry Rosehips on Physicochemical Properties of Fermented Meat Model System

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Rosehip is rich in vitamin C, phenolics, antioxidant activity and is widely used for food production. The effects of rosehip addition on the physicochemical properties of fermented meat system were investigated. Fermentation process of meat model system was carried out in flasks by using 50 gr meat batters. The control group did not contain rosehip, however, other three groups contained 10% fresh rosehip, 10% conventionally dried rosehip and 10% lyophilized rosehip, respectively. Starter culture mix was used in all groups and fermentation process was carried out at 90% moisture and 24 °C for 72h. Changes in pH, moisture, protein, fat, ash, color parameters (L*, a*, b*) and oxidation level of the batters were determined during fermentation period.

The results indicated that TBARS values gradually increased during storage period in all treatment groups ($p<0.05$). However, addition of fresh and dry rosehip decreased TBARS values compared to control group ($p<0.05$). Group with fresh rosehip had lowest TBARS values at the end of fermentation. pH values of batters were decreased with addition of rosehip and control group had highest pH values at the end of fermentation ($p<0.05$). While higher L* values were observed in batter with 10% fresh rosehip compared to other treatment groups at the beginning of the fermentation, same group had lowest L * values at the end of the fermentation ($p<0.05$). The addition of rosehip in batter showed non-significant effects on moisture, protein, fat and ash levels in batters.

The results of this study indicated that the use of rosehip as an ingredient for fermented meat system has no negative effects on quality parameters of fermented meat products.

**Keywords:** Fermented meat, rosehip, oxidation

**P-027**

# The Effects of Different Chloride Salts on Lipolytic and Proteolytic Properties of Traditionally Produced Pastırma

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The aim of the study was to investigate the effects of different chloride salts on proteolytic and lipolytic properties of traditionally produced pastırma (a Turkish dry-cured meat product). $Na^+$, $K^+$, $Ca^{+2}$ and $Mg^{+2}$ had a certain increase depending on their ratio in the curing mix. Non-protein nitrogenous matter value increased slightly in the presence of $CaCl_2$ and/or $MgCl_2$. Cathepsin B activity was lower compared to Cathepsin B+L and was higher than Cathepsin H. The different chloride salts treatment was found to have a statistically significant effect on the amount of free fatty acid of the pastırma samples. No differences were observed among the samples salted with different chloride salts with respect to TBARS values. The activities of acid lipase, neutral lipase and phospholipase remained at a certain level during the production of pastırma. The highest mean values of acid lipase and phospholipase were detected in samples containing NaCl+KCl+$CaCl_2$+$MgCl_2$ combination.

**Keywords:** Pastırma, cathespin, lipase, proteolysis, lipolysis, chloride salts

**P-028**

# A Study on the Production of Powder Şalgam

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Fermentation and drying technologies are the oldest methods used by humankind for the protection of foods. Fermentation process has many positive effects on foods such as the development of the taste, aroma, structure and increasing the nutritional value and shelf life. Products manufactured by fermentation are mainly pickles, vinegar, table olives, yogurt, wine and beer. Besides these products, there are some local fermented products such as şalgam, tarhana and boza which are less common compared to other fermented products. Şalgam is a beverage produced on an industrial scale in addition to local production especially in Adana and other cities of Cukurova region.

The freezing process is widely used for long-term preservation of vegetables and fruits. Cryopreservation process completely stoppes or reduces the chemical, biochemical and microbiological processes to minumum level in the structure of vegetables and fruits. On the other hand, drying technology provides end-products with a longer shelf life and reduced volume and weight. Therefore, it provides convenience in shipping and handling and contributes to the diversity of products on the market. It is possible to obtain a high quality end-product preserved with freze drying method which has all advantages of both freezing and drying techniques.

In this study, production of powder şalgam from fermented şalgam juice was aimed and some physical, chemical and sensory characteristics of powder şalgam juice were investigated. Moisture of the şalgams that were produced by lactic acid fermentation was removed via freeze drying and powder şalgam was obtained. pH, total acidity, dry matter, salt, total phenol, total anthocyanin, turbidity, colour (L*,a*,b*) and sensorial analyses were performed on fermented and powder şalgams afterward the data were analyzed statistically. According to the results, difference in colour was not observed in powder şalgam juice. Besides, şalgam juice produced by using powder şalgam at the ratio of 3.2% had been found to confirm values specified in the TSE 11149 şalgam standart. According to the results of sensory analysis, şalgam juice which was produced from powder şalgam had close score to the sample that used as a control and preferred by the panelists.

**Keywords:** Şalgam, powder şalgam, freeze drying, fermentation.

**Acknowledgement:** This research was supported as a patent application (Project No: FPT-2016-6426) from Cukurova University Unit of Scientific Research Projects.

**P-029**

## Cocoa Husk Extract as the Source of Functional Ingredients for Production of Edible Packaging Films Based on Alginate, Pectin and Chitosan

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Owing to the increased tendency of producing bioactives-enriched films and coatings for food applications, in this study the potential of formulating edible films from polymeric hydrocolloid materials (alginate, pectin, chitosan) in cocoa (*Theobroma cacao* L.) husk extract as the source of macroconstituent (polysaccharides) and bioactive compounds (polyphenols and methylxanthines) was investigated. Since cocoa husk extract represents the main cocoa processing by-product in the chocolate industry, valorization of this material by expoiting it as a source of added-value functional ingredients was examined. A comparative study of the physical, mechanical, bioactive and sensory properties of produced films, prior and after drying of films at 60°C, was undertaken, and the relation between specific properties (colour, sensory and mechanical properties) was deduced by correlation analysis. The effect of enrichment with polyphenolic compounds and theobromine derived from cocoa husk extract was determined by comparing the produced films with control films obtained only in distilled water.

According to the obtained results, edible films were produced with thickness ranging from 30-100 μm, which was primarily in dependence of the solubilization media (water or cocoa husk extract), while the water and dry matter content were more affected by the employed biopolymer material. Control alginate film generally exhibited the best mechanical (highest tensile strenght - 6,17 N and lowest deformation - 0,73 %) and sensory properties, while the enriched chitosan film prepared in cocoa husk extract exhibited the poorest respective properties and the most potent thickness (104,67 μm). By preparing the films in cocoa husk extract a significant increase of bioactive compounds content was achieved (even up to 3-fold higher) in relation to control films, while the bioactive properties remained preserved even after drying of films at 60°C. Enrichment of films in cocoa husk extract enabled to markedly enhance the bioactive content, but it negatively affected the physical, mechanical and sensory properties of produced films, which were better

for control films (especially alginate one).

**Keywords:** alginate, bioactive compounds, chitosan, cocoa husk extract, edible films, pectin

**Acknowledgements;** This study was supported by the Croatian Science Foundation in the scope of the SPECH-LRM (number 9158) project.

**P-030**

## Production of Sweet Black Mulberry Vinegar as Functional Food: Their Anthocyanins and Antioxidant Potential

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Black mulberry (*Morus nigra*) is soft, fleshy and it is a highly nutritious fruit grown in many European countries, particularly in Turkey. The medicinal values of this fruit due to their phenolic phytonutrients are shown in considerable studies with positive results. Black mulberry as an antioxidant-rich fruit contains great amount of anthocyanins, which are responsible for their attractive dark red color and also other phenolic compounds. Our previous study showed that black mulberry anthocyanins are very susceptible during vinegar production by aerated deep culture method and are easily degraded, approximately 88%. In this study, sweet vinegar productions from black mulberries as a different method from usual vinegar production are employed with no fermentation process and in a short time. Infusions of black mulberry fruits in grape vinegar (4:1.25, w/w, respectively) are prepared, kept overnight and then, filtered by muslin-cloth. Some sugar was added to these infusions and then, concentrated using conventional heating or evaporation. Final products had 50°bx values. Processing effects on antioxidant properties (DPPH and FRAP) and anthocyanin profile of black mulberry fruit are investigated. Anthocyanins of the black mulberry fruit were determined as cyanidin-3*O*-glucoside, cyanidin-3*O*-rutinoside and pelargonidin-3*O*-glucoside. Approximately, 42% of the black mulberry fruit anthocyanins were lost in the final product. Cyanidin-3*O*-glucoside derivative of the fruit anthocyanins is characterized by the lowest loss. Significant increases were observed in antioxidant properties in terms of FRAP and $EC_{50}$ values of black mulberry fruits after vinegar addition to black mulberry fruits and following concentration process ($P<0.05$). The final product had stronger antioxidant capacity than the black mulberry fruit. Differences between the two concentration methods in terms of anthocyanins and antioxidant properties of the product were not large enough to be significant ($P>0.05$). Also, the final products were characterized in terms of their physicochemical quality parameters such as total phenol, color values

($L^*$, $a^*$ and $b^*$), pH and titration acidity.

**Keywords:** Black mulberry, sweet vinegar, antioxidant capacity, anthocyanin

**P-031**

## Edible Coatings of Gelatin-sodium Caseinate with Boldo Extract Incorporated to Prevent the Lipid Oxidation on Brazil Nuts

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Gelatin (GEL) and sodium caseinate (SCas) have a good biodegradability, biocompatibility, film-forming ability, abundance and low cost. Both are excellent vehicles to incorporate bioactive compounds, such as Boldo of Chile extract (B) that presents fungistatic and antioxidant properties.

The aim of this investigation was to retard the lipid oxidation of Brazil nuts through application of GEL-SCas blended coating with B extract incorporated.

Brazil nuts from the same batch were immersed in the respective film-forming solutions (GEL100, SCas100, GEL50:SCas50 and GEL50:SCas50 + B) for 5 min, then removed and left to dry for 5 h at room temperature. The non-coated (control) and coated nuts were then packaged in PET cups and stored at 25ºC. The cross-section micrographs of nuts, the initial moisture and oil content and peroxide value (PV) at 0, 30, and 60 days of Brazil nuts were analyzed, as well as the transmission rate of oxygen (TRO) of the films.

Our results showed the cross-section micrographs of non-coated and coated Brazil nuts. For the day 0, Brazil nuts presented 56.49% of moisture content, 4.66% of oil content and 10.49 meq/kg of fat in PV analysis. For the day 30, all the coated Brazil nuts showed a lower PV than the non-coated nuts (34.67meq/kg of fat), where Brazil nuts coated with GEL50:SCas50 solution, without or with B extract added, showed the lower values (around 11.95meq/kg of fat). For the day 60, an increment of PV in non-coated nuts was observed (41.89meq/kg of fat), while coated nuts with GEL50:SCas50 + B solution showed a lower PV (11.61meq/kg of fat), similar value at day 0 and 30. Moreover, GEL50:Scas50 + B blended film showed the lower value of transmission

rate of oxygen (6.53 cc/[m2*day]).
This investigation concluded that the GEL50:SCas50 + B coating was more effective against lipid oxidation of the Brazil nut, compared with the other coatings, possibly due to the lower TRO presented.

**Keywords:** Biodegradables-polymers, edible coating, natural extract, Brazil nuts, lipid oxidation

**Acknowledgements:** The authors acknowledge the financial support from the São Paulo Research Foundation (FAPESP) for the financial support (13/07914-8), Postdoctoral fellowship of Jeannine Bonilla (14/03288-8) and to Brazilian National Council for Scientific and Technological Development (CNPq) for the Research fellowship of Paulo J.A. Sobral (30.0799/2013-6).

**P-032**

# Evaluation of Chemical, Microbiological and Sensory Properties of Şalgam Produced with Different Salts Mixtures to Reduce Sodium Level

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Şalgam is a traditional Turkish fermented beverage which mainly produced in Cukurova region of Turkey and having red-colour, cloudy and sour soft characters. It is obtained through lactic acid fermantation of a mixture including black carrot, the main raw material, sourdough, rock salt, bulgur flour (setik), turnip and drinkable water. Sodium chloride (NaCl) have an important role in şalgam processing influencing the flavour and microbiological stability of the final product. On the other hand, the increasing tendency of consumers to low-salt foods makes necessary to reduce content of sodium mineral in beverages. The objectives of this study were; (1) to decrease the level of NaCl in şalgam by using different salts (KCl, $CaCl_2$), (2) to evaluate the affect of different salts on the chemical, microbiological and sensory quality of the şalgam.

In this study, in order to reduce the amount of NaCl, şalgams were produced with the traditional method with using different salts. For this purpose, experiments were performed using five different salt combination as NaCl, NaCl-KCl, NaCl-$CaCl_2$, KCl-$CaCl_2$ and NaCl-KCl-$CaCl_2$. pH, total acidity, salt, dry matter, ash, total sugar, reducing sugar, volatile acid, microbiological analyses (lactic acid bacteria, total yeast, non-*Saccharomyces* spp., coliform and total mesophilic aerobic bacteria counts), sensory analysis and principal component analysis (PCA) were carried out on the end product. In addition, microbiological growth during first fermentation (dough fermentation) was followed by microbiological analyses as described above.

According to the results, total acidity as lactic acid between 7.40-8.71 g/L, pH between 3.26-3.48, total sugar and reducing sugar between 0.61-0.99 g/L and 0.15-0.38 g/L respectively were determined in şalgams. As a result of microbiological analysis highest number of lactic acid bacteria, total mesophilic aerobic bacteria, total yeast and number of non-*Saccharomyces* spp. yeast were counted on the second day of fermentation. Although, coliform bacteria was determined on the beginning of the fermentation, they disappeared at the end of the fermentation.

Sensory analysis results demonstrated that calcium salt give a bitter taste to the şalgam, therefore it is not suitable for the production. The most favored şalgams were determined as trials with NaCl and NaCl-

KCI. The present study revealed that it is possible to produce şalgam juice with a sodium content reduced by 50 % using a mixture of equal ratio of NaCI-KCI and this salt combination can replace use of NaCI on şalgam production.

**Keywords:** Şalgam, potassium chloride, mineral salt, fermentation

**Acknowledgement;** This research was supported by grant (Project No: ZF2013YL30) from Cukurova University Unit of Scientific Research Projects.

**P-033**

# Antioxidant Properties of Maillard Reaction Products from Glucose – arginine Model System

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The Maillard reaction products (MRPs), occurring between amines and carbonyl compounds, produces reducing materials which are known to have a free radical scavenging effect on active oxygen species formed in food products. Many studies have been conducted to mitigate MRPs such as acrylamide (AC) and hydroxymethylfurfural (HMF). Especially, heat-treated carbohydrate-rich bakery foods have high AC and HMF levels. Therefore, a model system including an arginine-glucose mixture was chosen to determine the process conditions which MRPs are increasing progressively.

In this study, a Maillard reaction (MR) model based on an arginine-glucose mixture (1:2 mol ratio) with pH 9 was heated at 60-120°C for 1-6 h. The effects of processing temperature and time on MRPs were studied using response surface methodology (RSM) based on central composite design (CCD). Antioxidant activity of MRPs were determined by 1,1-Diphenyl-2-picryl-hydrazyl (DPPH), 2,2-azinobis (3-ethyl-benzothiazoline-6-sulfonic acid) (ABTS) free radical scavenging assays and oxygen radical absorbance capacity (ORAC) assay as well as browning index (absorbance at 420 nm), change in pH, AC and HMF were recorded throughout the reaction.

The pH of model system decreased and browning index increased as reaction temperatures and times increased. The pH reduction and increase in browning intensity were concomitant with the increases in antioxidant activities of model system. $DPPH^{\cdot}$ scavenging activity of MRPs were in between 21.7±0.3 – 60.8±0.5% inhibition at a concentration of 0.5 mg/ml. ORAC values and $ABTS^{\cdot+}$ scavenging activities of MRPs were found in the range of 1.85±0.26 – 16.39±0.12 µmol/ml and 0.312±0.003 – 1.828±0.04 mM trolox/ml, respectively.

As a conclusion, prolonged heating process resulted in MRPs with more effective antioxidant properties that were well correlated with the pH and browning intensity through the reaction. Even though potentially harmful compounds originated from the MR, the relationship between MRPs and their antioxidant activities should offer possibilities to control some oxidative reactions in food products.

**Keywords:** Antioxidant activity, Maillard reaction products, glucose, arginine, model system

**P-034**

# An Investigation on Volatile Compounds and the Aroma Profile of *Bogma Raki* by GC/MS and GC/O Using Solid Phase Micro Extraction (SPME) Method

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In this study, volatile compounds and the aroma profile of *Bogma raki* produced from dried figs which have fallen under fig trees according to the traditional methods in laboratory conditions with twice distillations in Hatay and its surrounding provinces in Turkey were investigated. In this region, *Bogma* raki is produced using clay pots for fermentation under cool conditions and a copper made for distillation on a wood fire after fermentation. Distillation process may be carried out once or more according to the consumers' demand to obtain the desired tartness and flavour. Volatile components by gas chromatography-mass spectrometry (GC-MS) and aroma active compounds by gas chromatography-olfactometry (GC-O) using Head Space Solid Phase Micro Extraction (HS-SPME) method were determined.

According to the results; *Bogma raki* samples consisted of 40 to 43.5% (v/v) of ethanol, 291 and 415.86 mg/100mL p.a. of total volatile substances. Additionally, 39 volatile compounds (20 esters, 12 terpenes, 3 higher alcohols, 1 aldehyde, 1 fenolic compound, 1 primer alcohol and 1 furan) were determined from dried figs *Bogma raki* samples by HS-SPME-GC-MS analyses; 17 aroma active compounds (8 esters, 2 higher alcohols, 2 aldehydes, 1 terpene, 1 ketone, 1 primer alcohol, 1 furan and 1 sulphuric compound) were identified by HS-SPME-GC-O analyses, of which, 7 (Methyl butanoate, Ethyl butyrate, 3-methyl-1-butyl acetate, Methional, t-2-c-6-nonadienal, 1-octen-3-one and Dimethyl trisulfide) were detected only at the sniffing port, tentatively.

**Keywords:** Bogma raki, mass spectrometry (MS), gas chromatography (GC), olfactometry (O), flavour

**P-035**

# Effects of Pomegranate (*Punica granatum* L.) Byproducts Addition on Quality Characteristics of Chicken Meatball

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This study was conducted to develop an innovative chicken based food product. On the other hand, it aims to extend oxidative stability of the chicken meatball by adding ground pomegranate (*Punica granatum* L.) byproducts as natural antioxidant sources. Pomegranate, one of the oldest edible fruits, is extensively cultivated in tropical and subtropical countries. Literature studies have been reported benefits of pomegranate constituents such as peel, juice and seeds with the occurrence of high antioxidant activity, anticarcinogenic and anti-inflammatory properties. In the food industry, pomegranate byproducts, pomegranate peel and pomace, have been obtained from pomegranate fruits as waste during production of fruit juice. In the food plants, these wastes can not be utilized by the industry in anyway and have caused serious disposal problems. Furthermore, they have ultimately led to environmental pollution. At this point, the present study was focused on the determination of feasibility of pomegranate byproducts' use in food formulations for preventing environmental pollution as well as providing a new acquisition to food industry regarding the utilization of fruit wastes. In the study, after pressing of pomegranate, obtained peels and pomace were frozen at -18°C during 24 hours. Then, the frozen samples were lyophilized at -80°C for 48 hours in freeze dryer and milled into powder in grinder after lyophilization. Thereafter, ground pomegranate byproducts were incorporated at level of 2.5%, 5% and 7.5% to fresh minced chicken meat. Quality characteristics of raw chicken meatballs were investigated during refrigerated storage at 4°C for 7 days. Changes in thiobarbutiric acid (TBARS) value, colour (*L*, a*, b**), total phenolic content, total antioxidant activity, peroxide and *p*-anisidin values during storage were determined.

**Keywords:** Chicken meatball, pomegranate byproducts, peel, pomace, natural antioxidant, oxidative stability

**P-036**

# Ready to Eat Fish Ball Produced by Sous Vide Technology

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Nowadays, increase in consumer demand on minimally processed, additive free, fresh-like and ready to eat food products cause an industrial attention on sous vide technology which makes food safe enough while keeping nutritional properties and makes it easy to prepare at home by applying simple efforts. Fundamentally, sous vide processing is a technique through which freshly prepared foods are vacuum sealed into packages immediately before or after pasteurization followed by keeping refrigerated throughout their shelf life without requiring any protective additive.

Fish and fish products are famous for their healthy compositions including high quality protein, liquid soluble and insoluble vitamins and polyunsaturated fatty acids such as ω-3. So that consumption and fresh like production of fish products are growing related to increase in awareness about health concern of consumers all over the world. On the other hand, fish and fish products are prone to decay easily and require high attention during production and retail steps such as storage and transportation because of microbiological, physical and biochemical risks.

Sous vide technique can be applied to fish products to make them stable during refrigerated storage while ensuring its unique properties such as vitamin and fatty acid composition. However, applied sous vide conditions as time and temperature should be selected properly to obtain acceptable products especially for textural and sensory properties.

Although several fish products such as whole, fresh or semi processed fish, fish nuggets are on the market, adaptation of products as fish ball which are readily available on some local cuisine can be a good alternative for the consumers who are looking for healthy and ready to eat fish product alternatives. Fish ball production can be suitable for producers, because it requires less effort to prepare and several types of fish can be used at the same time.

The first objective of this study is to adapt locally produced fish ball to market food by applying proper mixture composition and preparation technique. The other goals are to evaluate textural, sensorial and microbiological properties of fish balls produced under sous vide processing conditions.

**Keywords:** Fish ball, sous vide processing, textural properties, sensory properties

**P-037**

## Determination of Biological Active Components of Fruit Teas Produced from Different Concentrations of *Vitis labrusca* L.

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The study investigates the antioxidant characteristics of fruit teas steeped in either hot or room-temperature water. Grapes used for making fruit teas were dried by two different methods (sun drying and freeze drying). Dried fruits were added at 4%, 8%, 12%, 16% and 20% into the black tea. Antioxidant activity and total phenol content (TPC) of samples were examined. The results confirm that extraction of fruit teas carried out with water at room temperature leads to the formation of infusions particularly rich in compounds with antioxidant activity. Cold infusions had a higher content of phenols compared to hot infusions. The same trend was also observed for antioxidant activities examined using the ABTS and DPPH assay. This research contains key information on the antioxidant properties and TPC of fruit teas produced from different concentrations of Vitis *labrusca* L.

**Keywords:** *Vitis labrusca* L., fruit tea, antioxidant activity, total phenolic content

**P-038**

# Ultrasound Assisted Extraction of Antioxidants from Chía Seed (*Salvia Hispanica* L.) as Potential Ingredient in Food Products

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*Salvia hispanica* L. seed, commonly known as chia, is a natural source of omega-3 (corresponding to 75 % of the total seed oil) and omega-6 (α-Linolenic acid), fiber (30%), proteins of high biological value, and natural antioxidants such as chlorogenic acid, caffeic acid, quercetin and kaempferol. The seed also has significant amount of dietary fiber compared with other fruits and seeds.

In this study different extracts obtained from Chia seed were evaluated. The extracts were evaluated in terms of their phenolic composition by Folin-Ciocalteu assay and antioxidant activity using different methodologies (ORAC, DPPH and ABTS). The first extraction was obtained using water as extractant solvent and mucilage and supernatant fractions were evaluated. The second extraction include different parameters to inhibit the viscous effect produced by mucilage such as temperature (25 - 70°C), extraction solvent (water, methanol and ethanol) and ionic effect (aqueous calcium chloride) at different times (30 - 60min), all of them assisted by ultrasound.

The extract obtained using $CaCl_2$ solution (0.2M) as extracting agent, showed the higher phenolic composition measured by Folin-Ciocalteu assay respect to the other extractants due to the mucilage contribution that lost its viscosity by the ionic strength effect. However the results obtained by antioxidant assays showed that the extracts obtained with organic extractants, with temperature and sonication times of 30 minutes have the higher antioxidant capacity values. Therefore, this extraction method showed better performance because extraction with aqueous ionic species, consider other components, like carbohydrates, and did not show relevant antioxidant capacity, respect to aqueous extraction.

**Keywords:** Chía, ultrasound, antioxidants

**Acknowledgements** to FONDECYT for the project 11140256.

**P-039**

# Result of the Development of Triticale- and Wheat-based Low Calorie Flour

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Today in modern bakery consumption in developed countries we often have to face the demand to reduce calorie intake through daily staple food. In order to meet this need we decided to develop flour mixtures for new bakery products with low calorie content. During this process we had to consider that the sensory properties of the products should not change in addition to calorie reduction. For the new developments both triticale and wheat flour were used beside components that ensured the suitable organoleptic properties. The end product is a flour mixture that is suitable both as yeast bread and as pasta products. In the process we investigated the effect of more protein isolates such as gluten and fiber products.

We investigated the quality of the flour mixtures and the final products which are the following: crude protein, fat, dietary fiber and energy content. In addition we measured the rheological properties of the dough. Besides the analysis of chemical properties of the different products we determined the glycemic index in human nutrition experiments.

According to our results the properties (both organoleptic and chemical) of the products can be successful if they are marketable. These results are exhibited on the poster.

**Keywords:** Triticale, wheat, flour, bakery products, glycemic index, low energy

**P-040**

# Application of Different Chloride Salt Mixtures for the Production of Naturally Fermented Black Table Olives Obtained From cv. Gemlik

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Table olive is an important fermented food product which is produced on industrial scale besides the production at homes domestically. Table olives are classified as green olives, turning colour olives and black olives according to the degree of ripeness of the fresh fruits. Production method is changed depending on the type of the table olive. Cv. Gemlik is the most common Turkish variety of black table olives and black table olives of cv. Gemlik is naturally produced with Gemlik style by the fermentation in brine or dry salt.

Sodium chloride (NaCl) is used as the main ingredient of the vegetable fermentation brines including table olives. However, lowering the dietary intake of sodium is advised by public health and regulatory authorities due to the relationship between high dietary sodium intake and cardiovascular diseases. There is also an increasing demand by consumers for low-salt and sodium-reduced food products for health reasons. Therefore, replacement of NaCl with other chloride salts such as potassium chloride (KCl), calcium chloride ($CaCl_2$) and magnesium chloride ($MgCl_2$) can overcome the negative effects of high NaCl.

In this study, five different combinations of chloride salts were used as 10% NaCl (control treatment), 5% NaCl+5% $CaCl_2$, 5% NaCl+5% KCl, 5% KCl+5% $CaCl_2$ and 3.3% NaCl+3.3% KCl+3.3% $CaCl_2$ for the fermentations of black table olives made from cv. Gemlik. Fermentations were carried out according to the traditional Gemlik method. The changes in the microbial association (lactic acid bacteria, mesophilic aerobic bacteria, yeasts), pH and titratable acidity were monitored in brine samples.

At the end of the fermentations, the lactic acid bacteria grown on MRS and M17 mediums were in the range of 6.51-7.50 log cfu/mL and 7.13-8.17 log cfu/mL. Yeast counts were ranged from 7.25 to 8.26 log cfu/mL.

Total acidity values were in the range of 1.17 and 4.54 g/l at the end of the fermentations. According to the sensory evaluation, combination of KCl and $CaCl_2$ salts led to bitter taste in the final product. Taste of the brines including $CaCl_2$ was less preferred by the panelists. Combination of chloride salts as 5% NaCl and 5% KCl resulted in low sodium content olives with good organoleptic characteristics. According to the results, acceptable end products can be produced using NaCl and KCl salt mixtures to meet the demands of low sodium intake in the production of table olives.

**Keywords:** Black table olive, gemlik, NaCl, salt reduction, fermentation

**Acknowledgement;** This research was supported by grant (Project No: ZF2013YL3) from Cukurova University Unit of Scientific Research Projects.

**P-041**

# Effects of Using Sunflower Oil on Textural Properties of Bologna Type Sausage

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In this study, the possibility of use of sunflower oil in bologna type-sausage was investigated. For this aim, five groups with different levels of sunflower oil (0 -control: beef meat fat-, 25, 50, 75 and 100% sunflower oil) were produced and analyzed in terms of textural properties (hardness, adhesiveness, springiness, resilience, cohesiveness, gumminess and chewiness). Use of sunflower oil showed different effects on investigated texture parameters. The substitution of beef meat fat by sunflower oil had very significant ($P<0.01$) effects on adhesiveness and cohesiveness and a significant effect ($P<0.05$) on hardness. However, the use of sunflower oil had no significant effects on resilience, springiness, gumminess and chewiness. The highest mean value of adhesiveness was determined in control group (100% beef meat fat). While the highest mean value of cohesiveness was determined in the group with 100% sunflower oil, groups with 50 and 75% sunflower oil were not statistically different than group with 100% sunflower oil. Texture profile analysis indicated that, when compared to the control group, use of sunflower oil decreased hardness, adhesiveness, gumminess and chewiness and increased resilience, cohesiveness, springiness.

**Keywords:** Sunflower oil, textural properties, sausage, hardness, adhesiveness, cohesiveness

**P-042**

# The Effects of Rosehips Addition on Fermentation Process of Meat Model System

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The objective of this study was to investigate the effect of using fresh and dry rosehips on the microbiological properties of fermented meat systems. Starter culture mix which contains *Lactobacillus curvatus, Staphylococcus xylosus, Staphylococcus carnosus* and *Pediococcus pentosaceus* was used in all groups and fermentation process was carried out at 90% moisture and 24 °C temperature for 72h. The control meat did not contain rosehip, however, other three groups contained 10% fresh rosehip, 10% conventionally dried rosehip and 10% lyophilized rosehip, respectively.

Changes in yeast and molds, total coliform, lactic acid bacteria and total viable aerobic counts during fermentation period were measured. Total viable aerobic counts for all groups increased during fermentation period ($P<0.05$). However, increase in total viable aerobic counts for control groups had more than other groups ($P<0.05$). Total viable counts at the end of storage period were found to be at the same level for rosehip added groups. The same trends for all groups were observed as for lactic acid bacteria counts. Less increase in total viable and lactic acid bacteria count in rosehip added groups was thought to be result of changes in pH. pH values of batters were decreased with addition of rosehip and control group had highest pH values at the end of fermentation ($p<0.05$). And also, the addition of rosehip did also not affect yeast, mold and coliform counts during fermentation.

The results of this study showed that the addition of rosehip did not have any significant effect on total coliform bacteria and yeast and mold count during fermentation.

**Keywords:** Fermented meat, rosehip, microbiological properties

**P-043**

# The Effects of Using Different Levels Hazelnut Oil on Instrumental Texture Properties of Bologna Type Sausage

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The effects of substitution of beef meat fat with hazelnut oil (0, 25, 50, 75% and 100%) on textural Parameters of Bologna type sausage were determined in this study. Five groups produced with different levels of hazelnut oil (0% -control: beef meat fat-, 25, 50, 75% and 100%) were analyzed with a Texture Profile Analyzer. Seven textural parameters (hardness, adhesiveness, springiness, resilience, cohesiveness, gumminess and chewiness) were determined. Using hazelnut oil significantly affected hardness and cohesiveness ($P<0.05$). In contrast, no statistically significant effect of oil level was observed on springiness, adhesiveness, resilience, chewiness and gumminess ($P>0,05$). While the highest mean value of hardness was determined in control group (100% beef meat fat), this value was not statistically different from those with 25% and 50% hazelnut oil. However, mean value of cohesiveness was found to be higher in group produced with 100% hazelnut oil than other groups (100% beef meat fat, 25, 50 and 75% hazelnut oil) but this value did not show any statistical differences from the group produced with 75% hazelnut oil.

**Keywords:** Bologna type sausage, texture

**P-044**

# Structural, Physical and Emulsifying Properties of Ultrasound-treated Sodium Caseinate and Lactoferrin

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Structural, physical and emulsifying properties of sodium caseinate and lactoferrin were investigated after these proteins to be subjected to ultrasound treatment. Aqueous sodium caseinate or lactoferrin solutions were sonicated for 2 to 6 minutes using a power of 300 W. Protein properties such as size, surface charge, molecular weight distribution, intrinsic viscosity, surface hydrophobicity and structural conformation from circular dichroism were evaluated. Sodium caseinate size was significantly reduced after ultrasound treatment while an opposite effect was observed for lactoferrin. Slight differences in molecular weight after ultrasound treatment were observed only for lactoferrin. Surface hydrophobicity was positively affected by the increase of sonication time. Circular dichroism spectra revealed no difference for sodium caseinate structure but slight changes were observed for lactoferrin. In addition, a fixed amount (1 wt.%) of these ultrasound-treated proteins were employed as emulsifiers to prepare oil in water emulsions (o/w). Emulsions were also produced using the same ultrasound conditions that aqueous protein solutions were subjected. They were evaluated in terms of droplet size, emulsifying activity, creaming index and emulsion stability. Emulsions showed reduced droplet size and improved stability with higher sonication times. Ultrasound treatment of aqueous protein solutions caused a slight improvement of emulsifying properties while treating aqueous protein solutions during emulsions formation resulted in a clear enhancement of emulsions stabilization.

**Keywords:** Emulsion, hydrophobicity, ultrasound

**P-045**

# Physically De-bittered Dried Olive Production

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Minimally processed, no additive included, high in nutrition value products are being demanded related to increase in consumers' awareness in all over the world. Olive, having benefits for human health, is one of the most important foods in Mediterranean culture and has been consumed during centuries. Olive consumption is increased from 1793500 tons to 1941000 tons in the world, and 300000 tons to 327500 tons in our country between 2010/2011 and 2015/2016. Oleuropein that is the responsible component causing bitter taste in olive can be removed by applying methods such as alkali (NaOH) treatment, keeping in salt and brine etc., although limited types of olives can be consumed without de-bittering. During these classical methods both salt content increases and nutritive value decreases in table olive. There is no study is available in the literature about dried olive processing, without any chemical or salt utilization, to produce olive in high antioxidant and phenolic content, having long shelf life.

Sonication, cold storage and drying technologies can be applied for olive de-bittering, and bitterness, nutritional value and sensorial perception of the product. Response surface methodology which has wide application area in food science and technology is one of the methods used for constructing experimental designs and optimization.

Edremit type olives harvested in 2015 was used in preliminary studies and washing period, storage time and storage temperature were selected as the most suitable optimization parameters and operating ranges for each parameter were determined.

It is aimed to evaluate minimum ultrasound assisted washing time, storing period and storing temperature to produce no salt added and high in nutritional value dried olives. Outputs of this work may fill the gap in the literature and can be used for both scientific researches and olive processing industry.

**Keywords:** Dried olives, de-bittering, ultrasound, response surface methodology, optimization

**P-046**

## Getting to Know Three Halophytic Vegetables

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Halophytic plants naturally grow on salt marshes and cliffs around the lagoon and seashores. Agretti, marsh samphire and rock samphire, with growing popularities in recent years, are edible halophytic plants. Marsh samphire (*Salicornia eurapa* L.) is a member of Chenopodiaceae family; Agretti (*Salsola soda* L.) is also a member of Chenopodiaceae family and it is naturally found on saline soil and rocks near sea in Istanbul, Izmir, Mersin and Izmir. Rock samphire (*Crithmum maritimum* L) also known as Sea Fennel is a member of the Apiaceae family, and it grows in rock crevices and rocky shores. The aim of this article is to give some information about agretti, marsh samphire and rock samphire nutritional value which are collected from the wild and evaluated mostly making pickles.

**Keywords:** *Crithmum maritimum* L., *Salicornia europaea* L., *Salsola soda L.*

**P-047**

# Physical Properties of Kashar Cheese Manufactured with and without Transglutaminase

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Transglutaminase (TG) is a transferase that forms both inter- and intra-molecular isopeptide bonds in and between many proteins by cross-linking of the amino acid residues of protein bound glutamine and lysine. The cross-linking affects the functional properties of proteins, thus enabling new ways of structure formation. The use of enzymes is considered acceptable by consumers, as they require high specification and are only used in catalytic processes; thus they present less probability of producing toxic compounds and are considered to be more natural than chemical treatments. TG enzyms catalyzes the covalent crosslinking formation in different proteins and provides an important treatment for food processing. These reactions lead to changes in protein functional properties and enable product formation with better rheological and sensory properties.

In this study, Kashar cheese texture were analyzed with and without the use of TG. The addition of TG (2 U $g^{-1}$ proteins) prior to the Kashar cheese process showed a no significant increase ($p>0.05$) in almost all the texture parameters analyzed. The fracturability, chewiness, hardness and gumminess parameter values obtained showed no significant increase ($p> 0.05$) in all cheese samples. Sensory features of the cheese haven't been influenced by the TG action.

**Keywords**: Kashar cheese, transglutaminase, texture analysis

**P-048**

# Minerals and Antioxidant Potential Variation among Three Dry Forms of Ginger Rhizomes

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Rhizomes *of Zingiber officinale*, commonly known as ginger, have been used as a spice due to their flavoring ability Ginger is also used as a remedy with many medicinal properties through ages all over the world, even in countries that not produce it. This study aims to compare the most accessible dry forms of ginger rhizomes (freshly dried ginger, dried rhizomes and powder ginger) in term of medicinal use. Samples mineral compositions were compared. Also antioxidant activity, was performed by two different tests for aqueous extracts (prepared following infusion and decoction procedures). Infusions were prepared by macerating ginger powder in hot water while decoctions were boiled for a long time (1 hour) to estimate the effect of long cooking time on the antioxidant properties. Also, total phenolic, flavonoid and tannin contents were established for each extract. The results showed remarkably dissimilar mineral compositions among samples especially for Potassium, magnesium and manganese which are interestingly more represented in freshly dried sample. As well as phytochemical profiles, the antioxidant potential was also dissimilar with a superiority of already dry samples. Moreover, decoction and infusion from the same sample were almost similar with a high radical inhibition percentage and a low Effective concentration 50% ($IC_{50}$). Curiously, the expected degradation of compounds in decoctions was not always observed. This work encourages analyzing samples before uses depending on needs and highlights the benefits of traditional preparations of ginger as sources of bioactive compounds namely antioxidants.

**Keywords:** *Zingiber officinale*, dry forms, minerals, antioxidant

properties

**P-049**

## Comparison of Amino Acid Profiles of Gelatins from Different Animal Sources (Bovine, Porcine and Fish)

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The aim of the study was to identify the similarities and differences in amino acid profiles of gelatins sourced from different animal origins (bovine, porcine and fish). In the study, 7 bovine, 12 porcine and 5 fish gelatin samples were examined. To evaluate the usefulness of the method, 9 commercial gelatin samples obtained from the market were analyzed for gelatin originality.

Chromatographic separations of amino acids were achieved with an Hypersil Gold 100 mm x 2.1 mm x 1.9µm C18 column with 5mM ammonium acetate in water: MeOH (95:5) %0.1 formic acid (A) and MeOH (B). Separated amino acids were identified by liquid chromatography tandem mass spectrometry (LC MSMS) without the need for derivatization. A total of 15 amino acids (arginine, aspartic acid, cysteine, glutamic acid, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tyrosine and valine) were analyzed. The method was found to be selective, linear ($r^2$>0.99) and precise for all of interested amino acids. The limits of the quantifications (LOQ) were found to be in the range from 0.53 to 1.20 mg $kg^{-1}$. Therefore the method was successfully applied for the determination of amino acids in gelatin samples.

The results showed that, none of the samples was contained leucine, lysine and phenylalanine. Threonine and serine were detected in only porcine samples. Arginine and cystine were not found in fish and bovine samples, respectively. The highest concentration of serine was found in fish samples. Various concentrations of other analyzed amino acids were determined in porcine, fish and bovine samples.

In conclusion, arginine, cystine and threonine were presented as distinctive amino acids and these amino acids can be significant

predictors in discrimination of the gelatin origins. This analytical method could therefore support the food industry in terms of determining the species authenticity of gelatine in foods.

**Keywords:** Gelatine, amino acids, LC MSMS

**P-050**

## The Utilization of Pumpkin Seed Oil in the Sausage Production

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This study investigated the possible usage of pumpkin seed oil which is beneficial to human health, instead of animal fat, and it effects on quality of bologna type sausage. For this purpose, beef body fat was replaced with various amounts (5%, 15%, 30%) of pumpkin seed oil in the bologna type sausage. Emulsion stability, jelly and fat separation, water holding capacity (WHC), emulsion viscosity and batter pH were determined. In addition, sausages were stored for 30 days and color (L, a, b) and thiobarbituric acid reactive substances (TBARS) values were determined on 1th, 7th, 14th, 21th, and 28th days of storage. The samples with pumpkin seed oil statistically ($p<0.05$) affected emulsion stability, jelly and fat separation. L values of sausages produced with 30% pumpkin seed oil was increased compared to control. The higher thiobarbituric acid reactive substances (TBARS) values were obtained in all treatment.

**Keywords:** Pumpkin seed oil, emulsion stability, emulsion viscosity, thiobarbituric acid reactive substances

**P-051**

# The Effects of Thermal Treatment on Phenolics Compounds

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Phenolic compounds are secondary metabolites that are derivatives of the pentose, phosphate, pathways in plants. Phenolic compounds exhibit a wide range of physiological properties, such as anti-allergenic, anti-artherogenic, anti-inflammatory, anti-microbial, antioxidant and anti-thrombotic effects. Phenolic compounds are very sensitive to heat. Heating effects the total phenolics, flavonoids, antioxidant activity. Most studies indicate that level of antioxidants and phenolics is reduced significantly by the heating process. However, bound phenolic acids esterified to cell walls release from the cell matrix with heating. In most studies on the effects of heat treatment on the total phenolic content, the results are contradicting. Some studies indicate that levels of phenolic acids increases after heating, due to the ability of heat to distrupt cellular matrix and cell wall whilst some studies report a reduction or no change in phenolics and antioxidant activity. In this study, effects of thermal treatment on phenolics compounds were evaluated.

**Keywords:** Antioxidant activity, extrusion, phenolics, blanching, thermal treatment

**P-052**

# The Effect of Different Drying Methods on Antioxidant Activities, Carotenoids Profiles and Some Chemical and Physical Characteristics of Some Apricot Varieties

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In this study; as material, 13 different varieties of apricots harvested from the gardens of Malatya Fruit Research Institute were used (Adilcevaz, Alkaya, Aprikoz, Çataloğlu, Hacıhaliloğlu, Hasanbey, İsmailağa, Kabaaşı, Mahmudun eriği, Soğancı, Şam, Şekerpare, Tokaloğlu-Erzincan). Apricots were dried using four different drying methods (sun drying without sulfur, sun drying by sulfurization, freeze drying and microwave drying).

Drying techniques on apricot varieties, statistically, was of great importance ($P<0.01$) on total dry matter, pH, titratable acidity, total sugar, reducing sugar, sucrose, hydroxymethylfurfurol (HMF), total phenolic content, antioxidant activity, lycopene, β-carotene, vitamin A, vitamin E, vitamin C, color (*L, a , b*), on the capacity of the browning level and rehydration. Via drying, total dry matter, pH, titratable acidity, reducing sugar, sucrose and glucose and total phenol content of apricot fruits were found to be increased in general and the antioxidant activity, lycopene, β-carotene, A, E and C vitamins were found to be decreased.

The results of this study showed that fresh and dried apricot fruits are natural antioxidant, carotenoids and vitamin sources and drying of apricot fruit causes the antioxidants, carotenoids and the amount of vitamins to be decreased.

**Keywords:** Apricot, dry apricot, drying techniques, total phenolic content, antioxidant activity, HMF, vitamins, carotenoids, lycopene, β-carotene

**P-053**

# Effect of Pre-treatments on Cooking Characteristics and Appearance of Dry Climbing Bean Seeds (*Phaseolus vulgaris* L.)

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Dry climbing bean seed samples used for this study were provided by Rwanda Agriculture Research Institute. The cooking time was evaluated at 20, 40, 60, 80,100, and 120 minutes. The lightness value of all pretreated and raw climbing bean seeds significantly ($p<0.05$) decreased as the cooking time increased up to 80 minutes, except unpre-treated and soaked in water which decreased up to 100 minutes. The highest lightness value was 31.35 of steam blanched climbing bean seeds. The lowest value was 21.58 of soaked in water. The yellowness and redness significantly increased ($p< 0.05$) as the cooking time increased up to 100 minutes. The highest redness value was 18.81 of power soaked and the lowest value was 13.19 of steam blanched. The 26.42 and 24.31 were the highest and lowest yellowness values for soaked in water and steam blanched of climbing bean flours respectively. The results showed that the hardness of pretreated and untreated climbing beans seeds significantly ($p<0.05$) decreased as the cooking time increased. The hardness of climbing beans soaked in 2% sodium bicarbonate, in water and in power at cooking up to 80min were 1.9N, 2.6N and 2.49N respectively, which is in the range of acceptable texture for human consumption. The bean soaked in 2% sodium bicarbonate followed by soaking in water exhibited the highest initial rate of hydration capacity compare to other samples. The unpre-treated climbing bean flour showed the lowest hydration capacity.

**Keywords:** Pre-treatments, cooking characteristics, appearance, climbing bean seeds

**P-054**

# An Initial Study for Detection of Sugar Adulterants in Mulberry Pekmez by Using Fourier Transform Infrared Spectroscopy

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Mulberry pekmez is a consistent and sweet product procured from grape juice, which is obtained from dry or fresh mulberries and then concentrated to a brix degree. This traditional food has valuable nutritional properties due to the constituents in its composition. The major components are carbohydrates, minerals and organic acids.

In the study, a Fourier Transform Infrared Spectroscopy (FTIR) in combination with attenuated total reflectance (ATR), for determination of sucrose sugar adulteration of mulberry pekmez was improved. The spectra were analyzed using chemometric methods. Mulberry pekmez was adulterated by two different fructose syrups (F20, F30), glucose syrup (G), sucrose syrup (S) and two different high fructose corn syrups (HFCS50, HFCS55). Prior to forming adulterated samples and data acquisition both sugar syrups and mulberry pekmez adjusted to a standard solid content ($60^0$ Bx) with distilled water to prevent spectral complications arising from differences in sugar concentrations. Calibration sets were prepared by spiking sugar syrups to mulberry pekmez and actual adulteration percentage correlated with FTIR predicted adulteration percentage by *partial least square (PLS).* Infrared spectrum of pure pekmez shows that absorbance bands were found at 778, 819, 868, 922, 1032, 1054, 1346, 1412, 1573, 2888 and 2929 $cm^{-1}$. 1184-944 $cm^{-1}$ spectral range was utilized for adulteration percentage prediction of F20, F30, HFCS50, HFCS55 and 1090-950 $cm^{-1}$ for sucrose. As a result, clear discrimination between mulberry pekmez and mulberry pekmez with different concentration of sugar syrups was achieved by this technique.

In conclusion; the results indicated that sugar adulteration of mulberry pekmez can be accurately and inexpensively detected in a short time by improved FTIR method.

**Keywords:** Mulberry pekmez, FTIR, sugar syrup, adulteration

**P-055**

## Identification of Bioactive Peptides in Kashar Cheese and Their Antioxidant Activities

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Kashar cheese is one of our types of cheese produced by being boiled in hot water and then kneaded after its curd has become acidized at a definite level and is included in the semi-hard “pasta filata” group. Kashar cheese is the most produced and consumed type of cheese in Turkey after Beyaz cheese. Generally Kashar cheese produce from raw milk and the ripening process important for features of Kashar cheese. Many biochemical events occur during ripening. Biochemical events are required to occur properly during ripening for a cheese output with unique quality characteristics. Proteolysis is the breakdown in the proteins and the most complex biochemical event occur in cheese during the ripening. Proteolysis plays a vital role in the development of textural changes in the cheese curd, and contribution to flavour and perhaps to off-flavour (bitterness) of cheese through the formation of peptides and free amino acids.

In this study, commercially provided Kashar cheese were analysed for peptid profile and their antioxidant activity. Cheese samples were taken on 1$^{st}$ day and ripened during the 3 months. All data represents the average of three experiments and analysis were made two parallel. The peptide profile of Kashar cheese was analysed using reverse-phase liquid chromatography (RP-HPLC) during ripening period.

Antioxidant activity of Kasar cheese were found 41,09 mM. Trolox $g^{-1}$ in the third month. Peptide fractions of kashar cheese collected 10 min intervals by HPLC. Antioxidant activity of fractions were found 920,726 mM Trolox $g^{-1}$, 545,544 mM Trolox $g^{-1}$, 783,864 mM Trolox $g^{-1}$, 392,12 mM Trolox $g^{-1}$ in the F3, F4, F5, F14 respectively. Peptide extraction of

Kashar cheese and sequence analysis was made by MALDİ-TOF MS-MS spectrometry.

**Keywords:** Bioactive peptides, kashar cheese, antioxidant activity

**P-056**

## Effect of Pre-treatment and Processing Conditions on the Rheological Characteristics of Dry Climbing Bean Seeds ( *Phaseolus vulgaris* L.) Flours

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It is difficult for many Rwandans to utilize dry climbing beans seeds (*Phaseolus vulgaris*. L) mainly because of longer cooking hours, poor textural characteristics of cooked bean seeds and the high consumption of basic fuel. One way to solve this problem is to utilize the flour of climbing bean seeds from different treatments and processing conditions. In this study, the rheological properties of the flour were assessed; and the pre-treatments such as soaking climbing bean seeds in water for 24hrs, soaking in 2% sodium bicarbonate solution and steam blanching for 10 minutes and processing methods such as roasting, cooking, germination of pre-treated climbing bean seeds were applied. The untreated raw climbing bean seed flour had the highest pasting temperature of 80.32 $^{0}$C and peak time of 8.09 min while soaked beans in sodium bicarbonate with germination had the lowest pasting temperature of 76.16$^{o}$C and peak time of 5.25 min. The peak viscosity of climbing bean flours varied from 143.24RVU to 301.77RVU. The untreated raw climbing bean flour had the lowest peak viscosity of 143.24RVU. The flour from climbing bean seeds pretreated with 2% sodium bicarbonate with cooking and germination had the highest final viscosity of 384.76 RVU and 362.13 RVU respectively, while the untreated raw climbing bean flour had the lowest of 233.65 RVU. The lowest setback viscosity of 43.26 RVU was observed in pretreated climbing bean flours with 2% sodium bicarbonate solution with germination. The highest setback viscosity of 48.70 RVU and 46.17RVU were observed in untreated raw climbing bean flours and untreated climbing bean flours with roasting respectively. The resulted rheological

properties in this research proved the utilization of climbing bean seed flours in food preparation with reduction in time, temperature and improved viscosities.

**Keywords:** Dry climbing bean seeds, flour, pre-treatment and processing conditions, rheological characteristics

**P-057**

## Antioxidants and Antimicrobial Activity of Hope Leaves and Hope Cones

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The leaves of the hop plant (*Humulus lupulus* L.) are an agricultural by-product that is not exploited. Like hop cones, hop leaves could also be used as a source of phenolic compounds. This study compared two hop cultivars from four different hop-growing regions (Žalec, Slovenia; Leutschach (Kranach), Austria; Hüll, Germany; Žatec, Czech Republic): cv. 'Aurora' and cv. 'Hallertauer Magnum'. Leaves and cones of these two cultivars were collected and their total phenolics and the antioxidative and antimicrobial activities of their ethanol extracts were determined. Samples were collected three years in succession (2008-2010). The leaves had 3-fold to 30-fold less total phenolics than the cones, and much lower DPPH radical scavenging activity (≤5-fold less), their $IC_{50}$ was much higher, than the cones' extracts regardless of the year and of the growing location. The best reducer was the extract from the Aurora leaves collected in the Czech Republic in 2010. In 25 min it reduced 0.117 mL/µg of ferric ions. Concerning antimicrobial activity, it was extraordinary for all hop cones extracts against gram positive *Staphylococcus aureus* (minimal inhibitory concentrations, MICs < 0.003 mg/mL), but with a similar, moderate antimicrobial activity (MICs>0.16 mg/mL) for hop cones and leaves extracts against gram negative *Escherichia coli* O157:H7. The results of a profile analyses showed a big difference between the leaves and cones for an unidentified peak with $t_r$ =35.1 min. The cones had no peak with such retention time.

**Keywords***:* By-products, antioxidants, antimicrobials

**P-058**

# Some Microbiological and Sensory Properties of Yogurt Containing Garlic

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In this study, some microbiological and sensory properties of yogurts containing garlic with different rates (0.5% to 1%) were determined during storage. In the yogurt production, will be used Taşköprü garlic has Geographical Indication registered (PDO) obtained from Taşköprü district of Kastamonu province and China garlic.

The experimental yogurts were graded by seven panelists (from the permanent staff of the Department of Food Engineering, Bayburt University, Turkey) who are familiar with product. They evaluated the samples for appearance, consistency (in the mouth, on the spoon), odor and taste and total score using a 25-point scale, with 5 being the worst and 25 the best quality.

The scope of microbiological analysis; Lactobacillus, Streptococcus, total aerobic mesophilic bacteria, total coliform, yeast and mold counts were determined during storage. Thus, the effects of different types of garlic used in production on some microbiological and sensory properties of yogurt had been identified.

**Keywords:** Taşköprü garlic, Kastamonu, yogurt, microbiological, sensory

**P-059**

# Protein Contents and Amino Acid Profiles of Einkorn and Emmer Wheat Candidate Lines

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Einkorn (*Triticum monococcum* L., subsp. *monococcum*), emmer (*Triticum dicoccum* Schuebl [Schrank], subsp. *dicoccum*) are potential food sources with good nutritional properties due to their valuable protein, vitamin and mineral contents. Correlation between levels of crude protein and each of amino acid in wheat samples is a main predictor for nutritional quality of wheat and its products. Thus, the aim of the study was to evaluate protein levels and amino acid profiles of selected accessions of einkorn and emmer wheat samples.

In field experiment, 36 einkorn and 49 emmer wheat lines collected from different provinces of Turkey and selected during the last five years were planted under augmented experimental design in 2015-16 seasons in Antalya/Turkey. Collected samples were dehulled and grinded prior to analyses. Amino acid profiles of the samples were determined by liquid chromatography electrospray ionization tandem mass spectrometry (LC ESI MSMS) and protein contents were measured by a Dumas combustion method. A total of 15 amino acids (arginine, aspartic acid, cysteine, glutamic acid, histidine, isoleucine, leucine, lysine, methionine, phenylalanine, proline, serine, threonine, tyrosine and valine) were monitored. The limits of the quantifications (LOQ) for all interested amino acids were found to be in the range from 0.53 to 1.20 mg $kg^{-1}$.

Results showed that the protein contents of einkorn and emmer wheats were found to be 15.52±1.23 and 12.58±1.69, respectively. Slight differences in amino acid composition were observed with einkorn being the lowest in lysine and highest in glutamic acid contents. Histidine, arginine, threonine and methionine concentrations in protein were negatively correlated, and the glutamic acid and proline concentrations were positively correlated, with the total protein contents of the wheats. In conclusion, 17 and 28 were found to be the most suitable lines for nutritional quality regarding with the protein and amino acid contents of einkorn and emmer wheats.

**Keywords:** Einkorn wheat, Emmer wheat, protein, amino acids

**P-060**

## Optimization Simple Maceration to Obtain Antioxidant Compounds from Bawang Dayak (*Eleutherine Palmifolia L. Merr*)

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In literature various methods were used for extracting antioxidant compounds from Bawang Dayak (*Eleutherine palmifolia* L.), but there is no report on optimizing the extraction of antioxidant compounds from this plant. By employing ethanol with various concentrations (50, 70, 90 %) as the solvent, dry leaves scale of Bawang Dayak (BD) was macerated for 12 to 24 h. Total phenolic content (TPC), total flavonoid content (TFC) and DPPH free radical scavenging activity of the extract were quantitatively determined. It was found that the highest TPC (904.018±12.56 mg/100gextract) was obtained using90% ethanol and macerated for 24 h while the lowest TPC (837.35±16.7 mg/100gextract) was obtained when using 70% ethanol for 24h.There is no correlation between TPC, TFC and DPPH scavenging activity. The highest TFC (396.60±2.21 mg/100 g extract) was obtained by using 70% ethanol with a maceration time of12 h and the lowest TFC (277.82±5.95 mg/100 g extract) was obtained when using 50 % ethanol with a maceration time of 12 h. Extract with the highest DPPH scavenging activity was obtained when using 50% and 70 % ethanol with a maceration time of 12 h, while the lowest was obtained when 70 % ethanol was used with a maceration time of 24 h.It is apparent that when different target (TPC, TFC, DPPH scavenging activity) is considered, different optimized extraction conditions (ethanol concentration, maceration time) may have to be used in extracting bioactive compounds from leaves scale of *E.palmifolia*. It is recommended to use ethanol as the solvent for extracting active compound from *E. palmifolia*.

**Keywords:** Leaves scale, bawang dayak, *Eleutherine palmifolia* L., maceration, antioxidant activity

**P-061**

# Inactivation of *Escherichia Coli* O157:H7 by Using Probiotic Cultures Grown in Carrot Juices Fermented Under Different Culture Conditions

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Fermented black and orange carrot juices were prepared using *Lactobacillus acidophilus* and *Lactobacillus casei* Shirota cultures. During fermentation, antibacterial effect of above-mentioned probiotic cultures on *Escherichia coli* O157:H7 was determined. After carrot juices were pasteurized at 95°C for 10 min and cooled to 37°C, cultures were inoculated. *E. coli* O157:H7 cell density was adjusted to $10^4$ and probiotic cultures cell density were adjusted to $10^7$ cfu/mL. Fermentations were conducted at two different temperature as 25°C and 15°C for 15 days. Samples were taken during fermentation in 0, 1, 3, 5, 7, 10, 15. days. pH values were measured and the numbers of *E. coli* O157:H7 and probiotic lactic acid bacteria were determined of samples. By the fifth day of the fermentation, it was determined that probiotic cultures reduced the numbers of *E. coli* O157:H7. According to our results, *L. acidophilus* had more antibacterial effect on growth of *E. coli* O157:H7 than *L. casei* Shirota and orange carrot juice showed more inhibition effect on growth of *E. coli* O157:H7 than black carrot juice.

**Keywords:** Carrot juice, antibacterial, *Escherichia coli* O157:H7

**P-062**

# Isolation-identification of Lactic Acid Bacteria and Yeasts from Table Olive and Determination of Some Properties of Isolates

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Functional foods, which include table olives, can be defined as those products in which preparation and preservation are carried out by a combination of salting, fermentation and/or acidification. Table olives are fruits of suitable varieties of the cultivated olive-tree (*Olea europaea sativa* Hoffg, Link) harvested at an appropriate stage of ripeness. Table olives are probably the most popular fermented vegetable in the Mediterranean region and are one of the most important components of the Mediterranean diet.

In study, twenty table olives samples were studied The table olive samples were collected from İzmir located in the Aegean region of Turkey. Ten samples were classified as green olives (GO) and ten samples were classified as black olives (BO). All the samples, produced by the traditional method, were obtained from traditional producers and purchased in traditional market. A total of 48 lactic acid bacteria (LAB) were isolated and identified from table olives produced with traditional method. Lactic acid bacteria in olive samples were identified as *Lactobacillus* (95.83%) and *Leuconostoc* (4.16%). Dominant species in olive samples were *Lb. pentosus* (31 isolates) followed by *Lb. plantarum* (15 isolates) and *Leu. mesenteroides*'in (2 isolates).

A total of 38 yeast were isolated and identified from table olives. Yeasts in olive samples identified as *Candida* (78.9%), *Geotrichum* (10.52%) and *Saccharomyces* (10.52%). Dominant species in olive samples were *C. pelliculosa* (8 isolates).

The aim of this work was to determine the microbiological characterization of table olives, the biochemical, physiological and phenotypic properties of strains LAB of isolated from the table olives. Besides, the isolated yeasts were also identified.

**Keywords:** Table olive, lactic acid bacteria, yeast, isolation, identification

**P-063**

# Characterization of Gelatin/Chitosan Scaffold Blended with Aloe Vera and Snail Mucus for Biomedical Applications

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Tissue engineering is a rapidly expanding interdisciplinary field involving biomaterials science, cell biology, cell-material interactions and surface characterization. Is worth highlighting that this work comes from previous studies related with matrices based on gelatin and chitosan for the manufacture of edible films, which aimed to extend the life of fresh food, so we have taken these matrices for use in applications in the biomedical field. The present study aims to test the hypothesis that the incorporation of Aloe vera and snail mucus could improve the structure, composition improvement and biodegradability, with a potential effect on bioactivity of the scaffold better than the control scaffolds of chitosan and gelatin. Scaffolds forming solutions were prepared by mixing a 2% gelatin (G) solution with a 1% chitosan (CH) solution (control) prepared in 0.05 M acetic acid, in the ratio of 1:1. After that, Aloe vera (A) and snail mucus (S) were conveniently added to blend G-CH composite solutions. These final solutions were freeze-dried after crosslinking and freezing under liquid nitrogen. Scaffolds were characterized by (SEM), porosity, swelling, mechanical properties, FTIR, and in vitro biodegradation. The addition of A and S increased the mean pore size and porosity and caused some changes in the pore architecture. The pores in the scaffolds were interconnected and their sizes ranged from 93 to 296 μm for composite scaffolds, the mean pore diameter was between 119±38 μm and 207±61 μm. The porosity of all A and S scaffolds formulations was higher than 90%, which suggested all scaffolds were with good porosity. Scaffold prepared with A and S had significantly lower Young modulus and higher EAB, this may be due to the interference of their functional groups. The FTIR spectrum indicates that S and A have interacted with the free amino and the hydroxyl group of CH and G. After 28 days of incubation, the scaffold was degraded between 70 and 80%, proving thus its biodegradability in a similar body fluid environment. This new combination of materials has very good molecular compatibility, improved porosity, elasticity and high biodegradability, being a good alternative for biomedical applications.

**Keywords:** Wound healing, porous gelatin scaffolds, absorbable interconnected network.

**Acknowledgements:** The authors would like to thank at the Brazilian National Council for Scientific and Technological Development (CNPq) and TWAS, for the research grants (190232/2014-5 CNPq/TWAS-FR: 3240279900). Especially thank also at Food Research Center **(FoRC),** Sao Paulo- Brazil.

**P-064**

# Food Additive: Curcumin

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Curcumin (diferuloylmethane) is a polyphenol found in the rhizomes of the plant *Curcuma longa* and other Curcuma species. It is derived from turmeric (in Turkish "zerdeçal") and commonly used as a spice, flavoring agent, food preservative, food colorant (supplement E 100) in beverages and in foods such as curry, mustard, etc. Commercial curcumin contains three major components: curcumin (77%), demethoxycurcumin (17%), and bisdemethoxycurcumin (3%), together referred to as curcuminoids. Extensive investigation over the last five decades reveals that curcumin and its derivatives have various pharmacological activities such as antiviral, anti-inflammatory, antimicrobial, antioxidant, anti-HIV, cancer preventive properties (prevent prostate, lung, gastrointestinal, bone, breast, and head & neck cancer), anti-parkinson, anti- Alzheimer's, anti-angiogenesis. Although its potential health benefits, curcumin has found limited use as a pharmacological or nutraceutical agent, which can be partly attributed to its low water solubility (it is insoluble in water and ether but is soluble in ethanol, dimethylsulfoxide and other organic solvents), chemical instability and poor oral bioavailability. Some methods such as encapsulation and nano particles (nano curcumin) are used for increase its water dispersibility, chemical stability and bioavailability.

**Keywords:** Curcumin, curcuma longa, zerdeçal, health benefit

**P-065**

# A Novel Approach to Delay Microbiological Spoilage of Sea Bass (*Dicentrarchus Labrax*) Fillets Coated with Biopolymer-Based Bioactive Materials Loaded Nanofibers

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Chitosan was used as nanocarrier encapsulation material to obtain nanofibers (CN) by electrospinning. These nanofibers were loaded with bioactive material (thymol; TLCN or a combination of thymol and liquid smoke; LSTLCN). The optimization of electrospinning parameters CN, TLCN and LSTLCN was detected before nanocoating experiments: the distance of flat collector to the needle for all groups was 12 cm and the applied voltages for CN, TLCN, LSTLCN were 20 kV, 22 kV and 23 kV, respectively. The flow rate and duration of the electrospinning process were 0.5 mL/h and 50 min. $75x10^{-3}$ g chitosan, $36x10^{-4}$ g thymol and $36x10^{-4}$ g liquid-smoke were used to coat 100-g fish fillets. Biopolymers and bioactive materials were dissolved in 70% TFA (trifluoraacetic acid) and 30% DCM (dichloromethane). After optimization and characterization of nanofibers, the fillets coated with nanofibers were wrapped with aluminum paper and stored in 6±1°C. There are a few methods to delay the microbiological growth, due to controlled release and increased contact area provided by this nanomaterial. Antimicrobial effectiveness of the electrospun nanofibers on fish fillets was determined in terms of Total Mesophlic Aerobic Bacteria count (TMABc), Psychrophilic Bacteria count (TPBc) and Yeast and Mold count (YMc). Finally, the fish fillets coated with chitosan based nanofibers loaded with bioactive materials had lower TMABc, TPBc, TYMc ($p<0.05$). This study indicated that coating of fish fillets with liquid smoke and thymol loaded chitosan based electrospun nanofibers could be a promising approach or technique to provide microbiological stability to the fish fillets.

**Keywords:** Combining of nanostructures, fish quality, electrospun nanofiber, encapsulation, microbiological spoilage

**P-066**

# Applicability of Acoustical Measurements to Compare Crispness of Wafers

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Nine different brands of wafers (Manner, Napoli, Sweet Gold, Jadro, Biscoteria, Bella, Fin Carre, Fin Carre Lemon and Fin Carre Strawberry) were analysed with the 3-point bending and the cutting test by using acoustic envelop detector attached to texture analyser. Parameters; Maximum sound pressure (MSP), Total count peaks (TCP), Mean sound value (MV) and Force (F) at highest sound peak were evaluated from Acoustic amplitude-time and Force-time curves. Wafers in different quality by means of crispness were compared according to these parameters.

Product Jadro has big MSP; on the other hand, it doesn't have great values of TCP, MV or F in 3-point bending test. Product Fin Carre normal has big MSP, F and MV, but doesn't have big values on TCP, even if there isn't big correlation of parameters for some products, we could find on product Sweet Gold and Fin Carre Strawberry similar variations of parameters.

Cutting test presented that Product Jadro had bigger values for almost all parameters. But F didn't show big differences on products. Parameter MV had also a similar range for all products, except from product Bella. For this product, the MV is very high, whereas parameters like Maximum sound signal and total count peak is lower than those of the other products.

The 3-point bending method is more suitable for acoustic emission for wafers than the cutting test since the 3-point bending method could distinguish the products better.

**Keywords:** Acoustic, crispness, texture, wafer

**P-067**

# Cellulose Nanocrystals Designated in Different Food Applications

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Cellulose is the most abundant natural polysaccharide, being the major structural component of plants. It is one of the renewable chemical sources that can be alternatives to petroleum-based materials and its regenerated forms are widely used in the industry. Chemically modified cellulose is a food additive, which is mainly used for its gelling and thickening properties. It is unique with properties such as biodegradability, chemical stability, high mechanical strength, and massive amount of chemical derivations. However, environmental concerns have arisen to produce more environment-friendly cellulose derived inventions. Therefore, nanoparticles from cellulose have been focus of research as are harmless and biodegradable alternatives. Cellulose microfibrils are found in association with other biopolymers, such as hemicelluloses, lignin and pectins in vegetal resources, several extraction and purification steps are needed for their isolation. Cellulose nanocrystals may be defined as negatively charged colloidal particles of cellulose. Moreover they have a very large surface to volume ratio, high surface area, good mechanical properties, renewability, low cost, and easy chemical and mechanical modification. As reported by numerous research previously, incorporation of cellulose nanocrystals into polymeric materials may also result in improved barrier and mechanical properties. Other aspects of cellulose nanocrystals comprise their ability to form highly stable surfactant-free emulsions and their role on emulsion stability. Using new technologic strategies related to nanotechnology is vital in many different parameters including sustainability, environmental concerns, waste valorization high availability and low prices. Bio-nanocomposites were used in films to improve physical, mechanical and thermal aspects, particularly the tensile strength; and to improve functionality as packaging agents. Therefore nanotechnological approaches in the design of cellulosic application will probably gain more importance in near future.

**Keywords:** Cellulose nanocrystals, emulsion, nanocomposites

## P-068

# Chemical and Physical Properties of Sorbus Fruit (*Sorbus Aucuparia* L.) Grown in Yusufeli Town

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There are large variety of wild fruits in Turkey because of different ecological regions. At present time, consumers progressively interest in etnic and organic foods. There for, there is a great need for researching and developping of wild fruits. İn this research, it has been enterprised for determination of main compositional constituents of sorbus wild fruits groen in Yusufeli town, Turkey. Dry matter in fruit pulp 60.17%; total sugar is 50.03%; ash is 2,40%; organic acit is 0,70%; protein 2,26%; phenolics content is 9,80 mgGAE/100g; it no found antioxidant activity in the rowan fruits; pH value is 5,21. At progressivet rienes stage, because of sorbus peel and pulp have been undergone enzymatic and non enzymatic browning low, L* value (nearly 50 in peel, 35 in pulp) have been measured. The extacts of the sorbus have not showed any antimicrobial activity against bacteria, yeasts and molds used in in this research.

**Keywords:** Sorbus, rowan, wild fruit, antioxidant activity, antimicrobial effect, chemical composition

**P-069**

# Comparative Study on Quality Characteristics of Saffron Depending on Quality Category

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Saffron, obtained from dried stigmas of Crocus sativus L. flowers, is widely used as a food 6 colouring and flavouring spice. Owing to its need for specific climatic conditions for growing 7 and much labour for harvesting of flowers, it is one of the most expensive spices. Due to the 8 strong flavour and colouring properties of saffron, its consumption has increased with 9 decreasing interest in synthetic food colourants, flavour and aroma agents. The aim of this 10 study was to determine and compare total phenolic and flavonoid content, antioxidant 11 activity, crocin content and volatile constituents of Iranian saffron belonging to different 12 quality categories. According to these results, total phenolic and flavonoid content and 13 antioxidant activity of the saffron samples values varies in the ranges 14.07–34.04 mg GAE/g 14 DM; 3.16–33.64 mg/g DM and 20.52–52.83 µmol/g DM, respectively. HPLC results showed 15 that the highest total crocin content was determined in the All Red sample (37.37 mg/g) and 16 the lowest in the Bunch sample (33.05 mg/g). Safranal, the main volatile compound of 17 saffron, was determined in the All Red, PS, PI, PII and Bunch category samples as 49.64%, 18 50.29 %, 50.42 %, 57.02 % and 61.31 %, respectively. The study showed that the percentage 19 of safranal increased with decreasing saffron quality.

**Keywords:** Saffron (*Crocus sativus* L.), quality

**P-070**

# Concentration of Apple Juice by Vacuum Microwave Evaporator and in Comparison with Rising Film Evaporator

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Concentration of fruit juices reduces cost of storage, packaging and transport, in addition with this treatment juice becomes microbiologically and chemically more stable. In recent years, with the changes in the consumer preferences, alternative methods are used instead of traditional heating processes with the increased demand of minimal treated, high quality and natural foods.

Microwave heating provide volumetric heating of food product and concentration carried out quickly with the combined system that allows mass and energy transfer quickly at a short time.

The aim of this study is producing concentrated apple juice with vacuum microwave evaporator and rising film evaporator and comparing the process conditions and quality parameters. Apple juice was concentrated different power levels (334, 502, 668 W at 500 mbar vacuum) at MVE and rising film evaporator (500 mbar). HMF, color and evaporation rates at these conditions were determined.

As a result, evaporation rates were found as 5.43, 11.50, 14.37 gH2O/min. and HMF values were found as 2.08, 1.81 and 1.65 ppm respectively for the powers of 334, 501, 668 W. The evaporation rate and HMF were found as 6.19 gH2O/min and 1.750 ppm respectively for rising film evaporator. The total color differences were 1.70 for 334W, 1.66 for 501 and 1.20 for 668 W. The lowest color difference, HMF value and the highest evaporation rate was found at the 668 W compared to rising film evaporator.

**Keywords:** Vacuum microwave evaporator rising film evaporator, apple juice concentrate, evaporation rate, HMF

**P-071**

# Design and Control of Dairy Texture-microstructure and Rheology as Tools to Understand Stirring and Hydrocolloid Use

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Even when fermented dairy products are named similarly, their properties are diverse. This paper discusses the development of product microstructure and texture as influenced by addition of hydrocolloids. Market demands put pressure on manufacturers to customize their products to meet retailers and consumer's expectations of quality, and safety, there is also a need to seize new market opportunities with innovative products. A Knowledge Transfer Partnership (KTP) between a SME dairy and the university aims to support product quality and innovation. This study focused on the eating quality parameters of yoghurt, quark and soft cheese, particularly development of texture properties and control.

Fermented products have been analyzed to develop a better understanding of the science underpinning product processing at industrial level, and factors influencing texture and stability. In addition to physicochemical properties such as composition, graininess and visual roughness, information about processing parameters, the rheology, sensory characteristics, texture and the microstructure using cryo scanning electron microscopy (cryo-SEM) were determined. Most samples were prepared at the company but were compared with other commercial products. Factors included levels of fat, degree of mechanical action (shearing, blending), use of stabilizers, and modifications to process.

The results show that separation, granules, creaminess and consistency index varied across the samples. Differences in the gel network were clear, with the microstructure of yogurt modified by stirring and shearing, but it was heterogeneous with variations on network configuration across sections (100 micrometer scale), with pockets of unaltered gel matrix surrounded by disrupted matrix. The addition of xanthan gum, locust bean gum, pectin and carrageenan provided a range of possible textures, related to microstructural configurations and characteristic rheological behavior, also influenced by fat content. However, not only fat content influences the number of grains and visual roughness, but also the processing method and the use of skimmed milk powder in fat free yogurt. Fresh unripened cheese (quark) was compared with other

commercially available products; cryo-SEM showed that a more heterogeneous structure is linked to different method of processing, even when the composition is similar (i.e. water content 82-85%).

Research and development activities embedded within the company are increasing their knowledge on quality features (i.e. creaminess, granule formation, syneresis) and their causes. KTP has a focus on professional training and is proving useful to link academic expertise to relevant industrial issues, bringing benefits to all parties.

**Keywords:** Dairy, hydrocolloids, texture, yoghurt

**P-072**

# Determination of Aroma Compounds of Rosa Odorata (Andrews) Sweet Wine Produced by Addition of Sugar and Honey

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The wine production from fruits has increased in recent years. Many fruits especially apple and orange are used in wine production. Fruit wines are also made other fruits such as strawberry, pear, papaya, mango, pomegranate and berries. Carbohydrates, organic acids, phenolic compounds, nitrogen compounds, water, alcohols and carbonyl compounds are the major constituents of wine. Fruits, used in the wine production, gives its characteristic features to wine. Depending on their antioxidant compounds, fruit wines have various positive impact on human health.

In this study, two different wines are made from fruits of *Rosa odorata* (Andrews) Sweet by addition of sugar and honey. Before the fermentation process, the amount of sugar in the must was adjusted to 20 brix. The production steps for the wines were, fermentation, maturation, ripening, racking, clarification and bottling. After 2 months of maturation aroma compounds were determined by SPME-Gas chromatography (GC) in wine samples. The dominant aroma components were identified in the wine produced by addition of sugar; ethanol 37.39%, ethyl acetate 6.56%, isobutyl alcohol 1.28%, 3-methyl-1-butanol 8.17%, 2-methyl-1-butanol 2.34%, capronate ethyl 9.53%, ethyl caprylate 23.02%, ethyl decanoate 5.69%. Same aroma compounds in the wine produced by addition of honey were determined as ethanol 33.54%, ethyl acetate 7.09%, isobutyl alcohol 1.63%, 3-methyl-1-butanol 12.57%, 2-methyl-1-butanol 3.12%, capronate ethyl 9.53%, ethyl caprylate 21.03%, ethyl decanoate 6.14%. It was determined that there was a slight difference in the percentage of major aroma compounds in two wine samples.

**Keywords:** Rose wine, *Rosa odorata* (andrews) sweet, gas chromatografy

**P-073**

# Determination of Salep Adulteration with Starches and Gums Using the DSC Technique

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Salep is a food additive which is not cultivated on a commercial scale and is obtained by collecting tubers of the *Orchidaceae* plants from the wild. Following various processes, the tubers are available for consumption as a highly valued food ingredient. Salep is mainly composed of mucilaginous and starchy material of polyholoside structure and can easily be adulterated by readily available, cheap ingredients that form similar textural structure. The most common adulterants are starches and gums.

The aim of the study was to identify the similarities and differences in glass transition (*Tg*) and melting transitions of powder salep and adulteration materials. *Tg* values and melting transitions of the samples were determined by differential scanning calorimetry (DSC). In the study, 4 salep tuber samples collected from different locations of Turkey (Yozgat, Bartın, Van and Muğla) were used. Tuber saleps were dried and grinded prior to analysis. Starch (potato, rice, wheat and corn) and gum (xantan gum, guar gum, gum arabic, locust bean gum) samples were collected from the market in powder forms. The DSC curves were obtained in the temperature range from 0 to 350°C under the dynamic atmosphere of $N_2$ (30 ml/min) heating rate of ß=10°C/min using an Al capsule containing approximately 30 mg of sample material.

The results showed that, there were no significantly differences among the *Tg* values of the samples. Similarly, melting temperature values of the samples were of identical. However, melting heat values of the salep samples were found to be in the range from 133.63 to 177.03 J/g, the values of the other analyzed samples (starches and gums) were between 176.08 and 323.62 J/g. Obtained findings clearly indicate that, the salep samples were characterized by significantly different melting heat values than the other adulteration materials.

In conclusion, DSC technique may be applicable for the quantitative detection of salep adulteration, based on the parameters in DSC melting curves.

**Keywords:** Salep, adulteration, starch, gum, DSC

**P-074**

# Effect of Different Nitrogen Sources on Levan Production

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Levan is a high valued biopolymer that draws more attention in the last decade. Levan can be used as an edible film former and help the food product to save its nutritional and structural properties. There are many aims associated with the optimization of fermentation processes which are like increasing the yield of the final product while using good manufacturing practices and decreasing the production cost. To obtain more product by less process cost, more and more process optimization studies have been made by most researchers.

In this study, we tried to find the effect of nitrogen amount and the type of nitrogen sources on the production of levan in a batch fermentation system. Firstly we used yeast extract then corn step liquor, peptone, tryptone, malt sprouts and urea was also used based on equal nitrogen proportion to obtain the highest levan amount. The highest amount of levan (15.52 g/L) was obtained in the flask which contains yeast extract.

**Keywords:** Levan, nitrogen source, optimization, process parameters

**P-075**

# Effect of Honey Powder on the Rheological Properties of Different Gums

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Honey is a natural product which includes glucose and fructose as a major component and organic acids, mineral salts, vitamins and phenolic compounds as a minor constituents. Due to nutritive and functional properties of honey, it is widely consumed by people of all ages throughout the world. However, usage of honey in different food formulations is difficult due to viscous character of honey, which obstruct the dispersion of it in the product. Therefore, in order to extend of the honey, honey powder is produced. In the present study, honey powder was fabricated using maltodextrin as a carrier agent and its influence on the rheological properties of the solution of xanthan (XG), locust bean gum (LBG) and their mixtures (1:1 w/w), which is necessary to determine usage possibilities of honey powder in the food formulations. The concentration of gum solution was 0.75% and honey powder was added to this solution in concentration of 10%. All of the gum solutions and honey powder/gum solutions showed shear thinning behavior. Ostwald de Waele model was suitable for the flow behavior of the samples. As the consistency value (*K*) of XG solution did not change with addition of honey powder, *K* value of LBG solution increased from 1.88 $Pa.s^n$ to 2.14 $Pa.s^n$ as a result of honey addition (10%) at 25 °C. *K* value of XG/LBG solution was found to be 2.69 $Pa.s^n$ and it decreased to 1.96 $Pa.s^n$ when honey powder was added. According to the results, honey powder differently affected the rheological characteristics of the hydrocolloids depending on the type, which could be considered during enrichment of the product with honey powder to maintain quality of the corresponding product.

**Keywords:** Honey powder, xanthan gum, locust bean gum, rheology

**P-076**

# Effect of Microwave Heating on the Yield and Quality of Red Bell Pepper Puree

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Microwave heating (MWH) is based on the transformation of alternating electromagnetic field energy into thermal energy by affecting the polar molecules of a material. Microwave heating has gained better acceptance in food processes like pasteurization, preheating, drying, blanching and cooking with the advantages of uniformity of heating and control of temperature. Microwave heating can be used in the production of vegetable puree.

In this study, microwave heating was applied as an alternative method to conventional heating for comparing the effect on the yield and quality of red bell pepper puree. The microwave application was optimized with respect to the yield and the outlet temperature by response surface methodology (RSM).

The optimum conditions found were a power of 900 W and a flow rate of 6.52 rpm for the microwave oven with RSM. Production of red bell pepper puree was carried out using these optimum conditions. At this optimum point, yield and outlet temperature were found as 76.76% and 95°C, respectively. Conventional heating (CH) was performed reaching the same temperature as with microwave heating (MWH) at 95°C and a process time of 9 min. As a result the yield increased 8.07% and also the pectin content (17.75%) and vitamin C (20.6%) were improved by the MWH.

**Keywords:** Red pepper puree, microwave heating, conventional heating, yield, quality

**P-077**

# Effect of Transglutaminase on Fish Medallion Properties Cooked with Different Methods

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This study reports the sensory, textural and color properties of salmon fish medallions prepared with different proportions of transglutaminase (1:4, 1:5 and 1:6) cooked with different methods (steaming, baking, frying). The preferred red color of salmon and lightness values were achieved with 1:6 microbial transglutaminase treatments of baked and fried fish medallions. The increase in MTGase concentration affected the hardness and gumminess values positively and the highest values were recorded in 1:4 MTGase fried fish medallions 5707.81N and 3583.95N, respectively. There were no statistically difference in springiness values between cooking methods and treatments. The adhesiveness values of medallions were affected from the increasing MTGase concentration. The adhesive forces of steamed and fried medallions were lower than initial values. The higher concentrations made the medallions more though not allowing the heat to penetrate inner parts. The lower concentrations were not successful in forming the medallion shape. The best results were obtained with 1:4 MTGase steamed, 1:5 MTGase fried and 1:6 baked samples.

**Keywords:** Fish medallion, transglutaminase, cooking methods

## P-078

# The Effects of Using Gelled Emulsion Prepared with Olive Oil on Some Characteristics of Chicken Patties

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In recent years, gelled emulsions are considered to have a great potential in fat replacement and modification strategies in healthier meat products. The objective of this study was to investigate the effects of partial beef fat replacement (0, 25, 50, 100%) with gelled emulsion (GE) prepared with olive oil on functional and quality of chicken patties. For this purpose gelled emulsion which consisted 9% inulin and 3% gelatin in water phase, was prepared. Control sample was prepared 100% beef fat (C). Three of GE groups were prepared by replacing beef fat with a level of 25%, 50%, 100%GE (GE25, GE50, GE100). All patty samples had 20% added fat content (beef fat, GE or both). Syneresis, thermal stability, centrifuge and creaming stability of gelled emulsion; chemical composition, cooking yield, fat and moisture retention of chicken patties were investigated. High thermal stability was recorded in GE (%96), also creaming stability results showed that GE protected its stability without any turbidity and separation of the layer. It was found that 34% fat reduction can be achieved when beef fat completely replaced with GE. Moisture contents of samples C, GE25 and GE50 were found 56.30%, 56.04% and 55.98% respectively while lowest moisture content (54.34%) was found in GE100 ($p<0.05$). The highest protein content (29.63%) was found in GE100 ($p<0.05$). The highest cooking yield (71.25%) was observed in C ($p<0.05$). GE50 had the highest fat retention (66.16%) and water retention (38.12%) within GE samples. That could help GE50 to have higher cooking yield than other GE samples ($p<0.05$). The results of the study showed that partial replacement of beef fat with 50% GE could be used for healthier meat products without negative effects on quality parameters compared to control samples

**Keywords:** Emulsion, gelled emulsion, meat products, chicken patty

## P-079

# Fourier Transform Infrared Spectroscopy as a Rapid Method for Halal Authentication of Meat Based Products

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Foods containing pork are known as “haram” meaning forbidden in Islam whereas horse and donkey meats are not “halal”, they are so-called “makrooh”, meaning something that is not desirable. Detection of intentional unwanted meat species substitution in “halal” meat products, which is a major fraud, is a crucial issue for the meat sector and for food control laboratories. This study was aimed to develop a rapid and reliable method for authentication of “halal” meat products based on Fourier Transform Infrared (FT-IR) Spectroscopy. This method would allow detection of pork, donkey or horse meat in intended “halal” products. Turkey meat was used as the main meat type, and it was mixed with pork, donkey or horse meat at the following levels, 0%, 5%, 10% and 100% (wt/wt). Specific characteristic regions were identified from FT-IR spectra for each adulterated meat mixture. Based on the spectral data obtained from FT-IR spectrometer, rapid discrimination of pork, horse and donkey meat adulteration could be ensured by characteristic regions with the following wavenumbers: 2980-2800 $cm^{-1}$, 1760-1710 $cm^{-1}$, 1480-1360 $cm^{-1}$, 1325-1210 $cm^{-1}$, and 1200-1020 $cm^{-1}$. In addition to these regions, the bands at wavenumbers between 1000 and 900 $cm^{-1}$, were useful to identify the presence of horse meat. Hierarchical cluster analysis (HCA) was also conducted by using the regions indicated above and fingerprint region according to absorbance values of spectra. These values allowed to group mixtures into different clusters based on their spectral similarities. Zoomed view of spectra and the clear distribution results from HCA showed that FT-IR spectroscopy is a sound technique for identification of species adulteration in “halal”

meat products even for the presence of small amounts of pork, donkey or horse meat.

**Keywords:** Halal meat authentication, FTIR spectroscopy, turkey meat, pork, donkey meat, horse meat

This work was supported by Scientific and Technological Research Council of Turkey (TÜBİTAK-project# 214O182).

**P-080**

## Grape Juice Application to Three Different Protein Films to Evaluate the Changes in the Quality of Different Cheese Samples

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Biodegradable films are focus of an increasing interest as they represent a natural and environmental-friend alternative to synthetic packaging materials. They might be defined as “thin layers to protect and extend the shelf life of food products that are also able to be consumed with the food materials”. Proteins are among the most common materials for biodegradable packaging that are widely used. Phenolics are mostly found in fruits and they are significant antioxidants that are sufficient for human health. Therefore, this study aimed to use three different sources of proteins: whey protein, soy protein and wheat gluten protein to investigate their effects on sliced kaşar and white cheese samples’ shelf life. Their combination with the grape juice addition was planned to be tested. Glycerol was used as the plasticiser and the films are formed using suitable methods. Fixed amount of 15 g of protein films were added onto 3 -3.5 g cheese samples. The results of the study revealed that films were elastic, adhesive, transparent and durable. Wheat gluten had a more stretch and adhesive structure. Before grape juice addition colour values of L, a, b were measured as 13.3, 5.35 and 14.6 for whey protein film, -5.79, 0.53 and 0.98 for gluten protein and for soy protein; -6.80, 0.41, 0.70 respectively. Soy protein and whey protein films were found as more protective since they decreased the moisture loss in the cheese samples more significantly. Grape juice added soy and whey protein films made the cheese samples more resistant to microbial growth. Combined usage of fruits with protein layers might be helpful to improve the cheese quality.

**Keywords:** Cheese quality, biodegradable films, protein films, antioxidant, phenolics

## P-081

# Identification of Mechanically Deboned Chicken Meat Adulteration by FT-IR Spectroscopy in Chicken and Turkey Meat Formulations in terms of Meat Components Structure

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Mechanically deboned chicken meat (MDCM) is a valuable, low-cost co-product from poultry meat processing, usually utilized in comminuted meat product formulations. The use of MDCM in the formulation instead of fresh meat without proper labelling is a typical case of fraud. The purpose of this study was to identify adulteration of chicken or turkey meat mixtures, with MDCM at different concentrations (0%, 90%, 95% and100%), by using the FT-IR spectra. The zoomed view of spectra indicated that regions at 2980-2800 $cm^{-1}$, 1760-1710 $cm^{-1}$, 1480-1360 $cm^{-1}$, 1325-1290 $cm^{-1}$, 1290-1210 $cm^{-1}$, 1200-1140 $cm^{-1}$, 1140-1020 $cm^{-1}$, and 1020-900 $cm^{-1}$ wavenumbers could be used to characterize fraudulent mixtures based on the structure of meat components. In addition to these regions, 3500-3000 $cm^{-1}$ could also be used, but only for turkey meat mixtures, to detect adulteration. Intensities of characteristic bands from chicken and turkey meats, related to lipids, generally increased with increased ratio of MDCM. Similarly, characteristic bands related to phosphorous compounds such as proteins, DNA and RNA demonstrated increased intensity, whereas 1305 $cm^{-1}$ originated from amide III bond of proteins showed decreased intensity with the increased ratio of MDCM. In the spectra of adulterated turkey meat mixtures, band intensities at wavenumbers 3300 and 3100 $cm^{-1}$ originated from amide A and amide B bonds of the proteins, respectively, also decreased. With increasing concentration of MDCM in

both, chicken and turkey meat mixtures, relative intensity of α-helix and antiparallel β sheet structures decreased while relative intensity of β sheet structures increased. These results indicate that the secondary structure of proteins from the second derivative spectra could also be used for characterization of adulterated mixtures. In conclusion, the FT-IR spectra of raw meat mixtures adulterated with MDCM at different concentrations showed a clear distribution pattern that enables to detect and identify the kind of adulteration present.

**Keywords:** Mechanically deboned chicken meat, FTIR spectroscopy, structure of meat components, secondary structures of proteins

This work was supported by Scientific and Technological Research Council of Turkey (TÜBİTAK-project# 214O182).

**P-082**

# Impact of a Novel-designed Crushing Operation on Fatty Acid and Sterol Composition of Virgin Olive Oil

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The aim of the present study was to analyze the effects of a novel crushing process on the structural changes in terms of fatty acid and sterol composition of virgin olive oil. The novel crushing system included a redesigned cooler, which can operate at different temperatures (4°, 8°, 13°, 18°, 24° and 30°C). Results demonstrated that the dominating fatty acid was oleic acid which reached to its peak value at 13°C, although the overall crushing process was not significantly effective on the content of oleic acid. Oleic acid was followed by palmitic and linoleic acids, respectively. While the content of palmitic acid was around 2% at 4°C, it exceeded 10% when the crusher temperature was increased above 4°C. However maximum linoleic acid content was found at 18°C, which tended to decrease at higher temperatures. Additionally considerable amounts of stearic acid, palmitoleic acid and linolenic acid were detected among the analyzed samples. Considering sterol composition of resulting olive oils, the predominant sterol was β-sitosterol with a range of 82.41-85.96% , which was not affected by the crushing temperature. In addition to β-sitosterol, considerable amounts of Δ-5-avenasterol, campesterol and sitostanol were also detected. It can be concluded that the dominating sterols found in olive oil samples were not affected by the changes in crusher temperature, however the amounts of 24-methylene-cholesterol, campestanol, stigmasterol, Δ-7-campesterol, clerosterol and Δ-7-stigmastenol contents, which were found in trace amounts, were significantly affected by different temperatures during crushing operation.

**Keywords:** Crushing, fatty acid, olive oil, sterol, temperature

**P-083**

# Investigation of Effects of Ultrasound Pre-treatment on Drying and Rehydration Characteristics of Apple Slices

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Effects of ultrasound pre-treatment on drying and rehydration characteristics of apple slices were investigated in this study. 5 mm thick slices of the apples of *Granny smith* variety were used in the experiments. An ultrasonic generator with 20 kHz frequency was used for application of ultrasound pre-treatment at selected conditions of time (10, 20, 30 min) and ultrasound amplitude (55 and 100 %). Drying experiments were done in a tray drier at 60 and 70°C with a 0.3 m/s air velocity. Drying time of apple slices was decreased by application of ultrasound pre-treatment. Data obtained were tested with five different thin layer mathematical models to represent the drying characteristics of apple samples, Page and Modified Page models found to be the most suitable models. The effective moisture diffusivity increased with the increase in pre-treatment time and ultrasound amplitude and its values are varied between 6.79 - 9.35 × $10^{-8}$ $m^2$/s. Rehydration experiments of dried apple samples were performed at 60°C. The rehydration ratio showed an increasing trend when ultrasound amplitude and time increased. On the other hand water holding capacity decreased with the increase in the amount of water uptake during rehydration. Rehydration kinetics of samples were fitted to Peleg model. Shrinkage of apple slices was decreased with increasing ultrasound pre-treatment time and amplitude. As the amplitude of ultrasound increased the cells deformation and collapse of cell structure increased which were clearly observed through scanning electron microscopy images of the dried samples. Results showed that the use of ultrasound as a pretreatment prior to air drying can find an application in food industry.

**Keywords:** Apple, drying, pre-treatment, ultrasound, mathematical modeling

**P-084**

# Microencapsulation of Anthocyanins from *Rosa Pimpinellifolia* Fruits

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The usage of natural color pigments as food colorants has gaining importance because of the consumer demands and carcinogenic nature of synthetic colorants. *Rosa pimpinellifolia* fruit (or hip) is a potential source of anthocyanin pigments which can be used as a natural red food colorant.

The main obstacle of the using of anthocyanins in food applications is relatively low stability of this pigments during processing and storage. Anthocyanin extracts obtained from different plant materials has some contaminants such as free sugars and organic acids. Free sugars in the extract results brown compounds because of Maillard reaction. Thus, purification of the extract improves the stability of anthocyanin pigments. Aqueous two phase systems (ATPS) has been recently used as purification of anthocyanins from crude extracts with high yield and low process costs. Microencapsulation is very popular technology in food industry to protect bioactive compounds. Microencapsulation process protect the natural pigments against environmental factors such as oxygen, temperature, metal ions etc.

The aim of this study was to investigation of the effects of ATPS purification of the anthocyanin extract of *Rosa pimpinellifolia* fruit on microcapsule properties. Anthocyanin retention, microencapsulation efficiency, solubility time, bulk density and color values of microcapsules were investigated.

30 g of lyophilized fruit were extracted with 400 mL acidified aqueous ethanol (70% v/v) for 30 minutes thorough an Ultra-Turrax at 10.000

rpm. Crude extract was purified with ATPS. Ethanol and ammonium sulphate were used to prepare ATPS. After phase separation top phase separated and concentrated by vacuum evaporator. Both crude and purified extracts were used for microencapsulation. *Rosa pimpinellifolia* extract and gam arabic-maltodextrin solution (1:4, 30%, w/w) were homogenized with Ultra-Turrax operating at 20.000 rpm for 5 minutes. Microcapsules were produced with spray dryer under following conditions; inlet air temperature 125°C, 25% feed pump rate, 100% aspirator rate and 30% air rotameter rate.

Purification of extract before spray drying with ATPS has positive effects on microcapsule properties. Anthocyanin retention, microencapsulation efficiency, solubility time, bulk density, $L^*$, $a^*$ and $b^*$ values were; 59.07, 55.54%; 94.10, 91.06%; 1.61, 3.33 s; 0.40, 0.75 g/mL; 77.19, 73.50; 14.11, 13.93; -2.95, -3.12 for microcapsules produced from purified extract and crude extract, respectively.

**Keywords:** Microencapsulation, aqueous two phase system, anthocyanin, purification

## P-085

# Microencapsulation of Chestnut Seedcoat's Water Extract by Spray Drying

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Chestnut (*Castanea sativa*) is an invaluable fruit that is outstanding with its richness in phenolic compounds and antioxidant activity. The functionality of chestnut is not only attributed to its fruit, but also to its shell, which constitutes 10% of the whole weight of chestnuts. Approximately 55% of the chestnuts are raw-consumed and 45% are processed worldwide. On the other hand, most of the high-value by-product, chesnut shells (seedcoats), are removed during processing, since their importance has not been completely understood yet. The aim of this study was to produce spray dried microcapsules from chestnut seedcoat's water extract and to investigate some physicochemical properties of the product.

Chestnut seedcoats were extracted according to the extraction conditions defined by Central Composite Design which was considering extraction temperature (65-95°C) and time (15-90 min). Total phenolic content (TPC) of the extracts was used as response to determine optimum extraction condition(s), estimated as 95°C for 65 min with the maximum TPC of 357.7 mg/g. The Box-Behnken response surface methodology was used to optimize the processing of spray drying. Maltodextrin (MD) and Arabic Gum (AG) were used as wall material for spray drying process. The independent variables used were the wall material ratio (5-20 %), MD:AG ratio and the inlet temperature (150-180 °C) whereas the responses were the product yield (PY) and the TPC of the microcapsules. The optimum spray drying conditions, simultaneously maximized the PY (69.62%) and TPC (272.52 mg/g), were determined as the wall material ratio of 12.5%, MD:AG ratio of 75:25 and the inlet temperature of 164°C. The microcapsules, produced at optimum conditions, were also analyzed for their moisture content

(3.2%), water activity (0.255), bulk density (0.32 g/cm$^3$), color (Hunter L=58.72, a=11.27, b=22.94), hygroscopicity (10.92%), solubility (79.88%), particle size (6.52 μm), total antioxidant activity (0.46 g/mg DPPH) and total flavonoid content (39.99 g/mg DPPH).

Since there is a growing interest to consume natural food products, especially in recent years natural food additives are attracting more attention due to health reasons. Accordingly, the chestnut seedcoat's extract powders produced throughout the present study may have the potential as a novel natural food additive in industry. Therefore, the fortification of food products with chestnut seedcoat powder could provide new horizons in improving novel functional foods with antioxidative properties.

**Keywords:** Chestnut shell, spray drying, microencapsulation, total phenolic content, total antioxidant activity

**P-086**

# Nanocellulose Production and Its Food Applications

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Nanocellulose is a term referring to nano-structured cellulose. This may be either cellulose nanofibers (CNF) also called microfibrillated cellulose (MFC), nanocrystalline cellulose (NCC), or bacterial nanocellulose, which refers to nano-structured cellulose produced by bacteria. It is pseudo-plastic and exhibits the property of certain gels or fluids that are viscous under normal conditions, but flow over time when shaken, agitated, or otherwise stressed. This property is also known as thixotropy. The high viscosity at low nanocellulose concentrations makes nanocellulose very interesting as a non-caloric stabilizer and gellant in food applications.

In this review we tried to show the potential of using nanocellulose in the food industry because of its mechanical properties, film-forming properties and viscosity etc. Nanocellulose can be used as thickeners, flavour carriers and suspension stabilizers in a wide variety of food products and useful for producing fillings, crushes, chips, wafers, soups, puddings etc. The food applications were recognised as a highly interesting application field for nanocellulose due to the rheological behaviour of the nanocellulose gel.

**Keywords:** Nanocellulose, rheology, MFC, CNF, food additive

**P-087**

# Obtaining and Characterization of Bionanocomposite Film Based on Tapioca Starch/Bovine Gelatin/Nanorod Zinc Oxide

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Tapioca starch/gelatin/nanorod ZnO (ZnO–N) bionanocomposites were prepared via solution casting technique. The effects of nanorod-rich zinc oxide incorporation on the mechanical, physicochemical, and crystalline structures, as well as the barrier properties of bionanocomposite films were investigated. X-ray diffraction analysis showed that the bionanocomposite film incorporated with ZnO–N at a concentration of 3.5% w/w exhibited high intensity peaks compared with control samples. UV light was absorbed with the addition of ZnO–N into the biopolymer matrix. Mechanical properties of films were improved by incorporation of ZnO–N into biopolymer matrix. Thus, the bionanocomposite films can be used in food, medicine, and pharmaceutical packaging.

**Keywords:** Bionanocomposite, gelatin, starch, nanorod zinc oxide, XRD

**P-088**

# Optimization of Process Parameters for Vacuum Microwave Evaporator by Response Surface Methodology

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Fruit and vegetable juices are beverages of high nutritional value because of involving minerals, vitamins, phenolic compounds and antioxidant substances for human health. Juices are obtained as clear, natural cloudy juices or pulps by processing of fruits. Concentration of fruit juices reduces cost of storage, packaging and transport, in addition with this treatment juice becomes microbiologically and chemically more stable.

The aim of this study was to optimizing the operating conditions (appropriate power and vacuum) of a vacuum microwave evaporator with response surface methodology (RSM).

Optimization of the process conditions were carried out with RSM using the Stat-Ease Design Expert 7.0 software and Central Composite Face Centered (alpha=1) Design (CCD). Power of microwave (334, 502, 688 W) and vacuum of system are independent variables. The independent variable had 3 levels with 1, 0, and +1. The study of 29 experimental points (the central point 5, 3 replicates) was created randomly by two variables CCD. The evaporation rate, HMF and Hue angle were determined as responses.

As a result, the evaluation of the optimization model was determined by analysis of variance. For optimization, desirability functions of RSM were advanced for the criteria of minimum HMF and maximum evaporation rate and Hue angle. The optimum process conditions were found by using a modified model CCD design in combination with RSM.

Optimizing the operating conditions of (668 W, 82 ºC and 500 mbar) vacuum microwave evaporator was evaluated by RSM.

**Keywords:** Vacuum microwave evaporator, apple juice concentrate, response surface methodology

**P-089**

## Physical and Oxidative Stability of Phosphate-free Meatballs Produced with Jerusalem Artichoke Powder during Frozen Storage

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Today reformulation strategies in meat products have gained attention as the demand for healthier food has been increased. Thus, use of natural and alternative ingredients in formulation of meat products has come into prominence. In this study, we aimed to investigate quality changes of frozen emulsified chicken meatballs produced with Jerusalem artichoke powder (JAP) with/without sodium carbonate (SC) as sodium tripolyphosphate (STPP) replacers. JAP was produced from fresh tubers by washing, peeling, slicing, oven-drying, grinding and screening operations. For production of meatballs, chicken breast muscle was minced through 3 mm and emulsified with sodium chloride, STPP and ice (control). Other treatments were prepared using 3.8%, 5.7% or 7.6% JAP, with or without 0.2% SC. After emulsification, meatball batters were prepared by mixing the emulsions with 8 mm minced muscles. After cold-setting of the batters at 0°C for 1 hour, batters were shaped and second cold-setting was performed at -18°C for 20 minutes. Meatballs were then deep-fat fried at 180±2°C for 3 minutes. The samples were cooled at 4°C, packaged under modified atmosphere and stored for 5 months at -18°C. pH, colour, thaw loss, TBA and carbonyl content of the samples were analysed during storage.

pH values of the samples were between 6.21-6.61. The results showed that pH values of control samples with phosphate were similar to samples with JAP and SC, while in formulations with JAP alone, pH values were lower than control ($P<0.05$). At the end of the storage, the highest pH values were recorded in samples containing SC ($P<0.05$). 0$^{th}$

month L*, a*, and b* values were between 44.99-55.61, 5.71-8.62 and 20.91-29.71. During frozen storage, L* values of samples with JAP alone were lower than other samples ($P<0.05$), a* values were increased except SC control group ($P<0.05$), b* values were usually remained stable. Thaw loss of the samples at 1st month was between 0.96-1.58%, and the values were similar to each other during storage period. TBA and carbonyl values were similar in samples during frozen storage, meaning that JAP showed similar properties to phosphates in delaying lipid and protein oxidation.

Our results showed that utilization of JAP and SC in emulsified chicken meatballs showed equivalent quality parameters in terms of physical and oxidative stability during frozen storage and might offer a novel advantage for reformulation of healthier poultry products.

**Keywords:** Phosphate, jerusalem artichoke, chicken, emulsified meatball, frozen storage

This study is granted by Republic of Turkey, Ministry of Science, Industry and Technology with Project No: SAN-TEZ, 0764.STZ.2014

## P-090

# Phytochemical Characterization of Common Tunisian Date Seed and the Effect of Its Decoction on Hepatic Oxidative Stress Induced by DMBA in Rats Wistar

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Oxidative stress has a great ability to damage almost all types of cellular components in the body if the endogenous antioxidant system is overcome. So the use of natural antioxidants improves its capacity for fighting this enemy which could be caused by multiples environmental agents.

In this context, the total polyphenols, flavonoids and condensed tannins were determined in the Korkobbi (common Tunisian date) seed and its phytochemical compounds were characterized by HPLC.

Besides, the preventive antioxidant activity of two concentrations (250mg per ml (AESD1) and 125mg per ml (AESD2)) of its aqueous extract seed date AESD was studied in rats at a rate of 5ml per kg corporal weight during 3 months. Oxidative stress was induced experimentally in Wistar rats by a unique dose of 7,12-dimethylbenz [a] anthracene (DMBA) (gavage) of the order of 20 mg / Kg. A known medicine Etoposide is used as positive control at a rate of 2mg/ kg (injection). Forty-eight female Wistar rats were divided into eight groups of six rats each. (G1: saline; G2: DMBA; G3: aqueous extract of date seed 250mg/ml; G4: aqueous extract of date seed 125 mg/ml, dimethoate; G5: AEDS1+ DMBA;G6: AEDS2+ DMBA; G7: Etoposide; G8: Etoposide+DMBA). The exploration of oxidative stress has been revealed by the evaluation of lipid peroxidation by hepatic MDA level and the rate of antioxidant enzymes (SOD, CAT, and GPX) liver level.

This result revealed the secondary metabolite richness of the seed of

this common Tunisian variety. It contains a high amount of polyphenols, flavonoids, and condensed tannins and the HPLC analysis proved a wide range of those phytochemical compounds.

Furthermore, the Pretreatment with its aqueous extract showed a preventive and corrective effect. It reduces the levels of MDA that have undergone a significant rise following the gavage of DMBA. Thus, this extract restores normal levels of antioxidant enzymes (SOD, CAT, GPX). This study suggests that liver damage induced by DMBA can be corrected by Korkobbi seed aqueous extract.

**Keywords:** Antioxidant enzymes

**P-091**

## Preparation of Food Nano-emulsions by High Pressure Homogenization: Production of Low-calorie Mayonnaise

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A high pressure homogenizer was used to produce low calorie mayonnaise from natural dietary fibres and ingredients. When orange fibre along with egg white powder, pectin and modified starch were used as a stabilizer system, the gel like structure was obtained where the viscosity was very high (> 40 Pa.s, at 5 s-1 shear rate). In order to obtain a stable low fat mayonnaise with the recipes containing guar and xanthan gums, a two-stage homogenization was required. For this purpose, orange fibre (0.8-1.0%), salt and sugar were mixed with water and this mixture was homogenized at 1000 bar in order to increase the water holding capacity of fibre. Then, the homogenized fibre was mixed with the remaining ingredients to form a premix for a second stage homogenization. Trials showed that when the second stage homogenization was carried out at a pressure range of 50-200 bar, the stability of 25% fat mayonnaise was greatest (stability index <7.0%) with acceptable organoleptic scores. Our results showed that the fat content of mayonnaise could be reduced down to 25% by high pressure homogenization of the natural fibres and ingredients. The low fat mayonnaise produced by high pressure homogenization was comparable to regular mayonnaise in terms of consistency and eating quality.

**Keywords:** High pressure homogenization, water in oil emulsions, low-calorie mayonnaise

**P-092**

# Rheological Properties of Dextrans Produced by *Leuconostoc mesenteroides* Isolated from Different Molasses

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Dextran is one of the polysaccharide type composed of glucose units. It is widely used in cosmetic, food and paper industries. In the food industry, dextrans are used with hydrocolloids due to their thickening and emulsifying capabilities. *Leuconostoc mesenteroides* produced dextran at sugar broth medium. In this study, *Leuconostoc mesenteroides* strains were isolated from molasses, important sugar industry waste, obtained from 4 different factories. These isolated strains are used for the production of dextrans at sugar broth. Steady and dynamic rheological properties of dextrans %10 (w/v) were determined at 25 °C. Ostwald de model well described the flow behaviour of the dextran solutions with $R^2$ values close to unity. Consistency coefficient (*K*) and flow behavior values of the dextrans changed between 0.13-32.44 $Pa.s^n$ and 0.36-0.88, respectively. Frequency sweep test was also conducted to determine viscoelastic characteristics of the samples. As for 3 dextrans, loss modulus (*G''*) values were found to be higher than storage modulus (*G'*) and for the other dextran *G'* was higher than *G''* values. In other words, as 3 dextrans showed liquid-like bahavior, the other was solid-like behavior. The results of the present study showed that strain variety played an important role in rheological properties of dextrans. According to the results, the purified dextrans produced by *Leuconostoc mesenteroides* isolated by molasses waste can be used in food formulations as a food ingredient due to their thickening properties.

**Keywords:** *Leuconostoc mesenteroides*, dextran, rheology, molasses, waste

**P-093**

# Rheological Properties of Gelatin Extracted from Broiler Skin

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Nowadays, while skin and bones derived from bovine and pig are widely used in the production of commercial gelatin, the gelatin is only made from bovine skin in our country. In this study, some rheological properties (gel strength, viscosity and melting point) of gelatin extracted from broiler skin were determined, these were compared with the properties of commercial bovine gelatin and the difference between them was presented as a statistical.

For gelatin extraction from broiler skin, defatted dried skin pieces was mixed with sodium hydroxide (0.15% w/v), sulfuric acid (0.15% w/v) and citric acid (0.7% w/v), respectively. After these treatments the pellets were washed with distilled water and the final extraction was carried out in distilled water at 50°C overnight without stirring. The gel strength and viscosity of the gelatin (6.67% concentration) were measured using texture analyzer (TA.XTPlus, Stable Microsystems, UK) and digital viscometer (Brookfield Engineering, Middleboro, MA, USA), respectively. The melting point of the gelatin (6.67% concentration) were measured moving a mixture of chloroform and red food color from the surface of the gel to down during heating.

It was determined the gel strength values of 166.50 and 238.25; viscosity values of 1.35 cP and 3.12 cP, and melting point values of 33.7°C and 31.4°C for broiler skin and commercial bovine gelatins, respectively. As a result; broiler skin gelatin could potentially be an alternative to commercial gelatin in terms of the rheological properties indicating the commercial quality of gelatin.

**Keywords:** Gelatin, gel strength, viscosity

**P-094**

# Rheological Properties of Gelatins Extracted from Gilt Head Bream (*Sparus aurata*) and Bass (*Dicentrarchus labrax*) Skins

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Ascertainment of new sources for gelatin production is important issue due to problems related with consumption of pig-based products. In this study, for this aim, gelatin was extracted from gild-head bream and bass skins which are by-products of fish processing. Gel strength (bloom) value of gelatins extracted from gilt head bream and bass skins was found to be 129.9 g and 70 g, respectively. Viscoelastic properties and melting temperature of the gelatins were determined by oscillation measurement. Melting temperature of the gelatins, where storage (*G'*) and loss (*G''*) modulus values are equal to each other, gilt head bream and bass were determined as, respectively, 21.21 and 16.79 °C. *G'* and *G''* values of both gelatins increased with frequency. Gilt head bream gelatin had greater *G'* and *G''* values than bass gelatin at all frequency levels analyzed. The experimental angular velocity versus *G'* and *G''* values were fitted to power law model and *K'*, *n'*, *K''* and *n''* model parameters were calculated. Determination coefficient values changed between 0.956 and 0.990. *K'* values were found to be higher than *K''* for both gelatin types, indicating solid-like behavior of the gelatin gels. *K'* and *K''* values of the gilt head bream gelatin was greater than those of bass gelatin, which is consistent with the bloom values. The findings of the present study highlighted that gilt head bream and bass skins were

evaluated as gelatin source which can be an alternative to mammalian-based gelatins.

**Keywords:** Gelatin, fish, rheology, viscoelastic

**P-095**

## Rheological Properties of Levan Solution Produced by *Zymomonas mobilis*

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Levan is naturally occured in plants and produced by some microorganisms as an extracellular polymer and is a homopolymer of fructose connected by β(2,6) links and branches through β(2,1) links. Plant based levan polymers are generally shorter (2000- 33,000 Da) than levan polymers produced by microorganisms (2-100 million Da).

Levan can be used as water soluble edible film former, an emulsifying and encapsulating agent, blood cholesterol lowering agent, immunomodulator agent in medicine, a strong adhesive and texture forming compound. In this study, we aimed to produce a levan solution by *Zymomonas mobilis* NRRL B-14023 strain in a synthetic medium and to calculate the shear rate, shear stress and viscosity values in a viscometer (Brookfield LVDV-II Pro) and four different mathematical models (Newtonian, Power Law, Herschel-Bulkley and Bingham) were applied to the obtained data. Newtonian model was found to be fitted.

**Keywords:** Levan, rheology, mathematical models, *Zymomonas mobilis*

**P-096**

# Sensory Properties of Gluten-free Revani (Sweet Semolina Pastry)

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Celiac is a syndrom resulted from the deformation of intestines natural structure due to the consumption of nourishments including gluten. Revani (sweet semolina pastry), which is usually consumed by man, cannot be eaten by celiac patients because it includes gluten protein. Production of alternative gluten-free products demonstrates great importance of these products for this patient group. In this study, by using buckwheat flour (BWF) and rice flour (RF) and chestnut flour (CF) gluten-free Revani (sweet semolina pastry) formulations were optimized through the employment of the Response Surface Methodology (RSM). Potato Starch (PS) was added to the samples including BWF and CF. It was determined that the addition of PS increased the edibility of the Revani (sweet semolina pastry) prepared with buckwheat flour and the processibility of the Revani's (sweet semolina pastry) flour prepared with chestnut flour. Panelists evaluated the Revani (sweet semolına pastry) in terms of color, appearance, structure, smell, taste and aroma, brittleness, feeling in the mouth, slice integrity and overall quality. In consequence of the sensory score that the sweet semolina pastries prepared with different formulations, control sample, rice, chestnut and buckwheat Revani (sweet semolina pastry) respectively had the highest score. Statistically Significant difference were found between produced Revani (sweet semolina pastry) in terms of overall quality ($p<0.001$).

**Keywords:** Revani (swith semolina pastry), sensory properties, gluten-free, celiac

**P-097**

## Storage Stability of Single and Double Layered Microcapsules of Probiotic Microorganisms

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Probiotics are living microorganisms which have beneficial effects to humans when applied in adequate numbers. Probiotics must survive during gastrointestinal tracts in order to showing health effects. Some techniques have been developed for this purpose. Among these techniques, microencapsulation is most promising methods for protection of probiotics. In this method, active material was covered with a wall material thus material can be protected from adverse effects of environment. Spray drying is the mostly used microencapsulation method.

In this study, *Saccharomyces boulardii*, *Lactobacillus acidophilus* and *Bifidobacterium bifidum* were microencapsulated by spray drying and spray chilling method. Microcapsules were stored for 45 days at 4°C and probiotic counts and survivability rates were followed during storage. Gum Arabic, β-cyclodextrine and hydrogenated palm fat were used as wall materials.

According to the results, the highest *S. boulardii*, *L. acidophilus* and *B. bifidum* count was determined in mono layered palm microcapsules as 7.75, 6.86 and 5.91 log cfu/g, respectively. In addition, survivability rates of all samples were determined higher than 55%. Survivability of *B.*

*bifidum* cells was lower than *S. boulardii* and *L. acidophilus*. At the end of the storage, counts and survivability rates of *S. boulardii*, *L. acidophilus* and *B. bifidum* were 6.42, 4.70, 4.10 log cfu/g and 88%, 70%, %61. Probiotic counts and survivability of mono layered microcapsules were higher than multi layered microcapsules.

In conclusion, microcapsules produced with palm fat has good stability compared to gum Arabic and β-cyclodextrine. It can be concluded that hydrophilic wall material limits oxygen and moisture permeability and provides higher protection of probiotics.

**Keywords:** Microencapsulation, spray drying, spray chilling, probiotics

**P-098**

## Production of Honey Powder with Vacuum Drying Method and Its Physicochemical Properties

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Honey is a functional and natural food product and contains a lot of nutritional macro and micro components such as sugars, water, organic acids, minerals, vitamins, variable enzymes, phenolic acids, flavonoids and free amino acids. Honey has antioxidant, antimicrobial, anticarcinogenic and anti-inflammatory effects and these properties of it have been used treatment some wounds and diseases by people for many years.

In this study; investigation of carrier material types and their ratios to preserve bioactive properties of honey at the highest level in honey powder production by using vacuum drying method were aimed. For that purpose; the effects of three different carrier materials (maltodextrin, gum Arabic, and whey proteins) and three different carrier material ratios (50%, 75% and 100% of honey amount) on production of honey powder was investigated in a 2x3 factorial experimental design. Drying conditions were carried out as 45°C for 5.5 hours and after that 60°C for 7.5 hours. Obtained honey-carrier film was milled for 30 seconds and by this way honey powders was produced. These powders was kept at -18°C for analysis.

Physical analyses (yield, color, particle size, bulk density, solubility and particle microstructure), chemical analyses (moisture content, water activity, pH, titratable acidity, diastase number, hydroxymethylfurfural (HMF) content and antioxidant activity) were performed to honey powder samples.

As a result of analyses, the highest yield was obtained in honey powders with whey protein as 95.69% among carrier materials types and when carrier material ratio was increased from 50% to 100%, in parallel with the yield of powders was increased from 88.76% to 92.91%. Volume mean diameter of honey powder samples produced with maltodextrin, gum Arabic and whey protein were determined as 117.72, 77.29 and 82.81 µm, respectively. Solubility values of honey powders were detected more than 90% in all samples. Raise in ratio of carrier materials into honey powder increased the bulk density of samples from 0.65 to 0.78 g/cm$^3$.

Diastase activity of honey powder samples produced with maltodextrin, gum Arabic and whey protein were measured as 2.07, 9.94 and 18.90, respectively. Additionally, diastase activity of honey, used in the study, was determined as 10.51, and this value was mainly conserved in samples produced with gum Arabic and whey proteins in vacuum drying method. HMF content of samples, dried with maltodextrin, gum Arabic and whey proteins, were detected as 21.70, 10.52 and 6.96 mg/kg, respectively.

**Keywords:** Honey, honey powder, vacuum drying, diastase number, HMF

**P-099**

# The Effect of Ultrasound Application for Oleuropein Removal at Green Olive

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Oleuropein is a glycoside existing at the olive structure which gives bitter taste. This compound could be removed with water or NaOH application. However, removing oleuropein with water takes long time as well as consumers negatively response to the NaOH application. In this respect, the aim of this study was to determine the effect of ultrasound application to accelerate the oleuropein removing at the production of green olive. Ultrasonic applications were carried out with a probe connected to ultrasonic generator with 20 kHz. Ultrasound with 25, 50 and 100 % amplitudes for 1, 2 and 3 hours were applied to the domat type green olive in water then the remaining oleuropein amounts were determined in the olives. As well, the same olive samples were also treated with water and NaOH separately as a control. Results showed that oleuropein was removed with increasing the ultrasound amplitude up to 50%. Additionally, extending the application time up to 2 hours also increased the efficiency of oleuropein removal from the olives. As a conclusion, ultrasound application could be useful for removing bitter taste at the production of green olives when at least with 50% amplitude for 2 hour was applied.

**Keywords:** Ultrasound, oleuropein, green olive, bitter taste

**P-100**

# The Effects of Coating with Beeswax on Volatile Compounds and Proteolysis Levels of Kashar Cheese During Ripening

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Kashar is a pasta-filata type cheese and it is originally made using raw sheep or cow milk without the addition starter cultures, and natural microflora in which affects its typical flavour. It is generally ripened without packaging in cold rooms for 3-10 months. This process causes the formation a harder layer and also growth of moulds on the surface. This is one of common problem encountered during ripening of the cheese. Therefore, new packaging materials or techniques are studied recently.

The aim of this study was to evaluate the effects of beeswax coating on volatile compounds and proteolysis of Kashar cheese during ripening. Kashar cheeses were coated with two different thickness of beeswax [single-layer coating (BW1) and double-layer coating (BW2)]. For comparison, vacuum packaged (VP) and without packaging material (control) were also studied. The cheeses were analyzed after 5, 60 and 120 days of ripening for proteolysis and volatiles. Urea-PAGE electrophoresis of the pH 4.6-insoluble fraction showed a few differences among cheeses. The degradation level of $\alpha_{s1}$-CN was higher in sample VP when compared to others. The highest concentration of

intact β-CN (%92,46) was determined in sample BW1 at 120 day of ripening. Peptide profiles by reversed-phase HPLC of pH 4.6-soluble fraction of the cheeses revealed only minor differences in the concentrations of some peptides among the cheeses. The lower concentrations of peptides were observed at the beginning of ripening; however, their concentrations and numbers increased during storage. TFAA concentrations of cheeses were almost same at day 5; it increased smoothly during ripening. The increase was the highest for sample BW2, followed by samples VP, C and BW1. Seventy seven volatile compounds including alcohols (15), aldehydes (7), ketones (5), esters (17), carboxylic acids (8), terpens (3), miscellaneous compounds (22), were detected. The main volatile components in all cheeses were the carboxylic acids, alcohols and esters. It was determined small differences in several volatile compounds among the cheeses. Proteolysis or formation of volatiles in the cheese did not negatively influence by the use of beeswax application with regardless of coating layer. In conclusion, use of beeswax may be natural, useful and practical application for cheese coating.

**Keywords:** Proteolysis, volatile compound, packaging, beeswax, kashar cheese

**P-101**

## The Importance of Hydrocolloids in Confectionery Products

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Hydrocolloids are used in the formulation of food products due to their ability of forming viscous dispersions and gelation in water. They are also very important for confectionery products. Hydrocolloids used in the confectionery industry are categorized in two classes: i.) Thickeners and ii.) Gelling agents. Guar gum is used in the production of candies and marshmallows, gum arabic in the gumdrop, gelatin in the jellies, agar agar and pectin fruit jellies. Gums play an important role in the textural properties of the products, therefore, they also affect the sensory properties in terms of textural characteristics and flavor release during consumption. As jellies including pectin or agar agar is brittle texture, jellies containing gelatin are more elastic. In addition, they also influence the rheological properties of midproducts, which are also important for the process design necessary for the production and the quality of the end product. In addition hydrocolloids have function in terms of preventing of sugar crystallization and emulsification of fat, which are

substantial problems occurred during storage of the confectionery products and they adversely influence the consumer acceptability of the confectionery products. Type and amount of the hydrocolloids and the interaction of hydrocolloids with other ingredient determine the quality characteristics of the confectionery products.

**Keywords:** Hydrocolloids, confectionery products, quality

**P-102**

## Use Of Quince Seed Gel Powder as the Stabilizer in Yogurt Production

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In the study, some physical, chemical, textural, microbiological and sensory properties of the yogurt samples produced using quince seed gel powder in 4 distinct concentrations as a stabilizer have been examined during 21-day storage period. The effect of stabilizer on the syneresis and acidity has been identified to be very significant and its effect on dry substance has been found to be significant. On the other hand, its effect on ash, pH and protein has been found to be statistically insignificant. While the effect of stabilizer ratio on the *L. bulgaricus* number was found to be statistically very significant, its effect on *S. thermophilus* number has been found to be statistically insignificant. The effect of storage period has been found to be insignificant on both bacteria. It has been determined that the number of *L. bulgaricus* and *S. thermophilus* increased with the increase in the stabilizer ratio. While the effect of stabilizer ratio on the frequency, consistency and cohesiveness were statistically very significant its effect on viscosity index was significant. Other than, effect of storage period on frequency, consistency and cohesiveness were determined as very significant. The textural properties increased during storage period except for viscosity

index. However, textural parameters decreased with increasing stabilizer ratio. The stabilizer ratio has been found to be statistically very significant on the structure and texture, flavor, the sense it has left in the mouth and the overall acceptability scores, among the sensory properties, significant on color, water release, flavor and aroma, and insignificant on acidity and gas formation. The storage period variable has been identified to be significant at the level of $p<0.01$ on acidity and gas formation, taste and flavor, the sense it has left in the mouth and the overall acceptability scores, among the sensory properties, and at the level of $p<0.05$ on color and flavor. In general, it has been identified that the yogurt with the lowest concentration (0.05%) in terms of all properties has received the highest scores in sensory evaluation. In conclusion, It has been determined that the use of quince seed gel powder with high methoxyl pectin content in the yogurt production and the increase in the storage period have increased the textural features of yogurt; on other hand, the increase in the stabilizer ratio caused negative changes in the textural properties of yogurt. Furthermore, it might be an alternative instead of other stabilizers, which potentially have negative effects on health.

**Keywords**: Quince seed gel powder, yogurt, stabilizer, texture, chemical characteristics, microbiologic characteristics and sensational characteristics

**P-103**

# Using Algae Oil to Improve Fatty Acid Profile of Chicken Weiner Sausages

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Excessive dietary intake of saturated fats (SF) and cholesterol cause potantiel health risk. Meat products are important source of SF. Therefore, unsaturated fatty acid sources have been investigated for possible usage in meat products for nutritionally-balanced diet.

The purpose of this study was to incorporate algae oil as source of n-3 polyunsaturated fatty acids (PUFA) from *crypthecodinium cohnii* in an emulsion by replacing beef fat. Five different chicken weiner type sausages were manufactured under commercial conditions by replacing 0 (control), 25 (25AO), 50 (50AO), 75 (75AO) and 100 (100 AO) of beef fat by algae oil. These sausages were stored at 4°C for 30 days. Chicken weiners type sausages analysez for pH, thiobarbituric acid reactive substances (TBARS), color (L*, a*, b*) on 0., 5., 10., 15., 20. and 30. days. Samples were also analysed once for cooking loss (CL), mouisture, protein, fat, ash, texture, fatty acid profile, cholesterol and sensory analysis after manufacturing.

Results indicated that addition ao algae oil affected moisture ($p<0.01$), fat ($p<0.01$) and ash ($p<0.01$). Also there were significant differnces among treatments cholesterol and hardness. The use of algea oil caused an increasing cholesterol and softness in structure of sausages compared to control ($p<0.01$). Color (L*, a*, b*), pH and TBARS were affected by incorporation of algae oil during storage. As far as sensory properties of sausages were concerned, the use of algae oil resulted in lower scores for taste and smell compared to control ($p<0.01$). However, there were no differences between control and 25AO for general acceptability scores.

**Keywords:** Sausage, fatty acid profile, algae oil, cholesterol

**P-104**

# Some Physical and Chemical Properties of Biscuits Produced as Adding of Flour Containing Different Levels of Enzyme Resistant Starch

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Functional foods consumed in normal daily diet, have health promoting effects as well as nutritious properties. With increasing health awareness, the demand of consumers to functional foods has also increased. Thus, international food industry begin to do more research on developing healthful and innovative food products.

Enzyme resistant starch (ERS) passes through the large intestine without digestion in the small intestine of healthy persons and it can be degraded by microorganisms in the large intestine. ERS is accepted in functional foods due to acting as a dietary fiber.

Consumption of processed foods added with dietary fiber is essential for a healthy lifestyle. Therefore, the using possibilities of flour containing ERS in biscuit production as an alternative source of dietary fiber was studied in this research.

Four different flour ratios (0%, 25%, 50% and 75%) were used in biscuit production and the chancing of weight, diameter and thickness of biscuits are investigated at the end of baking. Produced biscuits were stored at room temperature in zipped plastic bags for 60 days. Each sample were analysed in every 30 day for determining textural hardness and fracturability, dry-matter and ERS content.

Increasing addition of ERS containing flour to biscuit formula affected the weight loss of biscuits insignificantly (31.22%) but resulted to obtained more wider (43.20 - 47.80 mm) and thinner (3.90 - 2.40 mm) biscuits. It also increased moisture content (4.29 - 6.92%) and ERS (0.44 - 2.84%) content of biscuits while decreased hardness (1906.50 - 339.60 g) and fracturability (35.30 - 33.69 mm) values.

Moisture content (4.39 - 6.18%) and fracturability (34.11 - 34.99 mm) values of biscuit samples increased while hardness (1280.60 - 857.30 g) values decreased during storage. There was insignificant change in ERS content (1.64%) of samples during storage.

**Keywords:** Enzyme resistant starch, biscuit, functional food

**P-105**

## The Effects of Wheat Flour Particle Size on Physical Properties of Pound Cake

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In the study, the effect of flour particle size on physical properties of pound cake was investigated. There were 3 fractions with different particle size, obtained by sieving of grinded wheat. The volume weighted mean values for particle size of fractions were determined by a particle sizer and found as 22, 51 and 60 µm, respectively. It was seen that the particle size had a significant effect on viscosity values of pound cake batters while $a_w$ (0.89) and specific volume (101.33 g/100 mL) of the batter showed no significant difference depending on flour particle size. The moisture content and $a_w$ values of pound cake samples ranged between 12.58-14.73% and 0.75-0.80, respectively and the lowest moisture content and $a_w$ values belong to the cake prepared with the fraction of highest particle size. Even though the weight loss values of samples increased by increasing particle size, the height and specific volume values of cake samples increased as well. The hardness and fracturability values of cake samples increased by increasing particle size and the highest values were of the fraction of highest particle size and found as 25.57 N and 14.16 N, respectively. It was observed that the crust thickness also increased by increasing particle size. The particle size showed significant effect on color parameters of pound cakes. The cakes of highest particle size had the lowest L* (57.30) value and highest a* (11.48) value among samples. The cake prepared with intermediate particle size had the highest sensorial score for external and internal properties.

**Keywords:** Particle size, pound cake

## P-106

# Roles of maltodextrin on the mechanical and encapsulation properties of amorphous dairy matrix

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As a food ingredient, maltodextrin has been used in encapsulation of food components for several decades. Previous studies have indicated that sugars in mixtures with maltodextrins of low dextrose equivalent (DE) form systems with high viscosity and are often used to increase the $T_g$ of food solids to improve their dehydration properties and stability. However, there is no further study about how the types and contents of maltodextin affect the encapsulation properties of amorphous matrix, and the relationship between mechanical properties and encapsulation properties. The objectives of this study were to investigate the influence of maltodextrin type and contents on mechanical and encapsulation properties of wall systems consisting of lactose/maltodextrin/WPI mixtures. The relationship between flavor release and mechanical properties of encapsulation systems was also studied.

Encapsulation systems with wall materials consisting of lactose/WPI (4:1) mixture and lactose/MD/WPI (3:1:1 or 1:3:1) mixtures were spray dried. Wall systems with lactose/WPI (4:1) mixture had the highest encapsulation efficiency for EB after spray drying. The presence of maltodextrin delayed the crystallisation of amorphous lactose with storage at high water activity (≥ 0.54 $a_w$), while encapsulation systems with high DE (13-17 and 23-27) MD showed higher stable water content at 0.65 $a_w$ and 0.76 $a_w$ than those with low DE (4-7) MD. The $T_g$ values of encapsulation systems with wall materials consisting of lactose/MD/WPI (1:3:1) mixtures were higher than those of encapsulation systems with wall materials consisting of lactose/MD/WPI (3:1:1) mixtures, and encapsulation systems with maltodextrin in wall systems showed higher initial crystallisation temperatures than those of encapsulation systems with wall materials consisting of lactose/WPI (4:1) mixtures at all experimental $a_w$. Moreover, the addition of maltodextrin in wall systems could increase stiffness and reduce molecular mobility of lactose molecules when water content increased, and the presence of high molecular weight maltodextrin could delay lactose crystallisation and increase the stiffness of wall systems, and restrict the diffusion of flavor molecules during storage. Wall systems consisting of lactose/MD (13-17 or 23-27)/WPI (1:3:1) mixtures showed

better encapsulation properties for EB at 0.44-0.76 $a_w$. The food industry may use these data in the assessment of protection and release characteristics of flavor components in formulated systems, such as dairy-protein-based high protein drinks and snacks, and typical dairy ingredients.

**Keywords:** Encapsulation; Maltodextrin; Amorphous matrix; Molecular mobility; Flavor release

## P-107

# Comparative study of fludised bed and high shear granulation: the effects on water adsorption behaviours and flow properties of milk protein isolate powders

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The effect of fluidised bed (FB) and high shear mixer (HS) granulation processes on water adsorption and flow properties of milk protein isolate powder was investigated and compared. Milk protein isolate was agglomerated by fludised bed and high shear mixer granulators, respectively. The formed granules were characterised by different size fractions. The granules produced from HS adsorbed least moisture and showed the slowest adsorption kinetics, while the porous and loose structures made the granules from fludised bed (FB) present no significant difference to the non-agglomerated powder. Granulation reduced the cohesiveness of the MPI powder, with high HS having a much greater impact due to the formation of denser particles. Particle size played a critical role but was not the only factor that influenced water adsorption and flowability. Granulation processes contributed to different degrees to reducing the minimum outlet diameters of hoppers based on either mass-flow or core-flow discharges. HS granules had large wall friction angles, which may need steeper hopper walls

**Keywords: M**ilk protein isolate, fluidised bed granulation, high shear mixer granulation, flowability, water adsorption, hopper design

## P-108

# Influence of emulsion structure on cellular absorption of encapsulated bioactive nutrients in emulsions

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Low bioavailability of lipophilic bioactive nutrients, e.g., β-carotene, Vitamin E, polyphenols, ω-3 fatty acids, and peptides, greatly limits their potential health benefits. Many nanoencapsulation and delivery strategies have been designed to improve the bioavailability of these compounds. Among them, emulsion is an ideal delivery system due to its easy preparation, and maintain of stability, controlled release, and potential targeted delivery of encapsulated molecules. Many emulsion-based delivery systems have been successfully established to improve *in vitro* and *in vivo* bioavailability of a variety of bioactive nutrients. Here we show encapsulated β-carotene in oil-in-water (O/W) emulsions show a significant higher intracellular accumulation in caco-2 cell, compared with pure free molecules. Caco-2 cell treated with β-carotene loaded O/W emulsion (BC-EM) of small droplet size (220 d.nm) shows a higher intracellular β-carotene content than that treated with BC-EM of large droplet size (500 d.nm)). Furthermore, BC-EM stabilized with whey protein isolated (WPI) shows a highest intracellular β-carotene accumulation, followed by BC-EM stabilized by casein sodium salt and Tween 80. In conclusion, emulsion encapsulation significantly improves the *in vitro* epithelia cell uptake of β-carotene and thus potentially its *in vivo* bioavailability. Transportation of BC-EM into the epithelia cell is droplet size and oil-water interfacial structure dependent.

**Keywords:** Bioactive nutrients, emulsion, encapsulation, delivery, cellular uptake

## P-109

# Influence Of Ultrasound-Assistant Alkali Treatment On The Physicochemical Properties Of Rice Residue Protein

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Rice residue protein (RRP) is by-product from productions of starch syrups, lactic acid, monosodium glutamate, and alcohol. Due to poor solubility, its applications in food and pharmaceutical industries were restricted.

In this study, RRP (90±1.13 wt% protein content, wet basis) were purchased from Jinnong Biotechnology Co.. The RRP was firstly dispersed indifferent NaOH solution, reached the final protein concentration of 50 g/L (w/v). Then RRP solution was placed in jacket beaker and treated by ultrasound and at 50°C for 60 min. After the treatment, the samples were readjusted to pH 7.5, and centrifuged. Supernatants were collected and freeze-dried for 12 h to obtain the treated rice residue protein for the following investigations. Solubility, molecular structure, micro-structure and functional properties of RRP subjected to ultrasound-assisted alkali (UAA) treatment were investigated. Assisted by ultrasound, the solubility of RRP increased with the increasing alkali concentration, and reached the maximum value, 19.79 mg/ml, at the alkali concentration of 0.08 M, which was improved 230-fold compared to the untreated samples. In addition, the reduction in particle size of UAA treatment protein was observed. Sodium dodecyl sulfate - polyacrylamide gel electrophoresis (SDS-PAGE) showed UAA treatment prompt to degrade protein subunit. Secondary and tertiary structures of RRP after UAA treatment were studied by analysing Fourier transform infrared spectra, sulfhydryl and disulphide bond contents, and surface hydrophobicity. UAA treatment seemed to unfold the protein internal structural conformation, led to the exposure of buried functional groups, which are linked to the functionalities of rice protein in term good emulsifying properties, although foaming activity decreased. The decreased zeta potential of the UAA treated protein molecules could be the reason for the decreased stability of emulsifying and foaming.

UAA treatment of rice residue protein modified the protein structure and significantly improved the product solubility, which could have potential applications in the food and pharmaceutical industry.

**Keywords**: rice residue protein, ultrasound-assisted alkali treatment, solubility, functional properties

## P-110

## Bloom Development on Untempered Chocolate

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Surface bloom on untempered chocolate has been characterized as sandy areas mainly composed of non-fat particles. Unlike fat bloom on well-tempered chocolate, this type of bloom is originated from improper tempering. The polymorphic transformation of less stable fat crystals to more stable crystals leads to redistribution of fat portion, and causes component separation. In this study, the effects of cocoa particle size and the polymorphic transformation of cocoa butter on bloom formation were investigated. Roasted cocoa nibs were ground into four batches of liquor with varying particle sizes of 18, 25, 34 and 56μm ($D_{90}$ values, 90% smaller than) to produce untempered chocolates. The X-ray diffraction technique was used to study the polymorphisms of cocoa butter, and the corresponding changes on chocolate surface were monitored by microscopies. The surface whiteness was measured to indicate the extent of bloom formation. Based on the results, the bloom formation process was highly dependent on the transformation of cocoa butter polymorphic type IV to type V. The surface bloom was confirmed to be mainly cocoa particles at a microscopic level. Although the cocoa particle sizes had limited effects on inhibiting the bloom formation, a sample with a smaller $D_{90}$ value had a greater increase of whiteness index, which might be due to the changes on light diffraction because of different sizes of particles.

**Keywords:** Particle size effects, fat polymorphisms, untempered chocolate, bloom

## P-111

# Applicability Of Prickly Pear (*Opuntia Ficus-İndica*) Fruit in Ice Cream: Investigatıon of Some Physical Chemical Rheological and Sensorial Properties

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This study aimed to investigate the effect of different levels (1,3 and 5%) of liyophilized prickly pear addition on some physical, chemical, sensorial properties of ice cream samples and apparent viscosity (at 4 °C) of ice cream mixes were measured with three replicates.

Ice cream samples were produced and they were stored at -18°C for two days. Ice cream samples were analyzed in terms of sensorial properties by sixty five consumer panellists who were experienced and familiar with ice cream and prickly pear. Ice cream with the lower fruit ratio (1%) took high flavor, gumming structure and general acceptability scores among the samples. According to color measurements, increasing of fruit concentration resulted a decreasing in $L$ and $C^*$ values and increasing in $-a$, $b$, $\Delta E$ and $H°$ values in ice cream samples. The overrun values of samples ranged from 42.35% to 45.61%. Additionally, ice cream sample which having the highest overrun value (5% lyophilized fruit added sample) melted more slowly than others.

The pH values of ice cream samples ranged from 6.88 to 6.94. The highest and the lowest titratable acidity (%lactic acid) values were 0,25% and 0,22% (5% liyophilized prickly pear added and control, respectively). Ash contents of samples increased slightly with fruit addition in the range of 0.85% and 0.94%. The highest total solids and protein content were found in the 5% lyophilized prickly pear added sample as 36.45% and 5.45%, respectively. Viscosity values which are considered a part of rheological properties of foods were measured at 10,20 and 50 rpm in ice cream samples. Apparent viscosity of ice cream mixes ranged from 2082 to 9058 cP at 10 rpm, from 2444 to 7449 cP at 20 rpm, from 1955 to 3720 cP at 50 rpm.

As a result, it was observed that lyophilized prickly pear positively affected the physical, chemical and sensorial properties of ice cream samples.

**Keywords:** Prickly pear, ice cream, fruit, color, viscosity

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