



B-FoST

03<sup>rd</sup>

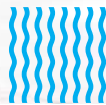
**BLACK SEA ASSOCIATION  
OF FOOD SCIENCE AND  
TECHNOLOGY CONGRESS**

13<sup>th</sup> - 14<sup>th</sup> December, 2023

Hotel Mona Plaza / Belgrade, Serbia

**PROGRAM**  
and  
**ABSTRACT BOOK**

[www.bfost2023.com](http://www.bfost2023.com)



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University of Donja Gorica



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**DAY 1**

**WEDNESDAY 13<sup>TH</sup> DECEMBER 2023**

**08.00 - 09.00**

**REGISTRATION**

**09.00-09.30**

**OPENING and WELCOME CEREMONY**

Deputy Minister of Science and Technology of Republic of Serbia - Prof. dr Marina Soković  
 Representative of Faculty of Agriculture University of Belgrade - Prof. dr Viktor Nedović  
 Dean of Faculty of Food Technology, Food Safety and Ecology UDG -  
 Prof. dr Aleksandra Martinović / *Montenegro*  
 Prof. dr Da-Wen Sun, *Royal Irish Academy / Ireland*  
 BFoST President - Prof. dr Miomir Nikšić / *Serbia*

**09.30 - 10.00**



**COFFEE BREAK**

10.00-10.40

**KEYNOTE 1**

- Da-Wen Sun / *Ireland*

Advancements in Hyperspectral Imaging Technology for Enhancing the Detection and Control of Food Quality and Safety

10.40-11.20

**KEYNOTE 2**

- Marina Soković / *Serbia*

Food as medicine: Your health is influenced by what you eat

11.20-12.00

**KEYNOTE 3**

- Sotirios Kiokias - *EU Research Executive Agency / Belgium*

MSCA Program in Horizon Europe with focus on Staff Exchanges Action

12.00-12.40

**KEYNOTE 4**

- Vladimir Kakurinov / *Macedonia*

Human behavior and its impact on hygienic design and food safety

**12.40 - 13.40**



**LUNCH BREAK / POSTER VIEWINGS / EXHIBITIONS**

13.40  
-  
15.40

**SESSION 01**

- Latest progress in Fundamental & Applied Food Science

*Chairs:* Nadiya Boyko, Katarina Smiljanić

**SESSION 02**

- Biotechnology and Bioengineering

*Chairs:* Viktor Nedović, Mark Shamtshyan



13.40-14.10

### PLENARY LECTURE 1

- **Nadiya Boyko / Ukraine**  
Bioactive molecules, post-biotics, fermented foods in prevention of age-relevant diseases

14.10-14.40

### PLENARY LECTURE 3

- **Katarina Smiljanić / Serbia**  
Do post-translational and processing-born food protein modifications affect protein digestibility and their immune properties?

14.40-15.10

### PLENARY LECTURE 5

- **Maja Kozarski / Serbia**  
Chitosan Production from Mushrooms: Current State of Knowledge

15.10-15.25

- **Danijel Milinčić / Serbia**  
Characterization and functional properties of goat milk based powder enriched with phenolic compounds from winemaking by-products

15.25-15.40

- **Milena Pantić / Serbia**  
Antimicrobial and antioxidant properties of crude chitosan extracted from cultivated *Agaricus bisporus*

### PLENARY LECTURE 2

- **Viktor Nedović / Serbia**  
Encapsulation of bioactives in food industry

### PLENARY LECTURE 4

- **Mark Shamtsyan / Russia**  
Bioactive compounds from mushrooms that can help to prevent and cure diseases

### PLENARY LECTURE 6

- **Nikos Tzortzakis / Cyprus**  
Medicinal and aromatic plants essential oils, hydrosols and their main component for the preservation of fresh produce
- **Nevena Barać / Serbia**  
In vitro antioxidant potential and mineral content of pectin-like polysaccharides isolated from soy hull

### PLENARY LECTURE 6

- **Maja Bensa / Slovenia**  
Litmaps – a useful tool for overcoming literature gaps: an example from food safety and chromatography

15.40 - 16.10



### COFFEE BREAK

16.10

### SESSION 03

17.40

- **Sustainability in Food Technology** - Chairs: Mona Elena Popa, Dragan Milićević

16.10-16.40

### PLENARY LECTURE 7

- **Mona Elena Popa / Romania**  
Sustainability in Food Technology  
Opportunities and challenges of agri-food waste and byproducts valorization

16.40-16.55

- **Dragan Milićević / Serbia** ▶ One Health – a holistic approach to achieving new trends in food safety and a sustainable food system

16.55-17.10

- **Merve Yavuz-Düzgün / Turkey** ▶ Comparison of physico-chemical properties of acidic and alkali pea proteins and entrapment yield with citrus pectin



17.10-17.25

- **Konstantin Kakurinov / Macedonia**

The role of parental influence on children's brand preferences

17.25-17.40

- **Milica Pešić / Serbia**

The changes of antioxidants bioavailability during in vitro gastrointestinal digestion of okara-enriched gluten-free bread

17.25

**SHORT ORAL PRESENTATION session**

*Chairs:* Mona Elena Popa, Dragan Miličević

17.45

**SHORT ORAL PRESENTATION session**

*Chairs:* Milena Pantić, Maja Kozarski

17.45-17.50

- **Karina Grigoryan / Armenia**

Efficiency of green biosynthesis silver nanoparticles as antibacterial against *Aeromonas hydrophila* isolated from infected rainbow trout

17.50-17.55

- **Mihaela Draghici / Romania**

Development of a new protein-vegetable "snack" product, nutritionally balanced

17.55-18.00

- **Maša Ilinčić / Montenegro**

Study of the Temperature Effect on the Growth of *E. coli* in Cheese

18.00-18.05

- **Nada Raičević / Montenegro**

Microbiome Analysis of Selected Montenegrin White Brine Cheeses

18.05-18.10

- **Amil Orahovac / Montenegro**

Evaluating Dietary Salt Intake Patterns in the Montenegrin Adult Population

18.10-18.15

- **Andrea Milačić / Montenegro**

Assessing the Quality and Authenticity of Montenegrin Olive Oil

- **Ana Ćirić / Serbia**

Rosehip (*Rosa canina* L.): A Phytochemical and Bioactive Ingredient Analysis for Functional Food Applications

- **Anita Najdenkoska / Macedonia**

Matrix effect in determination of pesticide in cereal products with gas chromatography

- **Filipa S. Reis / Portugal**

Assessing the bioactivity of extracts obtained from 22 different by-products of the agri-food industry

- **Jovana Petrović / Serbia**

Edible and bioactive mushroom *Agrocybe aegerita* (V. Brig.) Vizzini: a valuable resource for the next generation of pharmaceutical products

- **Gjyliza Bregu / Albania**

Hmf level and diastase number of some albanian honey samples

- **Jovana Mišković / Serbia**

The impact of seed priming of pea (*Pisum sativum* L.) with extracts of *Schizophyllum commune* Fr. 1815 on the plant's antioxidant activity under drought stress conditions

18.30 - 19.30



GET TOGETHER COCKTAIL RECEPTION



DAY 2

THURSDAY 14<sup>TH</sup> DECEMBER 2023

08.00 - 09.00

REGISTRATION

09.00-09.40

KEYNOTE 5

- Frank Moermann / *Belgium*

Robots in the food industry: challenges with respect to hygiene and cleaning/disinfection

09.40 - 10.10



COFFEE BREAK

10.10  
-  
12.10

SESSION 04

- Hygienic Engineering and Design

*Chairs:*

Huub Lelieveld, Mark Shamtshyan

SESSION 05

- Food Adulteration

*Chairs:*

Sladjana Šobajić, Irena Vovk

10.10-10.40

PLENARY LECTURE 8

- Vladimir Kakurinov / *Macedonia*

Hygienic Engineering and Design applied in Food Factories buildings

- Aleksandra Đukić Vuković / *Serbia*

Non-thermal technologies beyond food safety: role in fermented food and food waste valorization

10.40-11.10

- Nikoleta Lugonja / *Serbia*

The influence of thermal treatments on the quality of infant food

PLENARY LECTURE 9

- Sladjana Šobajić / *Serbia*

Controversies in the use of food supplements?

PLENARY LECTURE 10

- Irena Vovk / *Slovenia*

Challenges in Analyses of Phytonutrients in Food Samples

11.10-11.50

KEYNOTE 6

- Lillian Barros / *Belgium*

Innovative technologies for natural food ingredients from nature to products



11.50  
-  
15.00

**SESSION 06**

• **Novel Food Engineering Technologies**

*Chairs:* Mirjana Pešić,  
Saša Despotović

**SESSION 07**

• **New trends in Food Safety Laws and Regulations**

*Chairs:* Aleksandra Martinović,  
Charalampos Proestos

11.50-12.20

**PLENARY LECTURE 11**

• **Steva Lević / Serbia**

Spray drying in food technology:  
applications, innovations and quality  
control

**PLENARY LECTURE 12**

• **Aleksandra Martinović / Montenegro**

Beyond the Plate: The Interplay between  
Antimicrobial Resistance Emergence and  
the Safety of Our Food

12.20-12.50

**PLENARY LECTURE 13**

• **Saša Despotović / Serbia**

Effect of hop particle size on haze  
formation and sensory properties of the  
New England IPA beer

**PLENARY LECTURE 14**

• **Charalampos Proestos / Serbia**

Edible insects: tendency or necessity  
for the food industry

12.50-13.20

**PLENARY LECTURE 15**

• **Tanja Petrović / Serbia**

Active and intelligent packaging of food:  
A new trend for the future

**PLENARY LECTURE 16**

• **Andreja Rajkovic / Belgium VIDEO**

Microplastics and nanoplastics in  
food safety: from toxicity to microbial  
interactions

13.20-13.50

**PLENARY LECTURE 17**

• **Mirjana Pešić / Serbia**

Goat milk: carrier of bioactive compounds

• **Aleksandar Petrović, Nikolina Živković / Serbia**

Resveratrol – health in a glass of wine

• **Nenad Vujović / Serbia**

Analysis, current situation and perspective  
related to plant food safety in Serbia

13.50-14.05

• **Nevena Ivanović / Serbia**

Nutritional characteristics of whole grain  
products ON SERBIAN MARKET

14.05 - 15.00



**LUNCH BREAK / POSTER VIEWINGS / EXHIBITIONS**





15.00  
-  
16.30

**SESSION 08**

- Food Testing, Quality Control and Food Safety

*Chairs:* Andrej Gregori, Maja Bensa

**SESSION 09**

- Food and Industrial Microbiology

*Chairs:* Mirjana Rajilić-Stojanović, Jovana Vunduk

15.00-15.30

**PLENARY LECTURE 18**

- Huub Lelieveld / *Netherlands*  
Food safety and ingredients

15.30-16.00

**PLENARY LECTURE 20**

- Andrej Gregori / *Slovenia*  
Medicinal fungi food supplements - novel foods, adulteration and quality control

16.00-16.30

**PLENARY LECTURE 22**

- Dajana Vučinić / *Serbia*  
Digestibility, starch morphology, and nutritive value of rusks made from wheat flour with the addition of proso

16.30-16.45

- Maja Bensa / *Slovenia*

A matrix of critical points for consumer food safety

**PLENARY LECTURE 19**

- Mirjana Rajilić-Stojanović / *Serbia*  
Medicinal herb extracts as a novel food for microbiota manipulation

**PLENARY LECTURE 21**

- Jovana Vunduk / *Serbia*  
A new tool in mushroom toxicity screening: the use of a panel of bioluminescent whole cell bioreporter bacteria

- Antonios Chrysargyris / *Cyprus*

Antimicrobial, cytotoxic and anticancer activities from Cypriot aromatic plant extracts

- Bojana Vidović / *Serbia*

What are the benefits of fermented foods?

**16.45 - 17.15**

**E-POSTER**



**17.15  
-  
17.30**

**CLOSING CEREMONY**



03<sup>rd</sup>

BLACK SEA ASSOCIATION  
OF FOOD SCIENCE AND  
TECHNOLOGY CONGRESS

13<sup>th</sup> - 14<sup>th</sup> December  
Hotel Mona Plaza  
Belgrade, Serbia



## E-POSTER

• **Marina Tomašević / Croatia**

Effect of ultrasound and cold pressing on the composition of Graševina grape seed oil lipophilic and hydrophilic antioxidants

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• **Vesna Šolaja / Serbia**

The effect of biopriming of pea seeds (*Pisum sativum* L.) with extracts of *Schizophyllum commune* Fr. 1815 on the enzymatic antioxidant activity of seedling

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• **Vesna Šolaja / Serbia**

Antimicrobial activity of *Pleurotus salmoneostramineus* fruiting body extracts co-cultivated with *Pleurotus* spp. and *Lentinus crinitus*

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• **Natalija Uršulin-Trstenjak / Croatia**

Diet for patients with gastritis

---

• **Zorana Miloradović / Serbia**

The assessment of raw milk cheese production practices among Serbian small-scale dairy processors

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• **Antonios Chrysargyris / Cyprus**

The use of Cypriot oregano for the preservation of fresh spearmint

---

• **Nikos Tzortzakis / Cyprus**

Cypriot oregano essential oil and hydrosol as promising agents for the preservation of fresh basil

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• **Uroš Čakar / Croatia**

The study of fruit wine properties in the protection against oxidative stress

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• **Uroš Čakar / Serbia**

Fruit wine active compounds and its ability of hyperglycemia prevention

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**03** <sup>rd</sup> BLACK SEA ASSOCIATION  
OF FOOD SCIENCE AND  
TECHNOLOGY CONGRESS

13<sup>th</sup> - 14<sup>th</sup> December  
Hotel Mona Plaza  
Belgrade, Serbia



**B-FoST**



# ABSTRACT BOOK

## **3RD BLACK SEA ASSOCIATION OF FOOD SCIENCE AND TECHNOLOGY CONGRESS (B-FOST 2023)**

13TH TO 14TH DECEMBER 2023 IN MONA PLAZA HOTEL,  
BELGRADE, SERBIA



**B-FoST**



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Dear Colleagues and Partners,

On behalf of the Organizing and Scientific Committee of the **3rd B-Fost 2023 Congress (Black Sea Association of Food science and Technology) and Congress of Food Technologists of Serbia**, it is our great pleasure to invite you to participate and contribute to this event. The 3rd B-Fost 2023 Congress will be held **from 13th to 14th December 2023 in MONA PLAZA Hotel, Belgrade, Serbia.**

Congress is organized in cooperation with: **Institute of Food Technology, University of Belgrade, The Serbian Association of Food Technologists (SAFT), European Hygienic Engineering and Design Group (EHEDG), Global Harmonization Initiative (GHI), European Federation of Food Science and Technology (EFFoST), ISEKI Food Association (IFA) and [FoodHub Center of Excellence, University of Donja Gorica](#)**



**B-FoST 2023 Congress gives an unique opportunity for food scientists, researchers, technologists, producers and nutritionists, young scientists and students** for presentation of results and findings of their own work and exchange information on the new processes. We are looking forward to seeing you at the B-FoST Congress and welcoming you in Belgrade.

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**03** rd **BLACK SEA ASSOCIATION  
OF FOOD SCIENCE AND  
TECHNOLOGY CONGRESS**

13<sup>th</sup> - 14<sup>th</sup> December  
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**ABSTRACT BOOK**  
**Keynote lectures**

# KEYNOTE LECTURES



BF13

Keynote Lecture

## Advancements in Hyperspectral Imaging Technology for Enhancing the Detection and Control of Food Quality and Safety

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Hyperspectral imaging technology combines the strengths of mature optical sensing techniques—imaging and spectroscopy. This integration enables the capture of both spatial and spectral information for every pixel in an image, distinguishing it from traditional color imaging systems. This advanced capability has led to extensive exploration and advancement of hyperspectral imaging in various fields. Particularly in the food industry, hyperspectral imaging has gained momentum due to its ability to capture physical attributes like color, size, shape, and texture, as well as intrinsic chemical and molecular properties (e.g., water, fat, protein) of food products. This technology has found successful applications in ensuring food safety and quality control.

This presentation aims to provide an introduction to the fundamental principles and theoretical underpinnings of hyperspectral imaging. It then delves into a comprehensive exploration of recent advancements and applications in the realm of food safety and quality control, including the assessment and evaluation of muscle food quality and safety (salmon fillets, chicken fillets, pork, ham, minced lamb, poultry carcass), detection, analysis and grading of fruits (banana, lychee, kiwifruit, pear, citrus, strawberry, cucumber), visualization of kiwi sugar distribution, tracking tomato ripening, detection of melamine contamination in flour, etc.

**Keywords:** *hyperspectral imaging; food quality; food safety; nondestructive detection*

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BF22

Keynote Lecture

## Food as Medicine: your health is influenced by what you eat

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Understanding the relationship between consumption of food ingredients and obtaining good health is of immense importance, especially nowadays when processed and junk food is easily accessible to everyone. Science and medicine have shown that both overeating and malnutrition are to blame for a number of diet-related health issues, including high blood pressure, atherosclerosis, diabetes, vitamin deficiencies, coronary heart disease etc. Understanding of how dietary practices affect health has just lately become popular, creating new opportunities for the growth of food sector. An often under-appreciated food, mushrooms as well as many other overlooked plant species, have recently gained a lot of attention in both food and pharmaceutical industries. Along with being nutritionally desirable ingredients, mushrooms are also quite palatable, and sustainably produced food that not only meet basic nutritional demands but possess health-promoting qualities, making it a good example of functional food. Eating mushrooms on a regular basis will give the proper amount of fiber (including glucans) and other carbohydrates, proteins, vitamins (B1, B2, B12, C, D, and E) as well as polyunsaturated fatty acids, minerals, terpenoids, phenolics etc. Mushroom will exert a wide range of bioactive properties, such as antibacterial, anticancer, antiinflammatory, hepatoprotective, neuroprotective, cardioprotective, immunostimulatory and others. Importance of certain food ingredients in optimal health has even been recognized by Food and Agriculture Organization which suggested reintroducing lesser-known or completely ignored wild growing species into the everyday use. This re-evaluated their health-beneficial potential and highlighted their importance as part of cultural heritage, especially for species which have been once utilized, for example *Morus nigra*, *Cornus mas*, *Sorbus domestica* etc.

Due to the growing demand of consumers for healthy food products used to achieve optimal health, development of new generation of food products with disease preventing properties is essential.

**Keywords:** *food, health, dietary practices, mushrooms*



BF28

Keynote Lecture

## EU RESEARCH FUNDING OPPORTUNITIES (HORIZON EUROPE)/ MARIE-SKŁODOWSKA CURIE ACTIONS (MSCA) WITH FOCUS ON STAFF EXCHANGES

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### Abstract

The Covid-19 crisis has highlighted once more the importance of the world's reliance on a highly skilled research-based human capital that is able to detect and tackle emerging challenges. In the frame of the new EU Research Framework Program (Horizon Europe, 2021-2027), the European Union (EU) will continue reinforcing its efforts to entice more young people to a research career and promote its attractiveness for top talents from around the world. To this end, Marie Skłodowska-Curie Actions (MSCA) are the main EU instrument financing excellent projects to support all stages of researchers' careers and encouraging their mobility. Within the period 2014-2020 (Horizon 2020 Program), the MSCA Actions supported around 65,000 researchers including 25,000 candidates. The aim of this presentation is to provide an overview of MSCA in the frame of Horizon Europe presenting in a nutshell the main features of MSCA DN,PF,COFUND & Citizen Action and focuses on MSCA-SE Action that build partnerships between universities, research institutions, and industrial partners both within and beyond Europe.

During Horizon Europe (2021-2027), the following types of MSCA funding Actions are managed by the European Research Executive Agency of the European Commission:

- (i) **MSCA Doctoral Networks (DN)** supporting early-stage researchers to participate in competitively selected joint doctoral programs;
- (ii) **MSCA Postdoctoral fellowships (PF)** supporting the mobility of experienced researchers in postdoctoral projects;
- (iii) **MSCA COFUND** offering additional funding to regional, national and international PhD or postdoctoral projects;
- (iv) **MSCA and Citizens** aiming to bring research closer to the public-at-large through the European Researchers' Night event;
- (v) **MSCA Staff Exchanges (SE)** promoting the intersectoral and international mobility of researchers, management, and administrative staff at all career levels.

This action promotes interdisciplinary collaboration through exchanging staff and sharing knowledge at all stages of the innovation chain. The talk will clarify the novelties of MSCA Staff Exchanges compared to their precursor action in H-2020 (MSCA-RISE). Guidance on the preparation and submission of MSCA proposals along with examples of successful MSCA-SE projects relevant to Food & Nutrition topics will also be provided.

**Key words:** *EU, research funding, . MSCA*



BF31

Keynote Lecture

## Human behavior and its impact on hygienic design and food safety

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### Abstract

Food safety systems or standards have to be applied in the food industry, often as a legal obligation. Hygienic engineering and design in fact is application of techniques which are allowing effective and efficient cleaning of entire manufacturing asset (equipment, infrastructure, building, etc.), with purpose to minimize any risk of product contamination during asset work life. It is a prerequisite for the development and implementation of food safety systems and standards. However, although these systems are have been well known is for a long time ago known, we are still encountering many food safety incidents throughout the world, and the main factor for them is human behavior. The aim of this presentation is to establish how human behavior affects both, food safety and hygienic design.

The author within the period of 10 years (2007 to 2016), visited 425 companies all over the world, trained over 700 people, had over 40 informative meetings with: food operators, governmental and consulting companies and countless face to face meetings with all of them. During this period, 1,500 questionnaires were distributed to the food safety teams and food safety operators and who were/ are working in all food industry sectors, in companies had food safety issues and/or incidents. The questionnaire contained section on human relations according: workplace and responsibilities. All answers were analyzed and processed by mean arithmetical value.

Results from this investigation revealed that that the human behavior can be classified in 4 cases: 1. I didn't know; 2. I forgot; 3. I couldn't, and 4. I choose not to (I didn't want to). Elaboration of these causes allowed us to establish reasons for these kinds of human behavior and to give possible solutions how they can be overcome.

The conclusion from this research is that control of 3 hazards (micro/biological, chemical and physical is not a guaranty that the equipment manufacturing and designing will be hygienic, and that food safety will be achieved. According my opinion, human behavior has to be recognized as 4th food safety hazard.

**Key words:** *Human behavior, Food Safety, Hygienic Engineering and Design, Food safety hazards.*



BF20

Keynote Lecture

## Robots in the food industry: challenges with respect to hygiene and cleaning/disinfection

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In the food industry where profitability is still a daily concern, robots are mainly deployed for packing and palletizing tasks. However, the cost of robots is rapidly decreasing, while progress in gripper technology and intelligent image processing opens a window of new opportunities for the application of robots in the processing and production of food. Besides speed, robots are successful in repeating monotonous tasks in a precise and reproducible manner, providing enhanced product quality within specifications. If they are hygienically designed, robots also may reduce the risk for product contamination, not at least because humans always will remain a source of food contamination. Like all food machinery, robots must meet regulations with respect to food hygiene and easy cleaning. Especially parts of the robot that come in direct contact with food (e.g., gripper) may not cause food contamination, although other parts of the robot (e.g., robot arm) may require routine cleaning to avoid soil to drop or to be drawn into the main product or container. Where robots operate in an environment with exposed food, these robots are usually also a critical control point (CCP). The principles of HACCP such as hazard and risk analysis, measures to control physical, chemical and microbial contaminants, as well as monitoring and corrective actions can be implemented to ensure that the robot will not become a source of food contamination. Where robot parts may potentially introduce contaminants, robot designers/manufacturers and integrators must consider hygienic design as a means to reduce the likeliness of contamination. However, hygienic engineering is more than designing a robot and gripper suitable to manipulate exposed food. It also encompasses the use of food grade compressed air and food grade lubricants essential to allow proper operation of all robot parts without introducing extraneous contaminants detrimental to both the quality and safety of the food produced.

**Keywords:** *robot, gripper, food contamination, -hygienic design, cleaning*



BK32

Keynote Lecture

## Innovative Technologies for Natural Food Ingredients: From Nature to Products

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### Abstract

Recently, scientific validation of an array of applications and benefits arising from the use of natural ingredients and edible matrices has increased worldwide. Here, the improvement of health conditions through the use of plants and mushrooms represents a rich cultural legacy, with these matrices being traditionally used as sources of micro and macronutrients and in different medicinal preparations. These are made up of natural ingredients with high added value, acting as natural colorants and preservatives, and providing bioactive properties when added to other products.

Currently, various innovative technologies have been used to optimize extraction systems, increasing the purity of the natural target compounds and extraction yields. Some colorants have been successfully extracted from *Beta vulgaris* L., *Gomphrena globosa* L., *Bixa orellana* L., and *Curcuma longa* L., and used in different food formulations. On the other hand, a wide variety of biowastes and/or by-products have been effectively used as bioactive molecules, such as those from *Agaricus bisporus*, rich in pro-vitamin D2 (ergosterol), and fruit residues, which have shown to perform different bioactivities. Peels from acorn, in turn, have been used as preservatives, and by-products from fish industry used in the formulation of healthy pet food. Additionally, in this field, the use of figs and pumpkins through the extraction of bioactive compounds from all their components and subsequent incorporation into derived products, show satisfactory outcomes, boosting the circular economy of all its constituents. In parallel, bioactive molecules from olive pomace have been recovered for further incorporation into cosmeceutical formulations, while improving sustainable extraction processes and their optimization.

These results highlight the effectiveness of natural ingredients from different natural matrices, promoting their valorisation as sources of naturally-based ingredients able to be incorporated into widely consumed and appreciated food products at an industrial/commercial level.

**Keywords:** *Innovative technologies, Natural Food Ingredients, Nature to Products*







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ABSTRACT BOOK  
Plenary Lectures

# PLENARY LECTURES



BF15

Plenary Lecture 1

## BIOACTIVE MOLECULES, POST-BIOTICS, FERMENTED FOODS IN PREVENTION OF AGE-RELEVANT DISEASES

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Achieving personalized and healthy nutrition requires an understanding of not just the nutritional value of foods, but also its impact on the gut microbiome, gene expression, and other biological processes. This holistic approach led to establishing collaboration network between experts in epidemiology, biochemistry, behavioral science, food science, healthcare professionals, and industry stakeholders. In order to prevent age-relevant noncommunicable diseases one might think about the creation of “next-generation functional foods” (NGFF), that consider a variety of factors, including the origin of the ingredients, the presence of biologically active molecules and additives, the ease of preparation, original microbial content and their metabolites. Traditional dishes can serve as a valuable starting point for the development of such “next-generation” functional foods, as they often meet many of these criteria.

To facilitate the adoption of NGFF, it is essential to establish databases and artificial intelligence tools that can help calculate personalized nutrition needs. One of the key challenges in developing functional foods is balancing their potential health benefits with practical considerations such as shelf life, transportation, and recipe variability. To address these challenges, researchers are exploring a range of (bio) technological approaches, including fermentation and microbial cultivation.

An information system (IS) for personalized nutrition creation and prescriptions aimed to regulate the gut microbiota ratio, biodiversity, and functionality has been developed. The proposed IS operates as an algorithm for the selection of individually required contents from a large amount of data (databases, DBs). Recently, a new line of functional foods branded as Ediens<sup>TM</sup> has been developed that incorporates unique microbial starters and plant-based biological active compounds.

These products have been carefully tested in vitro, in vivo, and ex vivo models to assess their impact on human health. Personalized diets based on Ediens<sup>TM</sup> products have also been shown to effectively regulate the gut microbiome in limited controlled diet studies.

**Keywords:** *Bioactive molecules, post biotics, age relevant diseases, human microbiome, information system, functional food*



BF33

Plenary Lecture 2

## Encapsulation of bioactives in food industry

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The role of food today is more oriented to the prevention of nutrition-related diseases and improvement of the physical and mental well-being of consumers than to fulfil basic nutritional needs. Consequently, the food industry is searching for solutions to accomplish these goals. The nowadays industrial production of foods involves the addition of functional ingredients to increase process efficiency, tailor flavor, color, texture, or preservation properties, while recent trend is the inclusion of bioactive compounds with potential health benefits, such as vitamins, probiotics, minerals, polyphenols, omega-3-fatty acids, and phytosterols. In this regard, encapsulation became a powerful tool for a variety of reasons, including delayed-release, stability, thermal protection, and suitable sensorial profile of bioactives.

Encapsulation may be also used to immobilize cells or enzymes in food processing applications, such as fermentation processes and metabolite production processes. Immobilization of microbiological cells by entrapment within natural or synthetic polymers or by adsorption onto solid (in)organic carrier materials has become an increasing research area with high potential for industrial applications.

This paper is aiming to present the benefits resulting from the use of encapsulated ingredients and cells in the food industry. These benefits are going to be illustrated via several case studies developed in our lab over last years, such as aroma stabilization, protection of natural colorants, enriched beverages, beer, wine, cider and raspberry wine fermentations, active food packaging and so on.

**Keywords:** Immobilization, encapsulation, food industry



BF11B

Plenary Lecture 3

## Do post-translational and processing-born food protein modifications affect protein digestibility and their immune properties?

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Protein post-translational modifications and those induced by food processing (PTMs) occur in many forms and can widely influence protein structure and behaviour. Yet, their structural and functional aspects in protein architecture are mainly overlooked. Until recently, this was mostly a consequence of insurmountable obstacles related to their global proteome identification and quantification via mass spectrometry-based proteomics. However, recent advancement in high-resolution tandem mass spectrometry, coupled with dedicated software, such as PEAKS Studio for an unspecified identification of PTMs, enabled their confident mapping. In our recent works we have established a method for global, open and relative quantitative profiling of PTMs without enrichment step, demonstrating its usefulness in environmental (1), biomedical (2) and food technology (3) sciences.

PTMs could influence enzyme hydrolytic efficiency. This was a starting point to grow the idea of porcine trypsin being used in proteomics to serve as a probe to decipher differences in scissile bond hydrolysis caused by PTMs, based on steric and charge changes introduced as a possible hindrance or facilitation to its active site. We further hypothesized that the effects observed would be even more pronounced with human trypsin, since it is less efficient compared to the porcine counterpart. Therefore, we have reassessed our porcine-derived trypsin-generated proteomic data of the major peanut allergen Ara h 1 from the raw and roasted peanut, to look for possible facilitating/hindrance effects on trypsin digestion efficacy caused by PTMs positioned on K/R residues, by developing a manual method to analyse the extent of trypsin hydrolytic efficiency on modified and unmodified sequences. The algorithm based on machine learning of the big proteomic data in public repositories could be made to determine enzyme cleavage efficiency in relation to PTMs presence based on our developed manual method and it could be applied in other life science fields. This topic is important for understanding of peanut (food) allergy and human gastrointestinal digestion of proteins and PTMs introduced by food processing.

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BF 9

Plenary lecture 4

## Bioactive compounds from mushrooms can help to prevent and cure diseases.

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The unique structural characteristics of  $\beta$ -glucans allow them to perform many specialized physiological functions such as lowering cholesterol levels, regulating blood sugar levels, and boosting immunity. Not only can they be used in pharmaceuticals, but they are also a kind of ideal health food to be used as a food additive in the food industry with good application value and development prospects.

It has been established that beta-D-glucans are able to induce epigenetic remodeling myeloid cells at the level of their precursors, which provides a higher level of non-specific anti-infective protection. The phenomenon, referred to as “trained immunity”, indicates the formation of “cellular memory” in the system of innate immunity.

Given the totality of all the pharmacological properties of beta-D-glucans, their use is possible both for the prevention of seasonal respiratory diseases, including Covid-19, and for treatment in addition to basic therapy.

The pathophysiological features of the severe clinical course of Covid-19 associated with a high pro-inflammatory premorbid background in elderly people and people with various chronic inflammatory and metabolic diseases allow us to consider the appointment of preparations based on mushroom beta-D-glucans as the most adequate preventive measure. The pronounced anti-inflammatory activity shown by mushroom polysaccharides makes it possible to use them during the period of advanced clinical manifestations of infection, as an addition to basic therapy, to reduce the risk of developing the most severe complications of Covid-19: cytokine storm and coagulopathy.

Higher fungi Basidiomycota are the promising objects of biotechnology. Mushrooms are a source of various enzymes. Our studies show that mushrooms can be a promising source of collagenolytic, thrombolytic, lipolytic, milk-clotting, and other enzymes, which can be used in food, pharmaceutical, and cosmetic industries.

**Keywords:** Mushroom beta-glucans, immune-modulation, collagenase, thrombolytic activity, enzymes

**Acknowledgments:** This research work was carried out with the support of Russian Science Foundation Grant No. 22-24-00785.



BF19

Plenary Lecture 5

## Chitosan Production from Mushrooms: Current State of Knowledge

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Mushroom chitosan, a natural co-polymer of chitin, has recently gained increasing attention due to its significant advantages in comparison to crustacean chitosan. While supplies of crab waste are seasonally limited, commercial mushrooms can be obtained through a convenient process that has no geographic or seasonal limitations; mushrooms have a lower level of inorganic materials compared to crustacean waste, and therefore no demineralization treatment is required to remove calcium carbonate and other minerals during the isolation process; crustacean chitosan may vary in the physico-chemical properties, while mushroom chitosan has relatively consistent properties due to the possibility of controlled production conditions; and mushroom chitosan is apparently more effective in inducing an immune response as it is covalently linked to  $\beta$ -glucans.

The extraction of chitosan from *Agaricus bisporus* (Champignon) is intensively studied within our research group at the Faculty of Agriculture. In general, the extraction process consists of three steps: (1) alkaline treatment to remove protein and alkali soluble polysaccharides; (2) acid treatment to separate chitin and chitosan; and (3) precipitation of chitosan under alkaline conditions.

Protein removal was effectively achieved with 9 M NaOH at 121 °C in autoclave, during 1.5 h and 3 h. Chitosan separation was carried out with 5% acetic acid at 95 °C for 6 h and further precipitation under alkaline conditions. Chemical characterization by nuclear magnetic resonance (NMR) showed a high degree of deacylation of chitosan extracts 92.7 % (1.5h) and 92.3 % (3h), compared to commercially available mushroom chitosan 75-85%. The  $\beta$ -glucan content, determined using an enzymatic  $\beta$ -glucan assay kit (yeast and mushroom), was 229.7 mg/g (1.5 h) and 182.1 mg/g (3 h) dry weight (DW) of the chitosan extract. The  $\beta$ -glucan content of the commercial sample was significantly lower, 15.0 mg/g of DW extract.

Application of chitosan from *A. bisporus* can be important for modern pharmacy and medicine to improve the co-adsorption of organic molecules. Furthermore, composites based on natural clays and chitosan are being investigated within our research group. The discovery that these composites can act as drug carriers or coadjuvants in pharmaceutical preparations has greatly expanded the field of their application.

**Keywords:** *Agaricus bisporus*, chitosan, glucans, extraction, pharmaceutical preparation

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BF 2

Plenary lecture 6

## Medicinal and aromatic plants essential oils, hydrosols and their main component for the preservation of fresh produce

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### Abstract:

Medicinal and aromatic plants (MAPs) are widely used in many cuisines around the world as well as traditional medicines. MAPs are highly perishable with short shelf life. In an attempt to reduce the use of synthetic fungicides, a turn towards natural products such as essential oils (EOs) and natural compounds has been made, and their use for food preservation is investigated. In one study, Cypriot oregano (*Origanum dubium*) EO and hydrosol, due to their biocidal properties, were tested on fresh spearmint's quality preservation in different concentrations (0, 0.001, 0.01 and 0.1%) and time (0, 1, 5 and 10 min) of dipping application. In another study, new insights presented on the effects of eucalyptus (Euc), rosemary (Ros) EO, their mixture (50:50 v/v) and their common main component (i.e., eucalyptol) on the quality parameters, fruit response and inhibition of blue rot (*Penicillium expansum*) in apple and pear fruits during their shelf life. The results revealed that antifungal activity is not only related to eucalyptol, but to the synergistic effect of other EOs components. High EOs level, increased lipid peroxidation and hydrogen peroxide in fruits through oxidative stress, and optimum application is required for different fresh produce preservation, as alternative natural fungicides.

**Keywords:** *natural products; quality-related attributes; volatiles; eucalyptol*







**03**rd **BLACK SEA ASSOCIATION  
OF FOOD SCIENCE AND  
TECHNOLOGY CONGRESS**

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**ABSTRACT BOOK  
Lectures**

# LECTURES



BF35

## Characterization and functional properties of goat milk based powder enriched with phenolic compounds from winemaking by-products

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In recent years, consumer demand for functional foods has increased on the global market, mainly due to their positive effects on human health. The current trend in food innovation is therefore based on the development of healthier and more sustainable foods, and the use of bioactive compounds derived from various by-products. Grape seeds are one of the by-products generated during the winemaking process, and present a rich source of phenolic compounds which possess a wide range of biological activities. Although grape seeds have been intensively studied, they still represent an economic and environmental problem that requires new ways of utilisation to reduce wine industry waste. On the other hand, functional dairy products are widely accepted and increasingly included in the diets of consumers of all ages. Goat milk has attracted much attention in recent years due to its unique nutritional and functional properties and its ability to be promising carriers of phenolic compounds. Considering that goat milk proteins are deficient in phenolic compounds, their enrichment with grape seed extracts represents a promising model for the development of new functional food products or additives. Therefore, the aim of this study was to characterize a novel spray dried goat milk-based powder enriched with inulin and grape pomace seed extract (TMIE).

To characterize the obtained powder this study includes UHPLC MS/MS and electrophoretic analysis, DLS measurements and SEM microscopy of the obtained powder, as well as analysis of its antioxidant (ABTS<sup>•+</sup>; DPPH<sup>•</sup>, FRP, TAC) and techno-functional (emulsifying and foaming) properties.

UHPC MS/MS analysis of the methanolic extract showed the presence of free or weakly bound phenolic compounds in TMIE powder. Catechin and gallic acid derived from the seed extract were the most abundant phenolic compounds detected. In control skimmed (M) and thermally treated (TM) goat milk powders, phenolic compounds were not detected. Electrophoretic analysis of M, TM and TMIE powders showed the presence of characteristic protein bands of goat milk corresponding to caseins and whey proteins. The results of the particle size measurement showed a bimodal particle size distribution of the TMIE sample. Based on the results obtained, the presence of different complexes among inulin extracts and goat milk proteins was observed. Novel TMIE powder (0.1, 0.5 and 1.0% solutions) showed improved antioxidant properties while a 0.1% TMIE solution showed good emulsifying properties. All TMIE solutions tested (0.1, 0.5, and 1.0%) showed poor foaming properties. It can be concluded that formulated TMIE powder with good antioxidant and emulsifying properties can be a promising new functional additive or supplement.

**Keywords:** *Goat milk, grape seed, inulin, antioxidant properties, techno-functional properties*

**Acknowledgments:** This research was supported by the Science fund of Republic of Serbia, FUNPRO Project, #Grant No. 7744714



BF14B

## Antimicrobial and antioxidant properties of crude chitosan extracted from cultivated *Agaricus bisporus*

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Chitosan is a natural biopolymer that could be used in clay modification to adsorb mycotoxins, secondary metabolites of filamentous fungi commonly found in cereal grains and animal feed. Only a small number of mushrooms have chitosan, which is mostly produced from chitin through the deacetylation process. In this work, chitosan was extracted from the fruiting bodies of commercially grown *Agaricus bisporus* with 9 M NaOH for 1.5 h in an autoclave followed by the treatment with 5% acetic acid (150 °C, 6 h), precipitated under alkaline conditions and neutralized. The antioxidant properties of prepared chitosan were determined under *in vitro* conditions by using spectrophotometric tests, while antibacterial activity was tested using broth microdilution assay (C= 0.078-5 mg/ml conc). The mycotoxigenic strain of *Aspergillus flavus* was grown on a solid medium enriched with 20 mg/ml of chitosan. The percentage of inhibition of the mycelium growth compared with the control was calculated. Additionally, the composite of bentonite with chitosan isolated from the mushroom was prepared and modified with surfactant hexadecyltrimethylammonium bromide. Adsorption of mycotoxin zearalenone using composite at pH 3 by HPLC was determined.

The scavenging ability of free DPPH<sup>•</sup> radicals of the laboratory-prepared chitosan at a concentration of 5 mg/mL was 99.35%, while the ability to neutralize ABTS<sup>•+</sup> radical cations was in the range of 31-94%, depending on the concentration. The ferrous ions chelating ability of this sample was 98.50% at 5 mg/mL. Low bactericidal concentrations were detected, 2.5 mg/ml for *Escherichia coli* (ATCC 25922) and 0.625 mg/ml for *Enterococcus faecalis* (ATCC 29219). *A. flavus* was inhibited for approximately 36% after three days of growth on the agar with chitosan, compared with control. Clay-chitosan-surfactant composite adsorbed 91.75% of zearalenone, compared to the clay-chitosan composite (7.25%), which means that surfactant molecules have a main role in toxin adsorption. The antioxidative and antimicrobial activity of crude chitosan from mushrooms makes it a potential material for food packaging, while a clay-chitosan-surfactant composite could be used for decontamination of animal feed contaminated with mycotoxins.

**Keywords:** *Bioactivity, Chitosan, Clay, Composite, Mycotoxins*

### Acknowledgement

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BF35

## Litmaps - a useful tool for overcoming literature gaps: an example from food safety and chromatography

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Literature plays a crucial role in the attempts of researchers aiming to follow the achievements and developments in their research fields. While more experienced researchers usually have a good overview of the work undertaken by their peers and research groups exploring similar subjects, early-career researchers and those exploring new scientific topics can find literature review and staying up to date with relevant scientific literature quite challenging. Even when a lot of effort is put into finding relevant scientific articles in databases such as Web of Science and Scopus, literature gaps can still occur.

The aim of this presentation is to present Litmaps [1] as a new tool for overcoming literature gaps.

A practical example of researching food safety and chromatography will be used to present the use of Litmaps. Steps to avoid literature gaps will be shown in a comprehensive way by introducing the three main functions of Litmaps: 1) “Seed map”, 2) “Discover” and 3) “Visualize”. “Seed map” shows relevant literature starting from a single article. “Discover” enables finding relevant articles based on a group of articles. “Visualize” creates maps showing how articles are connected to each other through citations, which articles were more cited and creates a timeline of the articles based on their publication date.

Through the user experience of Litmaps the possibilities to increase the effectiveness of literature searches will be shown and encourage the audience to try overcoming literature gaps in their research using Litmaps.

Disclaimer: This presentation is not affiliated with Litmaps.

**Key Words:** Litmaps, Literature Gap, Program, Novel Approach to Literature

### Literature

1. Litmaps. [www.litmaps.com](http://www.litmaps.com)

### Acknowledgements

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BF 38

## In vitro antioxidant potential and mineral content of pectin-like polysaccharides isolated from soy hull

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### Introduction

Generally, soy hull is regarded as “waste” and used for animal feeding or discarded directly causing resource wastage and environmental pressure. However, soy hull can be a good source of bioactive compounds such as pectin-like polysaccharides. These polysaccharides may play an important role in food processing as a gelling agent, thickening agent and stabilizer as well as new composite matrices for targeted and controlled delivery of nutraceutical molecules. Pectin-like polysaccharides are also associated with several human health benefits.

### Objective

This work deals with the isolation of pectin-like polysaccharides from commercial soy hulls, their antioxidant potential as well as with their macro- and microelements content.

### Methodology

Pectin-like polysaccharides were isolated from heat- treated and defatted commercial soy hulls. Hulls were extracted with hot (85°C) 0.6% solution of ammonium oxalate using microwave oven for 5min. (at 450W). Hot solution was filtered through four layer filter cloth. The pH of filtrate was adjusted to 4.5 and centrifuged. Polysaccharides were precipitated with ethanol and dried at 65°C. Antioxidant potential of initial hulls extract and isolated polysaccharides was determined using ABTS radical scavenging activity, FRAP and iron(II) chelating ability methods. Macro- and microelement contents were determined by ICP-OES and ICP-MS.

### Results

Pectin-like polysaccharides of soy hulls are characterized with high ability to chelate Fe(II) ions and high ferric reducing power. Both abilities (28.58%; 3.17 mg/g AAE) were almost two times higher than those obtained for water extract of initial hulls (14.81%; 1.58 mg/g AAE). In contrast, their ability to scavenging ABTS radicals was twice lower than those obtained for initial hull extract. In addition, isolated polysaccharides can be a good source of several elements including K, Mg and Zn.

### Conclusion

According to the results of this study, soy hulls can be a significant source of bioactive polysaccharides.

**Keywords:** *Soy hull, pectin-like polysaccharide, antioxidant properties.*



BF23

Plenary lecture 7

## Opportunities and challenges of food waste and byproduct valorization

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Climate change is already an important topic for everyone and pollution, which is directly linked with carbon dioxide emissions, is the most important factor which influences it. Among the substances produced by the most of industries and human activities, food waste is not to be ignored when talking about pollution. It is an urgent need to change our food systems.

About 30%, which amounts to about 1.3 billion tons per year of food globally produced for human consumption is estimated to be lost or wasted along the supply chain each year. This has negative economic, environmental, and social impacts.

In the current worldwide situation (e.g., wars, pandemic through COVID-19, absence of food security, economic instability, recession), it is mandatory to adopt a more sustainable and resilient approach to ensure successful future food production. The supply chain management of the future has to ensure a more nutritious food for our permanently growing population.

Globally, along the entire agri-food supply chain, enormous amounts of waste and by-products are generated, and these are not entirely recovered or recirculate through a novel purpose. It is already well documented that these byproducts and waste are still valuable because of the rich content in bioactive compounds, including phenolic compounds which demonstrated to be good antioxidants, cardio protectors, anti-inflammatory agents, and having anticancer capacities, and others. Anyway, their industrial application is not widely implemented due to challenges such as waste conditioning and preservation steps before extraction of valuable compounds or processing to be further used.

Reutilization of these compounds will permit numerous new applications as food or feed ingredients or additives, nutraceuticals, functional food, cosmeceuticals, and at the same time these approaches represent environmentally friendly measures and economic benefits through value-added products.

The aim of this paper was to identify the optimal sustainable solutions but also the current limitations to valorise in general the food waste and specifically to show some my team results from vegetal food waste used in bread and minimally processed apples.

**Keywords:** *sustainable food industry, circular economy, waste valorization, nutritionally enriched food*



BF 12B

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## One Health - a holistic approach to achieving new trends in food safety and a sustainable food system

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Nowadays, the world's food systems are unsustainable and pose a serious threat to global sustainability. The challenges for creating a sustainable food system in the twenty-first century are driven by several factors, including diet-related emerging and re-emerging infective diseases and non-communicable diseases, population growth, globalization, biodiversity degradation, resource, and energy scarcity, environmental pollution, food contamination, climate change, and overuse of antibiotics.

Contaminated food and water can cause more than 200 different diseases, ranging from acute diarrhea to chronic non-communicable diseases such as cancer. Many of these diseases result from poor hygienic conditions associated with poor quality of life and nutrition. Food-related diseases particularly affect young, old, pregnant, and immunocompromised populations, compromising not only the food safety system but also the public health system. Public health is a crucial factor for national social stability and economic development.

The trend of increasing human population, urbanization, migration, and demographic changes, followed by increased food requirements, water consumption, and increased use of agro-technical chemicals, are the main factors associated with disrupting biodiversity/ecosystems and environmental pollution. These facts worsen climate conditions leading to more frequent natural disasters and the increasing incidence of communicable and non-communicable diseases associated with malnutrition. In this context, public health issues have become more complex, requiring a comprehensive, multisectoral, and holistic approach to overcoming such threats.

The One Health concept is a joint tripartite collaborative idea from the FAO, WHO, and OIE that assumes integrated disease surveillance and monitoring aimed at a better understanding of all factors involved in disease transmission and the emergence of new pathogens, including zoonoses. This approach is also considered effective for non-communicable health risks, such as environmental contaminants and toxins that can cause substantial increases in morbidity and mortality, as well as impacts on the socioeconomic growth of affected communities.

This paper aims to highlight the One Health approach, where the health of humans, animals, and the environment is addressed collectively to achieve the goals of the Agenda for Sustainable Development 2030 set by the UN.

**Keywords:** *food safety, One health, sustainable food system*





BF32

## COMPARISON OF PHYSICO-CHEMICAL PROPERTIES OF ACID and ALKALI SOLUBLE-PEA PROTEINS and ENTRAPMENT YIELD WITH CITRUS PECTIN

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### Abstract

In recent years, the potential of pea protein (PP) as a wall material for the encapsulation purposes has been widely investigated. However, the properties of pea proteins on the market can vary considerably, especially due to differences in production methods. The complexes of soluble pea proteins with anionic polysaccharides could provide robust wall materials for anthocyanins (ATC). The aim of this study was to compare PPIs provided by different producers and characterize the best PPI in terms of physico-chemical properties and entrapment yield with citrus pectin (CP) for anthocyanins.

Five different PPIs were examined for their solubilities using the Bradford assay.: the alkali PPI having the highest solubility and acidic PPI were characterized using  $\zeta$ -potential at a pH range of 3-10. Alkali PPI-CP were complexed at different pH values (pH 3 - 3.5 - 4 - 4.5) at different ratios. Acidification was conducted using HCl and carbonic acid using CO<sub>2</sub> pressure. Acidic PPI was complexed with CP without pH adjustment.  $\zeta$ -potential of complexes were measured using a particle electrophoresis instrument. The ATC-PPI-CP complexes were formed at different wall material concentration (2% and 3%) and core to wall ratio (1 - 1.5 - 2) and freeze-dried. Global yield was measured by dividing experimental dm by theoretical dm while entrapment yield was observed by pH-differential method for anthocyanin determination.

The PPI having an isoelectric point between the pH 4 - 5 gave an alkaline pH when dissolved in water and their solubilities were between 1 - 5% (w/w). However, the PPI sample which solubilizes in acidic pH had very high solubility (96.55% at pH 3, and 98.35% at pH 10). As the complexation pH decreased, the alkali PPI-CP complexes were more stable with a  $\zeta$ -potential approximately at -30 with different PPI-CP ratios. On the other hand, acidic PPI-CP complexes formed intense coacervates depending on the PPI-CP ratio (0.5-5). The global yield of ATC-PPI-CP complexes were between 91.36-96.71% while it was 20.53-55.95% for entrapment yield.

This study demonstrated that pea proteins obtained from different companies could exhibit different properties as they are produced with different production methods and different parameters leading them to have different behavior when forming complexes with polysaccharides. Our results may have important implications in the production of novel foods during the protein selection stage considering the structure of the end-product such as solid foods, smoothies, or beverages.

**Keywords:** Pea protein isolate, Citrus pectin, Complexation,  $\zeta$ -potential.



BF 36

## THE ROLE OF PARENTAL INFLUENCE ON CHILDREN'S BRAND PREFERENCES

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### Abstract

In the dynamic landscape of today's world, the profound influence of parental guidance on children's brand preferences and the formation of dietary patterns stands as a pivotal factor in shaping the future of healthy consumption habits. Recognizing parents' significant role in shaping their children's consumer behavior, this study aims to provide a nuanced understanding of how parental influence molds children's brand preferences for food products and subsequently impacts their dietary choices.

Drawing upon a rich tapestry of research, including the seminal works of Richins (1983) on consumer behavior and Ward et al. (1977) on information processing skills, this review underscores the influence of parental guidance on children's early interactions with food brands and the subsequent development of their food-related preferences, with the pioneering work of McNeal (1992) serving as a pivotal reference in comprehending the profound impact of marketing tactics on children's food choices. In addition, and by analyzing recent literature, the review delves into the transformative effects of parental branding strategies and practices, on the cultivation of children's brand preferences for specific food products (Chen and Sharma, 2020), while also discussing psychological and sociological dimensions (John et al., 2015; Kim and Lennon, 2013) elucidating how parental attitudes and behaviors contribute to forming children's brand loyalty and dietary patterns.

Thus, the findings of this paper indicate that parental influence significantly impacts children's brand preferences, shaping their early interactions with specific food brands and contributing to the development of long-term dietary patterns. The analysis underscores the critical role of parental guidance in cultivating positive food-related attitudes and fostering healthy consumption habits from a young age, highlighting the ethical imperative for responsible marketing practices, and emphasizing the importance of transparent and health-conscious strategies that prioritize the well-being of children.

In conclusion, the paper emphasizes the necessity of a comprehensive understanding of parental influence on children's brand preferences, as well as the adoption of responsible parenting strategies and ethical marketing approaches to ensure the healthy development of children's consumer behavior.

**Keywords:** Parental guidance, Brand preferences, Dietary patterns, Responsible marketing practices, Ethical imperative, Children's consumer behavior.



BF37

## THE CHANGES OF ANTIOXIDANTS BIOAVAILABILITY DURING *IN VITRO* GASTROINTESTINAL DIGESTION OF OKARA-ENRICHED GLUTEN-FREE BREAD

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Okara-enriched gluten-free bread made from a mixture of pseudocereals (buckwheat flour, rice flour, and millet flour) and okara can be intended for people with coeliac disease and gluten intolerance<sup>1</sup>. Due to its low sugars (glucose, fructose and sucrose) and high protein and dietary fiber content, it can be also recommended for people with diabetes and insulin resistance<sup>1</sup>. Flours and okara used for its production are rich in antioxidants<sup>1</sup>, so this bread has potential to be also used as a functional food to prevent oxidative stress. To test the antioxidant potential of functional foods, the bioavailability of antioxidants during *in vitro* gastrointestinal digestion is of primary importance. Therefore, the aim of this study was to determine the changes in bioavailability of antioxidant compounds by measuring the antioxidant capacity of soluble and insoluble fractions of gluten-free bread enriched with okara during *in vitro* gastrointestinal digestion (GID). Changes in antioxidant capacity were monitored after the oral, gastric, and intestinal phases using two antioxidant assays: DPPH radical scavenging activity (DPPH) and ferric reducing power (FRP).

The DPPH radical scavenging activity of the soluble fractions was not detected during any stage of *in vitro* GID, while the insoluble fractions showed the highest DPPH radical scavenging activity after the oral phase, decreased after the gastric phase and did not change after the intestinal phase. It seems that the lipophilic character of DPPH radicals strongly influences the results obtained. The soluble fraction showed a 1.3- and 2.7- fold increase of ferric reducing power after gastric and intestinal phases of *in vitro* GID compared to the oral phase, while the FRP of the insoluble fraction decreased after the gastric phase compared to the oral phase, but reached the highest value after the intestinal phase.

Lipophilic antioxidants present in okara-enriched gluten-free bread were not bioavailable, while bioavailability of hydrophilic antioxidants increased during the oral, gastric, and intestinal phases of *in vitro* GID. Both lipophilic and hydrophilic antioxidants have the potential to become bioavailable in the colon through the action of the microbiota, but further studies are needed.

**Keywords:** *gluten-free bread, okara, bioavailability, antioxidant capacity, in vitro gastrointestinal digestion*

Literature:

<sup>1</sup> Pešić, M. B., Pešić, M. M., Bezbradica, J., Stanojević, A. B., Ivković, P., Milinčić, D. D., Demin, M., Kostić, A.Ž., Dojčinović, B., Stanojević, S. P. (2023). Okara-Enriched Gluten-Free Bread: Nutritional, Antioxidant and Sensory Properties. *Molecules*, 28(10), 4098. <https://www.mdpi.com/1420-3049/28/10/4098>.

**Acknowledgment:** This work was supported by the Ministry of Science, Technological Development and Innovation of Republic of Serbia Grant No. 451-03-47/2023-01/200116



# SHORT ORAL PRESENTATIONS



BF8

## Efficiency of green biosynthesized silver nanoparticles as antibacterial agent against *Aeromonas hydrophila* isolated from infected rainbow trout

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Bacterial infections are considered the major cause of mortality in aquaculture. Among the common fish pathogens, *Aeromonas hydrophila* is a gram negative bacterium that can grow both in aerobic and anaerobic condition and causes a variety of diseases in fish. *Aeromonas hydrophila* is primary or secondary cause of ulcers and hemorrhagic septicemia in rainbow trout.

The present research was carried out to investigate the antibacterial efficiency of alginate-capped silver nanoparticles (Alg-Ag NPs) in vitro against *Aeromonas hydrophila* using disc diffusion assay and minimum inhibitory concentration.

Alg-Ag NPs have been obtained by green-chemistry technique via reduction of silver cations with alginate macromolecules. Alg-Ag NPs were negatively-charged ( $\xi$ -potential =  $-53.8 \pm 0.7$  mV) and spherically-shaped with hydrodynamic diameter of  $44 \pm 1$  nm. Nanocomposites of Alg-Ag NPs with common antibiotic enrofloxacin (Alg-Ag@Ef) have been prepared. Alg-Ag@Ef nanoparticles had negative charge ( $\xi$ -potential =  $-48.3 \pm 3.0$  mV) and submicron hydrodynamic diameter ( $343 \pm 79$  nm).

The antibacterial activity of nanocomposites of Alg-Ag NPs with antibiotic enrofloxacin (Alg-Ag@Ef) and without antibiotic was studied by incubation at a temperature of  $37^\circ\text{C}$  for 2 hours and 24 hours, at a certain dilution factor.

The results showed high inhibitory activity of Alg-Ag@Ef nanocomposite against *A. hydrophila*. Log reduction of bacterial cells was more than 6log. The reduction coefficient of *A. hydrophila* cells under the influence of the Alg-Ag NPs without antibiotic did not exceed 1.3 log. In control treatments with pure antibiotics, the reduction rate of *A. hydrophila* cells was no more than 4 log.

Thus, Ag NPs protected by an alginate shell and modified with a certain concentration of enrofloxacin has a synergistic effect against highly virulent pathogenic strains of *A. hydrophila*. It is important to note that the antagonistic effect was not observed.

As a conclusion of the study, these biologically synthesized nanoparticles were found to be highly effective against *A. hydrophila* infected of rainbow trout.

This result may have an advantage in encouraging the use of combined Ag NPs with conventional antibiotics in treating infectious diseases of rainbow trout caused by antibiotic-resistant bacteria.

**Keywords:** nanoparticles, *Aeromonas hydrophila*, rainbow trout



BF39

## DEVELOPMENT OF A NEW PROTEIN-VEGETABLE “SNACK” PRODUCT, NUTRITIONALLY BALANCED

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### Abstract

The product is in line with the current consumer requirements for increasing the availability on the local market of healthy, minimally processed, protein enhanced and, last but not least, nutritionally balanced. The main objective of the research is to develop, obtain and test a salty snack product, with a high content of vegetable proteins. The novelty of the product is mainly derived from the composition of the product which consists of a mixture of whole vegetables and seeds, minimizing waste. This mixture will be determined based on the ingredient composition, in order to obtain nutritionally balanced product. The optimization of the product development technologies are another criteria of the novelty of the product, which contributes to the development of the circular economy. The resulting product will be analyzed from a sensory point of view and at the same time, using a conjoint analysis, which will determine the purchase decision of consumers based on composition, processing technology, nutritional properties and last but not least based on the cost of the end product.

**Keywords:** *innovative product, vegetable protein, minimal processing, health, consumer*

### Acknowledgments

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BF40

## Study of the Temperature Effect on the Growth of *E. coli* in Cheese

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### Introduction

*E. coli* is the most common bacteria isolated from food and the cause of diseases transmitted by contaminated food. In addition, it holds a pivotal role in maintaining human intestinal microflora, which is essential for digestive health. Temperature is an essential external factor influencing microbial growth affecting their activity and reproductive rates, rendering it an indispensable tool for microbial control.

### Objective

This study aimed to assess how low temperatures affect *E. coli* growth in cheese from Montenegrin markets, exploring contamination sources in cheese production and measures for minimizing risks to food safety and public health.

### Methodology

This thesis combines theory and practical research through laboratory experiments. It involved collecting cheese samples from various sources, focusing on domestically produced cheese. Microbiological analysis were used to identify and quantify *E. coli* in the samples. Growth kinetics were monitored in cheeses stored at 4°C and -18°C.

### Results

The results of this research showed that *E. coli* can persist in low-temperature conditions in both young and old cheeses. The principal factors that affect this bacterial species' ability to grow and reproduce are temperature, pH, water activity, and sodium-chloride concentration. The outcomes also demonstrated that cheese is a high-risk product that may have an impact on people's health.

### Conclusion

These results reveal that *E. coli* can persist and proliferate in cheeses stored at 4°C and -18°C for up to a month and a half, although lower temperatures reduce bacterial growth. The risk of foodborne illness depends on pH, salt levels, and storage temperature. *E. coli* deactivation in cheese is gradual, especially in young cheeses, highlighting the significance of initial contamination as an indicator of hygiene in the entire production process, from farm to finished product.

**Keywords:** *E. coli*, cheese, temperature, growth kinetics, infection, pH, water activity



BF42

## Evaluating Dietary Salt Intake Patterns in the Montenegrin Adult Population

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Salt, pivotal in human culture, has spurred wars, signified wealth, warded off spirits, and symbolized fertility. These roles, coupled with evolving eating habits, have led to high salt consumption, influencing health outcomes. Urgent, unified action is needed to address the global and local (Montenegro) deaths from cardiovascular diseases and hypertension, closely tied to excessive salt intake.

### Objective

The study aimed to define the average values of daily salt intake of the adult population in Montenegro, to determine the deviation from the values of daily salt intake recommended by the WHO<sup>1</sup>, and to explain and establish the perception, knowledge and behaviour of Montenegrin adult population concerning excessive salt intake.

### Methodology

The results are based on in-depth research, analysis, and processing of data from the **Montenegrin National Dietary Survey (MNDS)**<sup>2</sup> and the general population and the **Questionnaire on Perception, Knowledge, and Behaviour About Salt Intake in Montenegro**.

### Results

The study determined that the adult population in Montenegro consumes an average of **12.70** grams of salt per day. On the other hand, the Questionnaire found that **84.44%** of the Montenegrin adult population knows that excessive salt intake can endanger their health and that the most significant percentage of respondents believe that they consume between 5 and 10 grams of salt per day.

Study reveals **Montenegrin adults consume an average of 12.70 g/day** of salt, **61% above WHO's recommendation (5g/day)**<sup>3</sup>. Men average 12.95 g; women, 11.45 g. Surprisingly, **84.44% are aware of salt's health risks**, and 46.22% know WHO's guidelines. However, a perceptual gap exists: **37% think their average daily salt intake is under 5 g/day**, but data contradicts this. This disconnect underscores the pressing need for improved public education regarding the health risks of excessive salt intake.

**Keywords:** *salt intake; eating habits; public health; Montenegro; adults.*

<sup>1</sup> World Health Organization

<sup>2</sup> University of Donja Gorica, et al., 2022. National Dietary Survey on Adolescent, Adults, Elderly and Pregnant Women in Montenegro. *EFSA Supporting Publications*, 19(2), available at: <https://efsa.onlinelibrary.wiley.com/doi/epdf/10.2903/sp.efsa.2022.EN-7196>

<sup>3</sup> WHO & FAO, 2003. Diet, nutrition, and the prevention of chronic diseases. Report of a Joint WHO/FAO Expert, Geneva: World Health Organization (WHO Technical Report Series, No. 916).





BF41

## Microbiome Analysis of Selected Montenegrin White Brine Cheeses

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### Introduction

Cheese is a symbol of Montenegrin culture, deeply rooted in tradition. Local producers, committed to preserving heritage, craft distinct cheeses shaped by the region's natural conditions. Among these, **white brine cheeses** stand out, made using traditional methods with raw milk and rennet, allowing natural microflora to shape its unique characteristics.

### Objective

The study aimed to thoroughly study the microbiome of white brine cheeses, identifying microorganisms and their roles in production. It seeks to improve understanding of cheese composition, explore indigenous strain use in industrial production, and identify promising candidates for application.

### Methodology

A total number of 15 cheese samples were collected from various Montenegrin regions. The analysis performed included chemical analysis for quality parameters, **MALDI-TOF**, and **WGS DNA sequencing**.

### Results

The results of the chemical analyses, that is, the quality parameters for the tested cheeses, were of satisfactory quality in relation to the type and name of the cheese under which it was marketed. Results obtained with MALDI-TOF and WGS showed there is a **great microbial diversity** among the analyzed cheese samples, with numerous species from **17 genera**. Among them, **lactic acid bacteria** are certainly the most important, whose representatives were the most represented, as expected.

### Conclusion

The research revealed a diverse bacterial community in Montenegrin white brine cheeses, with a prominent presence of LAB, essential for production. Isolating strains from different regions for further research could provide valuable insights. However, the detection of pathogenic bacteria, among which are some of the main causes of food-borne diseases, underscores the importance of improving production conditions and food safety measures.

**Keywords:** *microbiome; white brine cheese; lactic acid bacteria; MALDI-TOF MS; whole genome sequencing*



BF43

## Assessing the Quality and Authenticity of Montenegrin Olive Oil

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### Introduction

**Olive oil** is a symbol of the Mediterranean diet. For Montenegrin olive oil to be competitive in the domestic and global markets, the primary goal of the olive growing sector should not be quantity but quality. Yet, its quality remains under-analyzed with limited information available.

### Objective

The study aimed to assess the quality and authenticity of Montenegrin olive oils, determining if they align with European olive oil standards.

### Methodology

A total number of 15 olive oil samples were collected from various Montenegrin regions. Official methods were employed to evaluate quality metrics including **free fatty acid content (FFA)**, **peroxide value (PV)**, **UV light absorption** and **fatty acids composition** in Montenegrin olive oil.

### Results

Notable differences were found between the samples in the characteristics of acidity and peroxide value. The FFA were between 0,14 and 8,25% oleic acid, while PV ranged from 2,0 to 33,0 mEq/kg. Regarding the UV absorption coefficient, obtained values for  $K_{232}$  and  $K_{270}$  ranged from 1,63 to 4,22 and from 0,08 to 1,27, respectively, while only two obtained values of  $\Delta K$  were below the established limit ( $\Delta K \leq 0,01$ ). Monounsaturated fatty acids, primarily oleic acid, ranged from 50,33 to 82,50% and palmitoleic acid from 0,31 to 1,41%, while the range of polyunsaturated linoleic acid levels in samples was from 4,70 to 35,16%.

### Conclusion

The results of the analyses showed that Montenegro's olive oils often don't meet EU and local regulations. Many are mislabeled with higher quality categories than warranted. Oxidation is commonly found due to poor storage conditions. Many producers use inadequate packaging like transparent plastic, violating the Law on Olive Growing and Olive Oil<sup>1</sup> which mandates glass or metal packaging. This leads to quality degradation due to light, temperature, and oxygen exposure. Even high-quality oils can be downgraded if stored improperly. Additionally, mislabeling with non-regulated categories can misinform consumers.



BF44

## Rosehip (*Rosa canina* L.): A Phytochemical and Bioactive Ingredient Analysis for Functional Food Applications

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**Introduction:** The food industry increasingly utilizes plant extracts over synthetic antioxidants for preventing lipid oxidation, fighting foodborne pathogens, and prolonging shelf life of various products. The bioactive potential varies among plant species. Traditionally, extracts from rosehip fruits (*Rosa canina* L.) have preventive and curative effects on diabetes, memory disorders and cancer. In addition, these extracts are often used as antimicrobial, antinociceptive and anti-inflammatory agents.

**Objective:** The aim of this work was to investigate phytochemical composition and biological potential of aqueous extracts from the fruits of *R. canina*.

**Methodology:** The lyophilized aqueous extract was analyzed using Agilent 1290 Infinity ultra-high performance liquid chromatography (UHPLC) system in conjunction with quadrupole time-of-flight mass spectrometry. The extracts were analyzed for total polyphenol and flavonoid content (TPC and TFC, respectively) using spectrophotometric methods. The biological activities of aqueous extracts were evaluated under *in vitro* conditions. The Ferric reducing antioxidant power (FRAP) and DPPH radical scavenging assay were used to investigate antioxidant potential. Antimicrobial activity was determined using microdilution assay and crystal violet and MTT tests were used for evaluation of antibiofilm activity.

**Results and conclusions:** *R. canina* fruit's aqueous extract had 32 phenolic compounds, which were classified into eight classes. Qualitative phytochemical analyses showed that this extract contained flavan-3-ols and procyanidins, dominated by epicatechin (624.354 mg/100g) and a proanthocyanidin dimer hexoside type B (457.016 mg/100g). Furthermore, extract was high in total phenolic content (412.25 TE mg/g) but low in total flavonoid compounds (0.73 QE mg/g). The highest antioxidant capacity was measured by FRAP assay (103.29 AAE mg/g), whereas notable antimicrobial properties were determined as well, with a standout 67.68% antibiofilm activity against *Candida* spp. at 0.5 MIC. These findings highlight potential of *R. canina* as a dietary source of antioxidants and antimicrobial agents.

**Key words:** *Rosa canina*, aqueous extract, phytochemical composition; *in vitro* biological activity

**Acknowledgment:** This work has been supported by the Serbian Ministry of Science, Technological Development and Innovation (Grants: 451-03-47/2023-01/ 200007 and Strategic projects of scientific and technological cooperation between Republic of Serbia and People's Republic of China).



BF45

## Matrix effect in determination of pesticide in cereal products with gas chromatography

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### Introduction

Pesticides is commonly used for plant protection products and the upper levels of residues are establishes in Regulation (EC) No 396/2005.

### Objective

According the SANTE 11312/2021 document If the responses differ significantly, residues must be quantified using individual calibration standards in matrix [1]. In this research a study of the matrix effect was performed for pesticides in cereal products in order to establish a method for routine analysis of pesticides in cereal products.

### Results

A study of the matrix effect was performed for pesticides in cereal products, using a multiresidue method with gas chromatography (GC) with a FTD detection, with a previous cleanup step according to the SPE- QuEChERS method. Pesticides from cereal products are extracted with organic solvents acetonitrile, following by clean-up step with PSA (primary-secondary amine) for removal of sugars and C18 for removal of lipids and non-polar components. Spiked samples were prepared using a 10 µg/mL mixture of 16 pesticides: Metacrifos, Ethprophos, Phorate, Terbufos, Diazinone, Parathion methyl, Fenitrothion, Pirimfos methyl, Malathion, Fenthion, Parathion, Fenamifos, Buprofezin, Ethion, Phosmet, Phosalone. The comparison study of the area peak for each calibration level was performed for calibration with external standards and matrix-match calibration. RSD (%) was between 22% for Buprofezin as the lowest to 61% for Terbufos as the highest value.

### Conclusion

Statistical evaluation of the results showed that matrix remained after cleanup procedure. Extracts of blank matrix, preferably of the same type as the sample, should be used for calibration.

**Keywords:** *pesticides, matrix effect, cereal*

### References:

[1] Analytical quality control and method validation procedures for pesticide residues analysis in food and feed, SANTE 11312/2021



BF46

## Accessing the bioactivity of extracts obtained from 22 different by-products of the agri-food industry

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By-products from food industries are valuable sources of secondary metabolites with diverse biological activities. These bioactive compounds have gained attention for potential use in the food and pharmaceutical sectors [1]. In this context, 22 different by-products from olive, grape, and almond processing were provided by ISANATUR (Navarra, Spain), a company specialized in extracting and valorizing by-products. Besides the industry by-products, the evaluated samples also included the residues obtained after the application of supercritical fluid extraction. **Methodology:** Initially, the samples were macerated in an 80:20 methanolic solution, evaporated, and freeze-dried. The obtained extracts underwent testing regarding their antioxidant activity (by the thiobarbituric acid reactive species (TBARS) assay and cellular antioxidant assay (CAA), antimicrobial activity, and cytotoxic potential.

**Results:** Among the 22 by-products and SFE residues evaluated, 11 extracts showed promising antioxidant activity as in the TBARS assay they exhibited EC<sub>50</sub> values below 100 µg/mL (ranging from 5.6 to 88 µg/mL). Notably, 8 of these extracts were derived from olive processing, 1 from grape by-products, and 1 from almond processing. In the CAA, 3 extracts sourced from almond processing and 1 from olive processing showed the best results, ranging from 37% to 58% inhibition. In the antimicrobial assay, extracts from olive processing by-products stood out against gram-positive bacteria, including *Yersinia enterocolitica* and *Staphylococcus aureus*. Among the 11 extracts with significant antioxidant activity, only 6 inhibited the growth of *Aspergillus brasiliensis* and *Aspergillus fumigatus*. The MIC corresponded to the highest concentration assayed (10 mg/mL) tested. None of the extracts showed toxicity against the non-tumoral cells tested (PLP2). However, 1 extract from olives and 1 from grapes effectively inhibited the growth of four different tumor cell lines. **Conclusion:** These findings highlight the potential of by-product extracts as antioxidants, antimicrobial, and cytotoxic agents.

**Keywords:** *By-products, Bioactive potential, Circular economy, Functional ingredients*

[1] I. Chiocchio, M. Mandrone, M. Tacchini, A. Guerrini, and F. Poli, "Phytochemical Profile and In Vitro Bioactivities of Plant-Based By-Products in View of a Potential Reuse and Valorization," *Plants*, vol. 12, no. 4, Art. no. 4, Jan. 2023, doi: 10.3390/plants12040795.

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BF47

## EDIBLE AND BIOACTIVE MUSHROOM *AGROCYBE AEGERITA* (V. BRIG.) VIZZINI: A VALUABLE RESOURCE FOR THE NEXT GENERATION OF PHARMACEUTICAL PRODUCTS

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**Introduction:** Recent research demonstrated that inadequate lifestyle choices put people at risk of developing numerous diseases, some of which have been proven to be life-threatening, or they need a life-long management with medicines. Somewhere in between, the concept of using food ingredients to achieve optimal health was reevaluated. Mushrooms emerged as a valuable source of macronutrients, but also as a source of bioactive compounds with multiple applications in pharmaceutical industry. Herein, the skin protective potential of *Agrocybe aegerita* (synonym *Cyclocybe aegerita*) aqueous extract is presented.

**Objective:** The main objective was to evaluate antibacterial, antiinflammatory, and wound-healing properties of *C. aegerita* aqueous extract.

**Methodology:** To assess antibacterial activity, a modified microdilution method was used, whereas antiinflammatory activity was determined using human IL-6 ELISA Kit. Scratch wound healing assay was used to estimate the ability of the extract to stimulate cell migration, a critical step in the process closure of the wound.

**Results:** Results of antibacterial activity indicated that the growth of *Staphylococcus aureus*, skin infections causing agent, was inhibited with MIC value 4.00 mgmL<sup>-1</sup> and MBC value 8.00 mgmL<sup>-1</sup>. Wound healing assay indicated that *C. aegerita* extract actively promoted wound closure in the HaCaT cell model in a time frame of 24 h. Results of anti-inflammatory activity undoubtedly showed that production of IL-6 levels was significantly decreased when HaCaT cells were treated with *S. aureus* as inflammation-inducing agent, and then were co-treated with *C. aegerita* aqueous extract (IL-6 level was 4.56 pg/mL).

**Conclusion:** Obtained results indicate that *C. aegerita* aqueous extract has several bioactive properties potentially useful in various sectors of pharmaceutical and cosmeceutical industries. Carefully developed skin preparations with mushroom extract may reduce skin inflammation, decrease the incidence of staph infections and promote restoration of the skin's barrier function.

**Keywords:** *Cyclocybe aegerita*, aqueous extract, antibacterial, antiinflammatory and wound healing activity



BF48

## HMF LEVEL AND DIASTASE NUMBER OF SOME ALBANIAN HONEY SAMPLES

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### Abstract

Many nations have researched the characteristics of their honeys in scientific papers, where they have demonstrated to have many beneficial effects in a range of disciplines; nevertheless, we have especially decided to study their effects on wounds. Our present study's goal is to look into the physicochemical characteristics of some specific mono-floral honey samples that were gathered in various beekeeping locations of Albania. During the harvest in August–September 2022, 12 samples of honey were obtained directly from the beekeepers, all of whom were members of associations. Finding out some physicochemical characteristics of honey related to the concentration and activity of diastase (HMF) was the first step. For the measurement of pH, refractive index, ash, free acidity, water content, electrical conductivity, diastase activity, and HMF, procedures approved by the International Honey Commission were used. According to the results, HMF contents were approximately 88,5 mg/kg. Also appearing to be associated with HMF values are the diastase activity measurements. The freshness of the honey that we will use for our trials on the wounds depends mostly on both of these factors. The concentrations of HMF and diastase activity were significantly correlated pH, ash, free acidity, water content, electrical conductivity. The honey samples' physicochemical parameter levels demonstrated relatively good quality for the samples to be used in the future for our research on wound healing assays.

**Key words:** *physicochemical properties, HMF, Diastase activity, Albania.*



BF49

## The effect of biopriming of pea seeds (*Pisum sativum* L.) with extracts of *Schizophyllum commune* Fr. 1815 on the antioxidant activity of the plant under stress conditions (drought)

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Biopriming (BP) of seeds ensures increased resistance of seeds and young plants to stress, by integrating beneficial microorganisms and their products. In addition, research on filamentous fungi revealed their enormous potential in biotechnological processes and demonstrated their ability to increase plant resistance to stressful conditions.

### Aim:

The aim was to examine the influence of BP of pea seeds with polysaccharides (PSH) isolated from submerged cultures of *Schizophyllum commune* originating from Serbia (SRB) and Italy (IT), on the antioxidant activity of the plant under drought.

### Methodology:

The antioxidant activity of the methanolic extracts of the aerial parts, after the BP of the seeds with fungi exopolysaccharides (EPSH) and intrapolysaccharides (IPSH), was tested using the DPPH, ABTS and FRAP test. The content of total phenols and flavonoids was also determined.

### Results

Neutralization of ABTS radical was 1.5 times higher after treatment with IPSH SRB ( $36.99 \pm 2.69$  mg eq. T/g. d.m.) compared to control ( $24.47 \pm 3.63$  mg eq. T/y. d.m.), while the neutralization of DPPH radical was 2.2 times stronger after BP with EPSH SRB ( $IC_{50} = 69.81 \pm 6.70$   $\mu$ g/mL) than the control ( $IC_{50} = 155.28 \pm 0.81$   $\mu$ g/ mL). The strongest reduction potential was shown by pea extracts after BP with IPSH SRB ( $25.96 \pm 0.23$  mg eq. AA/g d.m.) and ITA ( $23.06 \pm 1.12$  mg eq. AA/ g d.m.). IPSH SRB also influenced the increase in phenols in AP ( $28.56 \pm 1.22$  mg eq. GA/g d.m.) compared to the control ( $18.82 \pm 0.68$  mg eq. GA/g d.m.), while the highest content of flavonoids was recorded after treatment with IPSH ITA ( $2.09 \pm 0.34$  mg eq. K/g d.m.).

### Conclusion

BP with PSH from *S. commune* improved the drought tolerance of pea, while the SRB strain showed a stronger effect, indicating their enormous potential as antioxidants.

**Keywords:** *S. commune* Fr., *Pisum sativum* L., biopriming, antioxidant activity

**Acknowledgments** This study was funded by the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia (Grant No. 451-03-68/2022-14/200125).

**End of short oral presentation**







**03**rd **BLACK SEA ASSOCIATION  
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13<sup>th</sup> - 14<sup>th</sup> December  
Hotel Mona Plaza  
Belgrade, Serbia

**ABSTRACT BOOK**  
**Plenary Lectures**

# **PLENARY LECTURES**



BF 67

Plenary lecture 8

## HYGIENIC ENGINEERING AND DESIGN APPLIED IN FOOD FACTORIES

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### Abstract

Food producing companies are the most important link in the food production chain. Having in mind that food safety is legal obligation in almost all countries worldwide, their manufacturing sites and construction should switch from industrial engineering and design (creation and development of concepts and specification that are optimizing production, value and appearance of products) to hygienic engineering and design, which is providing effective and efficient cleaning of all assets that are used in the food production. The aim of this presentation is to show what the key hygienic design principles for food factories are.

The most important organization dealing with hygienic design worldwide is European Hygienic Engineering and Design Group (EHEDG). There are 10 Working Groups dealing with various hygienic engineering and design issues, and one of them is Factory Design including design of utility systems, in which one of the subgroups is Building design. This subgroup produced document titled: Hygienic design principles for food factories, which can serve as a guideline for food manufacturing buildings, but it is also applicable to food service buildings. This document discuss in details: Site (location, plan, boundary fences and walls, and its access); Hygienic building design (buildings and adequate space for cleaning, inspection and pest control; internal divisions (segregation, zoning hazard analysis, hygienic design criteria for zones, zone barriers, storage and personnel areas, cleaning facilities, equipment and chemicals, and food washing facilities); Building fabric (foundations, superstructures, roofs, floors, drains, coving, kerbs, posts and barriers, walls, transport docks, doors, windows, ceilings, food contact surfaces, etc.); and Services and utilities (electrical installations, ventilation and temperature control, process and transport air, lighting, water and food and solid waste).

It has to be noted that this document does not consider any international or national building standards or safety standards (e.g. fire). However, it is a best document that can be found when considering building and/or reconstruction of food factory which can eliminate any potential unhygienic features related to hazard harborage and the reduction of cleaning efficacy. Following the advice in this document should, therefore, ensure that the building will be designed to the minimum hygienic building design standards that are applicable worldwide.

**Key words:** *Hygienic engineering and design, Food factories, Building Design.*



BF64

Plenary Lecture 9

## CONTROVERSIES IN THE USE OF FOOD SUPPLEMENTS

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Major reasons for using supplements are nutrient deficiency prevention and potential health promoting or even therapeutic effects. In nutrient deficiency prevention the main advantages of food supplements are simple usage; potential precision nutritive effects; low energy and nutritive density. At the same time disadvantages are the risk of micronutrient sufficit; the potential for food-drug interactions; replacement for balanced and varied diet.

Potential problems with the use of food supplements also are in the area of regulation and quality control, lack of efficacy evidence and usage of misleading claims, contamination and purity or non-standardized quality, lack of data on long-term effects.

Although this food category belongs to the self-care health products, the advice of a health worker is highly recommended as well as individualized approach to each consumer.

**Keywords:** *food supplements, health promoting, therapeutic effects, controversies*



BF17

Plenary lecture 10

## Challenges in Analyses of Phytonutrients in Food Samples

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Phytonutrients are a large group of compounds with different chemical structures and bioactivities (antioxidant activity, enhancement of immune response or cell-to-cell communication, lowering blood pressure and/or cholesterol level, etc.). Due to this diversity many daily consumed phytonutrients are still unknown. Even though many phytonutrients have not been properly investigated, several phytonutrients are used as ingredients of food supplements or functional foods. An increase in the use of phytonutrients created the demand for new sources of these compounds.

The lecture will focus on targeted and non-targeted analyses of phytonutrients in food samples using chromatographic and hyphenated techniques.

Methods based on high-performance thin-layer chromatography (HPTLC-densitometry, HPTLC-image analysis, HPTLC-MS/(MS) and high-performance liquid chromatography (HPLC-UV/Vis, (U) HPLC-MS/(MS)) for targeted and non-targeted analyses of phytonutrients in food samples (e.g., food supplements, plant materials, bee pollen) will be discussed.

Issues related to stability of the analytes, lack of chromophores, isomeric structures, lack of commercial standards and standard reference materials and unknown impurities in standards were shown to be the main problem in development of chromatographic methods for analyses of phytonutrients in food samples.

On the path of discovery of new sources of phytonutrients, development of new food products as well as quality and safety control, methods based on chromatographic techniques are indispensable. Methods based on complementary chromatographic techniques provide important information during the method development process.

**Key Words:** *Phytonutrients, Food, Food supplements, Bee products, Chromatography*

### Acknowledgements

This study was supported by the Slovenian Research and Innovation Agency (ARIS; research core funding No. P1-0005 and the bilateral project BI-TR/20-23-004) and the Scientific and Technological Research Council of Türkiye (TÜBİTAK; project No: 119N569).



BF16

## Non-thermal technologies beyond food safety: role in fermented food and waste valorization

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Interaction of non-thermal emerging technologies with microorganisms in food is not limited to inactivation of pathogens and spoilage. Cold plasma and pulsed electric field treatments induce stress responses in microorganisms subjected to different treatment conditions with outcomes from growth retardation to stimulation depending also on the chemical composition and presence of specific compounds in the treated matrix.

Beneficial microorganisms present in functional food, complex microbial communities of raw food, or microbiota of food wastes used as substrates for fermentation could be modulated by these techniques. Additionally, the response of treated microorganisms to other stressors could be significantly altered. Sub-lethal non-thermal treatments of lactic acid bacteria for biorefinery processes will be discussed in detail for different treatment setups. Applications in open fermentation, extraction of microbial proteins, production of postbiotics, or intensification of processes are fields where sub-lethal pulsed electric field and cold plasma treatments are important, with innovation potential. Knowledge of microbial responses to sub-lethal treatments is limited, but their impact will be wide and significant in the coming era of low-energy processing with sustainability and green technologies at its core.

**Keywords:** *Non-thermal technologies, food safety, food and waste*



BF50

## The influence of thermal treatments on the quality of baby food

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Human milk is the best source of nutrition for infants and babies. Apart from essential nutrients, it contains bioactive components which are crucial for growth and effective in developing the gut microbiota and immune system. The World Health Organization recommends the use of human milk in the nutrition of preterm and low birth weight infants. Preterm infants require specific nutrition to overcome growth deficits and prevent postnatal growth failure. To ensure that preterm babies receive adequate amounts of nutrients and healthy doses of bioactive components, human milk banks collect mothers' own or donor human milk when their mothers are unable to provide enough breast milk. Milk stored in banks should be thermally treated to ensure that it is safe for consumption. Common thermal treatments include freeze storage and pasteurization, which may alter the nutritional value of milk. This study aimed to compare the effects of thermal treatments on the nutrient and antioxidant potential of different infant foods. Storage and pasteurization processes alter the basic nutritional composition and antioxidant capacity of human milk. Lipid and protein properties of human milk are affected by storage and pasteurization. Lipid content is further reduced when milk is pasteurized after freezing. Although freezing followed by pasteurization is common in milk banks, it negatively impacts the quality of milk. However, deficiencies in preterm milk after storage and pasteurization can be compensated by a fortifier. To provide adequate nutrition for infants, individual milk supplementation with quality fortifiers should be used in milk banks, ensuring higher protein, lipid and antioxidant components that are required for normal infant development.

**Keywords:** *human milk, infant food, pasteurization, freezing*



BF29

Plenary lecture 11

## SPRAY DRYING IN FOOD TECHNOLOGY: APPLICATIONS, INNOVATIONS AND QUALITY CONTROL

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### Abstract

Food preservation is one of the main concerns of modern food technology. In order to preserve high quality food, the reduction or elimination of microbial and enzymatic activity is one of the main tasks of the various preservation strategies. The protection and long storage stability of food ingredients such as flavorings, colorants, vegetable oils, probiotics, and minerals is also considered an important goal of food preservation processes. Drying of products is one of the most commonly used methods to reduce water content and maintain food quality.

In this context, spray drying is considered an efficient method for rapid water evaporation and production of large quantities of fine powders suitable for use as food ingredients. In addition to water evaporation, spray drying is also used in encapsulation processes where additional materials i.e. carriers are added to protect the active ingredients during drying at high temperatures. Because spray drying is a dynamic process that operates with large volumes of materials, an assessment of potential risks and health hazards must be made, especially when potentially harmful materials are being dried. Energy efficiency is another factor that must be evaluated to achieve economically and environmentally sustainable production based on spray drying.

Modern spray drying processes require constant monitoring of product quality and optimization of process parameters. Therefore, the food industry and the scientific community have introduced numerous quality assessment procedures and analytical techniques for quality control of spray-dried products.

**Acknowledgment:** This work was supported by Ministry of Science, Technological Development, and Innovation of the Republic of Serbia (Contract number 451-03-47/2023-01/200116).

**Key words:** *spray drying, food technology: applications, innovations*





BF51

Plenary lecture12

## Beyond the Plate: The Interplay between Antimicrobial Resistance Emergence and the Safety of Our Food

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The discovery of antibiotics marked a pivotal moment in human history, revolutionizing healthcare and saving countless lives. Today, antibiotics are produced on a massive scale across the globe, with most of them originating during the “golden era of antibiotics” from the 1930s to the 1960s. As a result, infectious diseases have ceased to be the leading cause of human mortality, and antibiotics have found extensive use in agricultural production. However, a concerning trend has emerged as bacteria continuously develop resistance to these life-saving drugs.

Antibiotics have played a crucial role in shaping the health and well-being of people worldwide. In response, bacteria have been steadily developing mechanisms of antimicrobial resistance (AMR), presenting humanity with a new and formidable challenge. The interconnected nature of our global food production system has made it a reservoir for antibiotic-resistant bacteria. Evidence now confirms the rapid spread of residual antibiotics in food products, contributing to over 48 million people suffering from foodborne diseases annually. Food animals and plant-derived raw materials used in food production and processing are primary sources of antibiotic resistance genes (ARGs), conferring resistance to nine major antibiotic classes.

Addressing this issue requires multidisciplinary and collaborative efforts to suppress the spread of antimicrobial resistance while safeguarding antibiotics for the protection of human and animal health. Antimicrobials are vital for human and animal health, food safety, and trade. However, a global consensus on responsible use across sectors should be a top priority. Only through collective action can we establish more efficient mechanisms for controlling antimicrobials. Achieving these goals demands interdisciplinary approaches, education, research, improved disease prevention, and the development of innovative therapies and strategies.

**Keywords:** *Antimicrobial Resistance, Emergence, Safety Food*



BF 52

Plenary Lecture 13

## Effect of hop particle size on haze formation and sensory properties of the New England IPA beer

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### Abstract

The craft beer movement started in America during the eighties of the last century and has spread around the globe, bringing a broad spectrum of beer styles, aromas and colours. New England India Pale Ale (NEIPA) is a modern craft beer style from 2003. It is trendy among beer lovers. The main characteristics of the style are bright colour, haziness, and citrus notes and aromas. Haze in beer has long been considered a problem. Therefore, it was thoroughly investigated to avoid or remove its formation from beer. The source of beer haze can be biological or nonbiological. Nonbiological most often occurs due to chemical reactions between haze-active proteins and polyphenols. Chemical bonds between HA proteins and polyphenols can be weak, i.e. hydrogen bonds or strong, i.e. covalent bonds. The HA proteins are mainly from malt, reaching proline and glutamine, while polyphenols originate from hops and malt chaff.

Nevertheless, for NEIPA, beer haze is an essential and positive sensory attribute. Beer is rich in HA proteins but not that much in polyphenols, so the formation of larger protein-polyphenol complexes is limited. These large complexes may create haze. This article presents current knowledge on haze development mechanisms in beer, dry hop's impact on sensory attributes of NEIPA beer, and haze formation. The research investigated the effect of different sizes of hops particle sizes on haze and sensor attributes of NEIPA. Different sizes of hop particles were obtained by shredding. No statistically significant differences were found in turbidity. In the sensory analysis, there was a statistically significant difference in a sample obtained by using hop particle sizes smaller than 1.5 mm and larger than 1 mm, and that in the JAR scale for the expressiveness of taste and citrus aroma, and the hedonic scale there is a statistically significant difference for same sample for smell liking. The JAR scale values are too close to the central "just right" cutoff to conclude a substantial difference.

**Keywords:** *beer, NEIPA, dry hop, haze, hops, particle size, sensor attributes*



BF25

Plenary lecture 14

## EDIBLE INSECTS: TENDENCY OR NECESSITY FOR THE FOOD INDUSTRY?

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### Abstract

Eating insects has been a widespread habit in many cultures for many years. Edible insects represent an innovative food source with many advantages that will help the problem of protein and energy shortages created by the rapid growth of the world population. Using insects as food can increase the economy and help protect the environment and the human survival. The aim of this research was to prepare edible insect flours and use them as potential raw materials for preparing functional food due to high protein content and bioactive compounds contained.

Their nutritional value is excellent, since according to many studies insects have high protein content, high concentrations of various essential amino acids, a well-balanced fatty acid profile, with a high content of monounsaturated, polyunsaturated fatty acids and many minerals, trace elements, and vitamins. However, there are several risks in the use of edible insects (contaminants like: allergens, heavy metals, toxins, microbes), which need to be researched more extensively. Main goals of this research are to spread knowledge and change the process of obtaining edible insects in better and safer ways.

The edible insect food industry can develop on a solid basis, through the expansion of the composition of the insects already used and the future legalization of new species of edible insects as well as the establishment of additional legislative frameworks for the breeding, development, processing, storage, and safety of these innovative new foods.

**Key words:** *edible insects; contaminants; novel raw materials; functional foods; protein; bioactive compounds*



BF53

Plenary Lecture 16

## Food safety in the age of microplastics and nanoplastics: toxicity and microbial interactions in hazard assessment

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Microplastics (MPs) contaminate aquatic and terrestrial ecosystems worldwide and enter food, water and various other commodities. The ingestion of MPs, detected in food and water, is considered the main route of human exposure to MPs. Although exposure to MPs, as well as to nanoplastics (NPs), as such is not questionable, the quantitative exposure assessment is missing. Furthermore, hazards assessment is still premature. In this study we aimed to assess the microbiological and toxicological interactions of MPs, NPs and their carried cargo using state-of-the art methods and techniques, such as Oxford nanopore whole genome sequencing, Illumina shotgun metagenomics, Agilent Seahorse XFe96 analyzer and Sartorius SX5 live cell imaging.

In our study of microbiological interactions data have shown that MPs can form abiotic support that allows microbial attachment, adhesion, and biofilm formation. During the offshore incubation campaigns in violent North Sea, in water channels close to intensive agricultural and aquaculture areas, and in port waters, not only was microbial colonization detected, but shotgun metagenome sequencing indicated presence of potentially pathogenic species and presence of antimicrobial resistance genes in the microbiome of MPs. The diversity and distribution of the observed microbiome was influenced by season variation, geographical location and factors such as water temperature, salinity gradient, and ecosystem activity. However, the natural microbiome was not the only concern when it comes to MPs. We confirmed attachment and biofilm formation by foodborne and clinical isolates of *Campylobacter jejuni*, *Listeria monocytogenes* and *Staphylococcus aureus* which were strain-specific. This characteristic contributes to the persistence and transmission of these pathogens. Investigations of modulated virulence and toxin production using transcriptomic (based on RT-PCR and RNAseq), ELISA and *in vitro* infectivity studies did not provide conclusive results, but minor changes observed were also strain-specific. Nonetheless, we obtained definitive data on possible attachment of cyanobacterial microcystins on selected MPs and of staphylococcal enterotoxins. The limited and inconclusive results the effects of MPs on microbial virulence and evolution, combined with the evidence of microbial toxins attachment to MPs emphasize the need for further extensive research on MP-microbiome interactions.

Toxicological studies of selected NPs, both with and without microcystin LR, aflatoxin B1 and fumonisins, showed a clear and dose-dependent effect on mitochondrial health and bioenergetics in the intestinal Caco-2 and hepatic HepG2 cells. The effects assessed by extracellular flux analysis and live cell imaging were different when comparing individual and mixture exposure scenarios. These effects also depended on the type and size of NPs/MPs tested, and the duration of exposure. In general, the observed effects clearly indicated the potential of the tested NPs to disrupt oxidative phosphorylation and ATP synthesis. These included reduced capacity for maximal cellular respiration and a decrease in



the so-called reserve respiratory capacity.

Further studies using organoids as a more representative *in vitro* model are expected to provide additional insights to the current results.

**Keywords:** *micorplastics, nanoplastics, toxicity, pathogens, virulence, risk, antimicrobial resistance,*

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BF24

\Plenary Lecture 17

## GOAT MILK: CARRIER OF BIOACTIVE COMPOUNDS

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### Abstract

The demand for functional food ingredients continues to grow as modern consumers are increasingly interested in their personal health. Consumers expect the food to be healthy or even capable of preventing illness. Recently, investigations have demonstrated that a healthy diet can prevent non-communicable diseases such as hypertension, diabetes, heart disease and cancers. To meet consumers' demands, the food industry seeks to maximize the intended benefits of additives in foods and bioactive components delivered through foods.

Milk proteins have high nutritional value and good sensory and techno-functional properties (solubility, emulsifying, viscosity building, gelling, and film-forming properties) that make them highly suitable as food ingredients in various dairy and food products. Milk proteins derived from cow milk are the most exploited, but goat milk has attracted the attention of consumers, food scientists and technologists in the last decades. Goat milk possesses many advantages over cow milk: high biological value proteins, essential fatty acids, high mineral bioavailability and vitamin content, better protein and lipid digestibility and lower allergenicity. Caseins are the most abundant proteins in milk and represent 74% of total goat milk proteins. Caseins are organized as supramolecular aggregates, called casein micelles (CMs), that are at the basis of the formation of structure and texture in dairy products. By changing the surface of CMs it is possible to change the techno-functional and technological properties of milk affecting, positively or negatively, many dairy processes such as cheese and yogurt manufacturing or the production of skim milk powder and UHT milk (ultra-high temperature processed). Recently, it has been demonstrated that goat casein micelles can be nanocarriers for bioactive compounds, whereas goat milk can be a good medium for prebiotic substances and probiotic bacteria. Furthermore, goat milk can provide a protective role during *in vitro* gastrointestinal digestion of functional food enabling target delivery of bioactive compounds in the intestine or colon.

**Key words:** *Goat milk proteins, Bioactive compounds, Nanocarrier, In vitro digestion.*

**Acknowledgment:** This research was supported by the Science fund of Republic of Serbia, FUNPRO Project, #Grant No. 7744714



BF24

Plenary Lecture 15

## Active and intelligent packaging of food – A new trend for the future

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Nowadays, health and well-being issues are of great importance and consumer demand for high-quality and safe food is constantly increasing. This scenario has triggered the development of active and intelligent packaging. Conventional packaging is a passive barrier that protects food from external environmental factors during the supply chain. Modern trends include the development of packaging that interacts with food and plays an active role in its preservation and quality maintenance.

Active packaging techniques rely on physical, chemical or biological reactions of the active component of the packaging with the atmosphere above the enclosed product to achieve the desired effect. This includes the use of active absorbers, emitters or other multi-asset systems applied in the form of sachets and labels. In addition, active ingredients can also be incorporated directly into the packaging material. Absorbers remove unwanted compounds that accelerate food spoilage, such as oxygen, excess water, ethylene, carbon dioxide and other specific compounds. Emitting systems actively release compounds such as carbon dioxide, ethanol, antioxidants, antimicrobials, etc., into the packaged product or headspace.

Intelligent packaging (IP) is designed to monitor packaged food in real-time to communicate with consumers and provide information about the condition of the food, the environment, and/or the integrity of the packaging. IP systems use indicators, sensors and data carriers. These small intelligent devices are able to collect, store and transmit information about food quality and safety parameters. IP includes time-temperature, gas leakage, freshness, pathogens indicators as well as ripeness and gas sensors and biosensors.

The demand for active and intelligent packaging will increase in the future as it aims to reduce food waste and improve food safety. The future of this technology, for which there are already numerous patents, should therefore be promising and depends only on a greater number of studies that prove its effectiveness and economic viability.

**Key words:** *Active packaging, Intelligent packaging, Absorbers, Indicators, Sensors*



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13<sup>th</sup> - 14<sup>th</sup> December  
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**ABSTRACT BOOK  
Lectures**

# LECTURES





BF55

## Nutritional characteristics of whole grain products on serbian market

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**Objective:** A healthy diet includes optimal amounts of macronutrients, micronutrients and biologically active compounds with health-promoting effects. Cereals certainly have an important place in this. It is recommended that at least half of the total cereal consumption should consist of whole grains or wholemeal flour, as this is one of the necessary conditions for improving the health of the population.

**Materials and methods:** We determined the fiber, sugar, and total carbohydrate (TCH) content of 20 samples of fine bakery products (FBP, cakes, savory cookies, crackers) and 20 snack products (SP, French fries, flips, expanded products) with the whole-grain flour content. We used the AOAC methods.

**Results:** The sugar content in fine bakery products ranged from 1.0-25.9 g/100g, while in snack products it ranged from 0.3 to 3.9 g/100g. The fiber content was 2.9-8.9 g/100g and 2.6-7.5 g/100g respectively. The ratio of TCH to dietary fiber was 4.7-18.5:1 for FBP and 4.5-36.5:1 for SP. 25% of FBP samples and 50% of SP samples had a TCH to fiber ratio greater than 10:1.

**Conclusion:** The whole grain products studied were not only a source of dietary fiber, but also a significant source of sugar: for these products to be part of a healthy, balanced diet, products with a lower TCH/fiber ratio must be chosen.

**Keywords:** *whole grain, fiber, sugar, carbohydrates.*



BF7

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## Analysis, current situation and perspective related to plant food safety in Serbia

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**Abstract:** Food products of plant origin are subject to safety and quality control in production and trade. Food safety control of plant origin and mixed origin in all stages of production, processing and wholesale trade, as well as control over the implementation of laws and other regulations and standards in the field of quality control of food products of plant origin, is under the jurisdiction of the Ministry of Agriculture, Forestry and Water Management, in the Sector of Agriculture Inspection.

The safety control of products of plant origin verifies the compliance of products, systems and procedures in relation to the Food Safety Act and by-laws adopted on the basis of that Act. Food safety systems, hygiene and traceability are in the foreground.

Food products of plant origin are the following: grain products (flour, bread, pastry, pasta), sugar, confectionery, fruit and vegetable products, soft drinks, spices, coffee, yeast, mustard, tea and other food products produced from agricultural and vegetable.

The results on which this extensive analysis is based are part of a number of activities in the Agricultural Inspection's multi-year control planning, and each represents a significant study of the safety and quality of all food in the system.

The results on which this extensive analysis is based are part of the numerous activities of the multi-year planning of controls of the Agricultural Inspection, and certainly represent a significant study on the safety and quality of food of plant origin in the Republic of Serbia.

**Keywords:** *plant, food, safety*



BF27

## Resveratrol - health in a wine glass

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### Abstract

Resveratrol (*trans*-3,4',5-trihydroxystilbene) is a phenolic phytoalexin produced by grapevines under stress conditions resulting from attack by pathogens such as *Botrytis cinerea*, UV light, irradiation, ozone, heavy metal ions, injury, and frost. It belongs to the group of stilbenes. It exists in two isomers - *cis*- and *trans*-resveratrol, the latter being more abundant in nature and biologically more active. Thus, the aim of this work was to collect and summarize the available literature on resveratrol as a powerful antioxidant and its health properties.

The synthesis of resveratrol occurs mainly in grape skin, which contains 50 to 100 µg/g. Red wines are a major source of resveratrol, as it is extracted from crushed grape berries during maceration and fermentation using the ethanol produced. Resveratrol content in wine depends on grape variety, weather conditions, winemaking techniques and fermentation conditions. In terms of health benefits, *trans*-resveratrol and its glucoside (piceid) may inhibit the oxidation of low-density lipoproteins in the early stages of atherosclerosis, contributing to the cardioprotective properties of red wine. According to the well-known "French paradox", the French have fewer cardiovascular problems despite their high-fat diet because of their high consumption of red wine. In addition to these benefits, resveratrol also has anti-cancer, antioxidant, anti-inflammatory and neuroprotective effects. Resveratrol also has antitumor effects and is considered a potential candidate for the prevention and treatment of various cancers because it inhibits all stages of carcinogenesis (initiation, promotion and proliferation). Resveratrol may regulate the immune system by interacting with multiple molecular targets. Recent studies support resveratrol's antiviral activity against several viruses, including coronavirus. On the other hand, due to its low bioavailability, it is not possible to achieve the doses required for a therapeutic effect by drinking wine.

However, the combination of alcohol and resveratrol in red wine is responsible for increasing "healthy" cholesterol level, reducing the formation of blood clots and preventing arterial damage. Relatively recent study has shown that the daily intake of resveratrol is on the order of several mg/day, with red wine being the richest source (about 90%).

**Key words:** Wine, Resveratrol, Antioxidant effects.



**03**rd **BLACK SEA ASSOCIATION  
OF FOOD SCIENCE AND  
TECHNOLOGY CONGRESS**

13<sup>th</sup> - 14<sup>th</sup> December  
Hotel Mona Plaza  
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**ABSTRACT BOOK**  
**Plenary Lectures**

# PLENARY LECTURES



BF 6

Plenary Lecture 18

## Food safety, food ingredients and food crimes

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Ingredients used for food production must be safe or be made safe. Chemical food safety depends on the raw materials that may or are even likely to contain natural toxins, such as the linamarin in cassava, the staple food of a billion people, a substance that paralyses children irreversibly. Physical safety hazards often are natural and should be controlled by adequate processing. Microbial safety depends on correct processing, packaging and storage.

Worldwide each year unsafe food causes 600 million cases of foodborne diseases and 420 000 deaths of which 30% are children under 5 years of age (WHO). This may be reduced significantly by adequate food safety management. GHI proposes a legal requirement for food companies to employ a certified food safety professional (CP), without one the company cannot operate. The CP cannot be dismissed. Sometimes diseases and deaths are the result of crimes. Therefore, GHI developed a really anonymous whistleblowing webpage, in more than 40 languages. Even GHI cannot find out who reported a food safety incident. A global network of experts judges any report and if found to be serious and not fabricated, GHI asks local food safety authorities to investigate.

Keywords : Food safety, food ingredients, food crimes



BF 26

Plenary lecture 19

## Medicinal herb extracts as a novel food for microbiota manipulation

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Human microbiota is a complex microbial ecosystem that resides in, and on the human body. The human colon actually can be seen as a specialized bioreactor, while microbiota that performs numerous functions can be perceived as a microbial organ of the human body. Feeding microbiota throughout our life is essential for our wellbeing. This is illustrated by the fact that one of the major components of human breast milk are indigestible oligosaccharides. These, human milk oligosaccharides stimulate beneficial components of microbiota. In adulthood, it is clear that various plant components are providing essential food for microbiota. Although indigestible carbohydrates include dietary fibers and prebiotics are evidently health promoting, there are several diseases which symptoms can be provoked by indigestible carbohydrates. Overall, there is a need for the development of alternative foods for microbiota manipulation. Relevantly, polyphenols have been recognized as a novel class of prebiotics. These secondary plant metabolites show a range of health promoting biological activities. Recent evidence indicates that their interaction with human host is direct, but also mediated by microbiota. Interestingly, one family of intestinal microbes is specialized in polyphenol degradation, while addition of polyphenols in microbiological media shows that these substances have the ability to suppress the growth of pathogenic and promote the growth of beneficial and probiotic microorganisms. Therefore, the foods which are rich in polyphenols represent an unexplored, novel tool for microbiota manipulation. Among different foods, medicinal herbs represent particularly interesting group of plants since they have the highest content of polyphenols, and history of safe application for prevention and treatment of various diseases. While the mode of action of medicinal herbs is still not definitely determined, results of in vitro tests indicate that changes of microbiota composition and activity by medicinal plant polyphenols might represent a relevant mechanism for promoting human health.

Keywords: microbiota, Medicinal herb extracts, novel foods



BF 56

Plenary lecture 20

## Medicinal fungi food supplements - novel foods, adulteration and quality control

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Fungal food supplements are gaining on popularity with many of their aspects unanswered, unknown or drastically commercialized. In EU some species are recognized as novel foods through untransparent, unprofessional decisions, without checking true facts either through communication between EU member states, between scientists or producers. Even if certain species are proven not to be novel and their sales legalized in certain parts of EU, they remain on the novel foods list and are considered unsafe and illegal in other states of EU. Many of producers are not willing to share their data on possible sales of these »novel foods« before 15.5.1997 in order to protect their business. There are almost no producers investing in toxicology studies to prove the safety of their novel food products because this way they enable sales to competition. They rather invest in testing of their proprietary blends and formulas which are protected with patents or keep selling novel foods under fake declarations or as a »non-food« products. A novel food classification system, which was designed to protect end customers has failed completely - it functions in a completely irrational manner, taking into account no facts and at the same time is disabling development of new, better food products in EU.

Adulteration of fungal food supplements is of major concern but scientifically indefinite and thus many times used to discredit the competition. This is the case even if "adulterated" products are of much higher quality in certain aspects i.e., containing higher concentrations of certain medicinal components.

Quality measures and commercial promotions of fungal food supplements are excessively based on the content of beta glucans, an important fungal medicinal component. Beta glucans do stimulate the immune system but on other hand can cause adverse reactions if consumed for a too long periods of time, a fact completely ignored by the whole industry. Beta glucans content is most often determined using analytical methods or test kits which are unreliable and can be easily faked.

Keywords: Medicinal fungi, food supplements, novel foods, adulteration



BF18

Plenary lecture 21

## A new tool in mushroom toxicity screening: the use of a panel of bioluminescent whole-cell bioreporter bacteria

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Since time immemorial humanity extracted Nature. Natural sources are heavily prospected in the search for new bioactive compounds with fungi, particularly mushrooms, at the center of the current health and biotechnology hype. The lifestyle of the mushroom's vegetative form, surrounded by bacteria and other competitive microorganisms, gave indices for the quest for antibiofilm compounds to be used to combat microbial resistance. However, bioprospecting for toxic compounds is time-consuming with a high degree of variability if evaluated by the crystal violet-dyeing-based method. Most importantly, the exact mechanism of its action remains unknown. Hereby, we tested a new method for mushroom-derived compounds toxicity screening based on *Escherichia coli* strains harboring different plasmids containing the lux operon fused with specific promoters. Each strain points to a different kind of toxicity. When exposed to toxic compounds these test strains produce bioluminescence which can be quantified.

Extracts derived from different mushroom species (40 samples) were evaluated for specific toxicities like quorum sensing, heat shock (general cytotoxicity), genotoxicity, fatty acid deliverability (general stress), and protein damage. The effect appeared as bioluminescence emitted by a panel of genetically engineered bacteria. To evaluate the level of specific toxicity the induction factor was calculated for each sample tested. Based on the value of the induction factor, the toxicity was graded as high, low, particular, inhibition, or no toxicity. Most of the samples expressed the effect on quorum sensing with particularly to high toxicity. *Cordyceps militaris* and *C. sinensis* showed the highest level of anti-biofilm activity. The Chaga extract was the most cytotoxic while *C. militaris* caused membrane damage of bioreporter bacterial strain.

This novel method provided a fast, wholesome, real-time, and effective way to examine mechanisms of mushroom-derived compounds toxicity. The application of a panel of bioluminescent whole-cell bioreporter bacteria enables a clear direction for further research of antibiofilm compounds or molecules with specific toxicity of interest.

**Keywords:** *anti-biofilm activity, anti-quorum sensing, bioluminescence, Cordyceps spp., toxicity, whole-cell bioreporter bacteria*





BF 56

Plenary Lecture 22

## Digestibility, starch morphology, and nutritive value of rusks made from wheat flour with the addition of proso

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### Background and Objectives

“Modern diseases” that are the result of a “high sugar, low nutrient” diet are becoming more prevalent. Incorporation of “traditional” gluten-free cereals, like proso, in “everyday” food, such as rusks, would allow diabetics and people looking to increase fiber and nutrient content to include rusks in their diet.

### Findings

Compared to wheat rusks, rusks with the addition of proso showed a higher content of microelements and essential amino acids. Also, higher content of dietary fiber and smaller and more regularly arranged starch granules increased the digestibility of rusks with the addition of proso. Additionally, rusks with the addition of proso showed better antioxidative properties and had a lower glycemic index when compared with wheat rusks.

### Conclusions

Incorporation of proso flour in rusk production could be beneficial not only to people suffering from diabetes but also as a way of improving general well-being. However, due to the decreased water absorption and, therefore, greater hardness and fracturability, our results suggested that the addition of proso flour should be capped at 20%.

### Significance and Novelty

To our knowledge, this is the first description of the effects of different additions of proso on digestibility, starch morphology, glycemic index, and nutritive and antioxidative properties of rusks. *Cereal Chemistry*, 2023

Keywords: Digestibility, starch morphology, nutritive value of rusks



BF4

## Antimicrobial, cytotoxic and anticancer activities from Cypriot aromatic plant extracts

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### Abstract:

Medicinal and aromatic plants (MAP) are used in everyday life as flavorings (food and beverages), medicines (folklore remedies), dyes, and perfumes (cosmetics and perfumery) among others. Many endemic and unexploited MAP species are known to present a variety of benefits on human health and are used as remedies up to nowadays. The present study aimed to investigate the antimicrobial activity, cytotoxicity and anticancer activity of six endemic Cypriot MAP species: *Melissa officinalis*, *Mentha piperita*, *Origanum dubium*, *Salvia fruticosa*, *Sideritis cypria*, and *Thymus capitatus*. Plant phytochemical analysis was also performed. The results from this study indicated great antibacterial activity from *O. dubium* ethanolic extract (followed by *T. capitatus*) against *Staphylococcus aureus* and *Bacillus cereus* (10 times more effective than commercial food preservatives E211 and E224). Extracts from *O. dubium*, *T. capitatus* and *S. cypria* exhibited great antifungal activity, whereas *M. officinalis* was found more effective against *Aspergillus versicolor*. Great inhibitory effects on the growth and proliferation of cancer cell lines MDA-MB231 (breast), HeLa (cervix), SKOV3 (ovarian) was observed by *S. cypria*. Moreover, *O. dubium* was found to be more effective against colon cancer cell lines HCT116 (more aggressive and highly metastatic) and HT29 (less invasive). The two aforementioned cell lines (HCT116 and HT29) were also affected by *S. cypria* extract, but the effects were lower than the one caused by *O. dubium*. In conclusion, the results derived from this study suggest that the use of natural products (i.e. plant extracts) could be considered as an alternative mean for the development of natural preservatives (without negatively affecting human health and the environment). Thus, it is of great essence to further investigate the examined MAP and their properties *in vitro* and *in vivo*.

**Keywords:** Medicinal and aromatic plants; plant extracts; antimicrobial activity; cytotoxicity



BF 57

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## What are the benefits of fermented foods?

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Although fermented foods have been an integral part of the human diet across different cultures for thousands of years, there is increasing interest in these products among food and nutrition scientists, health professionals, and consumers. In addition to improving food safety and extending the shelf-life of seasonal foods, fermentation affects the sensory and nutritional properties. Fermentation increases peptides, amino acids, vitamins, and minerals content in foods, improves digestibility and bioavailability, and reduces potential toxins and allergens. It also generates many bioactive compounds that exert antioxidant, anti-inflammatory, antimicrobial, immunomodulatory, antihypertensive, anticancer, and other health-promoting properties. Recent epidemiological studies linked the consumption of fermented foods with lowering the risk of chronic diseases, increasing longevity, and improving quality of life. An increasing number of animal studies followed by clinical studies support the benefits of fermented foods against obesity, diabetes, cardiovascular disease, cancer, allergies, and other chronic diseases, highlighting the modulatory effects of beneficial microorganisms and bioactive compounds formed during fermentation on gut microbiota. However, there are no specific dietary recommendations for fermented foods intake. Assessing the potential health benefits of fermented foods remains a challenge since there are over 5000 fermented foods and beverages globally, and many still need to be studied. Considering the lack of specific fermented food biomarkers, future studies should focus on identifying novel biomarkers and assessing the dietary intake of different fermented foods to define the optimal intake necessary to provide health benefits.

**Keywords:** *fermented foods, bioactive compounds, health effects, biomarker, intake*

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BF 58

## A matrix of critical points for consumer food safety

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Food safety in the agro-food chain has improved, but foodborne diseases remain an international problem. Although different regulatory and inspection mechanisms are in place to ensure food safety from production through retail, consumers are left to their own devices. Consumer food safety at home depends on three factors: 1) consumer knowledge, 2) attitude and 3) the practice of food safety. The European Food Safety Authority has found that the primary place of exposure to foodborne outbreaks is in domestic premises (2016-2021) [1] and therefore consumers have an important role in ensuring food safety. Furthermore, a better understanding of consumer knowledge, attitude and practice of food safety is needed to improve food safety and public health. The aim of this project was to identify the critical points in consumer food handling for maintaining food safety.

### Methodology

Critical points in consumer food handling (e.g. shopping, storing, cooking, serving, eating etc.) were considered to find out what actions affect food safety positively or negatively.

### Results

A matrix of critical points for consumer food handling was developed. These critical points included shopping, food storing, hand and kitchen hygiene, cross contamination, food preparation, defrosting, temperature maintenance across hot and cold chains, leftovers handling, influence of pets, etc.

### Conclusion

Consumer knowledge, attitude and practice of the identified critical points are important for food safety. The matrix can be applied to develop questionnaires and educational campaigns for consumers. The matrix can also serve as a basis for development of more standardised questionnaires which would enable comparisons across time and geographic locations.

### Literature

EFSA. (n.d.). *Foodborne outbreaks - dashboard*. <https://www.efsa.europa.eu/en/microstrategy/FBO-dashboard>

### Acknowledgement

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**Key Words:** *Food Safety, Consumers, Critical points, Food handling*





# **E-POSTERS**



BF 59

## Effect of ultrasound and cold pressing on the composition of Graševina grape seed oil lipophilic and hydrophilic antioxidants

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**Introduction:** Grape and wine annual production, as reported by OIV (International Organisation of Vine and Wine) for 2022, reached up to 79.4 million tons and 258.3 million hectoliters, respectively. Consequently, this sector on an annual basis generates around 5-7 million tons of a very valuable by-product, grape pomace. Although both pomace skin and seed are rich sources of phenolic antioxidants, seeds have recently drawn considerable attention as a source of vegetable oil with both lipophilic and hydrophilic antioxidants. Cold pressing is a conventional method that offers possibility to produce high quality oils, but with relatively low yield. However, this can be increased by application of preprocessing techniques like pulsed electric fields or microwave treatments. In addition, effect of ultrasound pretreatments on the yield and chemical composition of grape seeds oil have not earlier been studied.

**Objective:** The aim of this research was to study the effect of ultrasound pretreatment of grape pomace seeds on the extraction yield of cold pressing and chemical composition of obtained grape seed oil.

**Methodology:** Graševina grape seed pomace from vintage 2022 was used in this research. Ultrasound pretreatment was performed in ultrasonic bath operating at frequencies of 37 kHz and 80 kHz. The concentrations of tocopherols and tocotrienols were determined by HPLC-FLUO analysis. Analysis of total and individual polyphenols were determined by spectrophotometry and HPLC-DAD/MS, respectively. Antioxidant capacity was determined by the ORAC method, where both hydrophilic (H-ORAC) and lipophilic fraction (L-ORAC) were analyzed.

**Results and conclusion:** Oil extraction method combining ultrasound pretreatment and cold pressing were applied for the first time on the grape seed pomace. Ultrasound pretreatment contributed to the extraction of lipophilic and hydrophilic antioxidants, representing a useful tool in reducing the waste amount and producing high quality grape seed oil.

**Keywords:** *Grape pomace, Grape seed oil, Ultrasound, Tocochromanols, Polyphenols*



BF 60

## Nutrition of patients suffering from gastritis

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Improper diet based on fast food, enjoyment of alcohol, sweets, spicy foods and daily exposure to high levels of stress, have led to various gastrointestinal problems. One of the most common diseases by the gastrointestinal system is gastritis - an inflammatory process with damage to the gastric mucosa.

**Objectives:** For the purpose of analyzing dietary and lifestyle habits in gastritis patients, a research was conducted through an online anonymous questionnaire Google docs. in two cycles – from 26 December 2022 to 5 January 2023 and from 2 to 24 May 2023.

**Participants and methods:** In order to record data from the target group, a questionnaire was placed in the Facebook group “GERD, gastritis – how to survive these troubles?”. The study included 244 participants diagnosed with gastritis, predominantly female from Southeast Europe. The questionnaire consisted of twelve questions that included demographic data, eating habits of participants, the presence of risk factors, knowledge of (un)permitted foods, and methods of treating symptoms.

**Results:** According to the results of the conducted research, most of the participants are informed about nutrition in gastritis, but despite adequate information and multiple prevalence of gastritis symptoms, there is still a large representation of unrecommended foods in the diet of patients, which can be confirmed by the representation of at least two characteristics of bad eating habits. In order to alleviate the symptoms present, participants use pharmacological drugs and natural preparations to an equal extent, but most often it is a combination of the prescribed drug and herbal preparations. The most commonly used herbal preparations are Iberogast drops, mint, yarrow, chamomile and okra teas, okra tincture and black cumin oil. Data on “home-prepared” herbal preparations have not been recorded.

**Conclusion:** All the symptoms that accompany gastritis create significant discomfort for the patient, and greatly dictate the lifestyle and choice of diet. In order to maintain a significant quality of life even in the acute stage of the disease, a good balance in the diet, use of pharmacological drugs and adherence to doctor’s instructions is essential.

**Keywords:** *gastritis, diet, lifestyle habits, questionnaire survey*





BF 61

## The assessment of raw milk cheese production practices among Serbian small-scale dairy processors

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### ABSTRACT

Traditional cheese production in Serbia takes places predominantly in small-scale dairy production, using either raw or pasteurized milk. Raw milk cheeses, known for their authentic and rich taste, pose a safety risk due to the potential contamination with foodborne pathogens. To ensure the safety of these products, small scale dairy processors must take stringent measures from the milking process to the distribution of their products.

The objective of this study was to assess the prevalence of raw milk cheese production among small-scale dairy producers in different regions of Serbia and to gain insights into their practices and habits related to cheese production and distribution.

The questionnaire was developed targeting small scale dairy processors, to obtain data about dairy processing and selling, raw material and cheese making practices. Survey participants (n=58) were interviewed in person, mostly at their production sites.

Raw milk cheese producers (43% of survey participants), mainly located in northern and eastern parts of Serbia are producing white brined cheese (76%) and fresh cheese (64%), using milk from their own farms (88%). They are selling cheeses packaged in unsealed plastic boxes (48%) or plastic bags (52%), at their doorsteps (72%) and open-markets (52%). Kitchen products are used for cleaning and disinfecting (76%). Only 24% of producers are labeling their products, 12% indicating the date of production and 16% specifying the expiration date. The lack of an adequate label indicates that customers are often exposed to raw milk cheeses without being aware of it. The observational results showed that raw milk cheese producers often work with inadequate infrastructure, equipment and utensils and have limited awareness of the associated product-related risks.

These findings suggest the urgency for training initiatives addressing the food safety risks tied to raw milk cheeses, as well as for establishing precise guidelines for raw milk cheese production.

**Key words:** *small scale dairy producers, raw milk cheese, manufacturing practices*



BF 1

## The use of Cypriot oregano for the preservation of fresh spearmint

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### Abstract

Medicinal and aromatic plants (or so-called herbs) are widely used in many cuisines around the world as well as traditional medicines. However, when herbs are used fresh are highly perishable with short shelf life. Natural products such as essential oils (EOs) and plant extracts are gaining interest and their use for food preservation (including fresh produce) is investigated. The present study aimed to assess the effectiveness of Cypriot oregano (*Origanum dubium*) EO and hydrosol on fresh spearmint's quality preservation. Different concentrations (0, 0.001, 0.01 and 0.1%) and time (0, 1, 5 and 10 min) of application were investigated. The dipping method of application was used and spearmint bundles were afterwards stored at 4 °C for six days. The results from this study, showed that increased concentration and time of EO application increased spearmint's respiration rate and at the same time resulted in a less marketable and acceptable product (especially 0.1%-10 min). All applied EO treatments (except 0.01%-1 min and 0.01%-10 min) resulted in increased phenolic content and antioxidants of spearmint at the end of storage. A more acceptable product with more pleasant aroma was reported with the application of 0.001%-1 min hydrosol as to 0.1%-5 min, 0.01%-10 min and 0.1%-10 min at the end of storage. Moreover, all applied hydrosol treatments were found to increase spearmint's, phenols, antioxidants and flavonoids (except 0.001%-10 min). The findings for the present study indicate that EO and hydrosol from *O. dubium* could be considered as agents for the preservation of fresh spearmint as long as the optimum combination of concentration and time are applied. Further investigation for the putative uses of the examined EO and hydrosol on other produce, as well as method of application (dipping, vapor) are needed.

**Keywords:** *spearmint; essential oil; hydrosol; quality*



BF5

## Cypriot oregano essential oil and hydrosol as promising agents for the preservation of fresh basil

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### Abstract

Basil (*Ocimum basilicum*) is used in the food industry as a flavoring agent in fresh and dry form. Fresh basil is an extremely perishable product, exhibiting a very short shelf life. The interest for the use of natural products such as essential oils (EOs), hydrosols, plant extracts and natural compounds for the preservation of fresh produce (including herbs) is increasing. Little to no information is available for the preservation of fresh herbs. The present study aimed to evaluate the effects of Cypriot oregano (*Origanum dubium*) EO and hydrosol applications at different concentrations (0, 0.001, 0.01 and 0.1%) for different time (0, 1, 5 and 10 min) on fresh basil's quality attributes during storage at 4 °C for six days. The results from this study revealed increased weight loss with 0.001%-1 min, 0.01%-10 min and 0.1%-10 min EO application, whereas hydrosol 5 min (all concentrations), 0.01%-10 min and 0.1%-10 min also increased basil's weight loss. A less aromatic (not pleasant aroma) and less marketable product was found with higher EO concentration and time of application, while hydrosol application (except 0.1%-5 min and 0.001%-10 min) preserved basil's aroma even after six days of storage. Total phenolic content, antioxidants, flavonoids and ascorbic acid content of basil increased with the application of 0.01%-10 min EO. Application of hydrosol 0.001%-1 min decreased phenols and antioxidants, while 0.1%-5 min and 0.001%-10 min also decreased product's total flavonoids. The increase in basil's phytochemicals (i.e. antioxidants, ascorbic acid) and the preservation of its sensory attributes (i.e. aroma, appearance) indicate a higher nutritional value product. However, further investigation of the examined products (EO and hydrosol) and their application on fresh produce (i.e. concentration, time, method of application, product) is needed.

**Keywords:** *basil; essential oils; hydrosols; postharvest quality*



BF62

## The study of fruit wine properties in the protection against oxidative stress

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Sour cherry is among highly produced drupe fruits in Serbia. It can be processed in many forms and the most common are juice and jam. Beside these two one form which is not very common is wine. During the processing of sour cherry into the wine biologically active compounds are preserved in final product. The aim of this study was to determine phenolic profile, and activity of fruit wine on enzymatic systems in vitro and lipid peroxidation. Sour cherry wines were produced in microvinifications. Phenolic profile was evaluated by UPLC TQ-MS/MS. Level of lipid peroxidation (malondialdehyde (MDA) level) and activity of enzymes of antioxidant protection superoxide dismutase (SOD), catalase (CAT) and glutathione peroxidase (GPx) were evaluated on synaptosomes. Synaptosomes were isolated from the brain of Wistar albino rats. Phenolic profile of sour cherry wine was obtained after by UPLC TQ-MS/MS analysis. Phenolic acids and flavonoids were detected in samples. Among other phenolic acids were detected *p*-coumaric (1,21-3,17 µg/ml), protocatechuic (9.71-17.52 µg/ml), gallic (12.78-19.52 µg/ml) and caffeic (2.73-8.42 µg/ml). Flavonoids detected in sour cherry wines were catechin (5.21-12.11 µg/ml), epicatechin (27.51-47.51 µg/ml) and quercetin (15.31-28.27 µg/ml). Antioxidant properties of detected phenolic compounds affected on the activity of enzymes of antioxidant protection and level of lipid peroxidation. The MDA level was in range (1.45-2.57 nmol/mg), while SOD activity was in range (3.52-5.21 U/mg). Activity of GPx was in range (0.0183-0.0207 U/mg) as well as CAT (0.037-0.058 U/mg). Sour cherry wine is rich source of phenolic acids and flavonoids which exhibit beneficial health effect on the human organism.

**Keywords:** *sour cherry, fruit wine, phenolic compounds, antioxidant properties, oxidative stress*



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## Fruit wine active compounds and its ability of hyperglycemia prevention

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Apricot fruit is mostly processed in Serbia into the juice, jam and liquor. During processing on high temperatures, the content of biologically active compounds in apricot products significantly decrease. Processing techniques, such as the production of wine from apricot, offers ability to preserve content of biologically active compounds such as polyphenols in fruit wine. Polyphenols showed many beneficial health effects. The aim of this study was to investigate  $\alpha$ -glucosidase inhibitory activity of apricot wine, and contribution of some phenolic compounds to it activity. Fruit wines were produced in microvinification. Samples were lyophilized and dissolved in DMSO. The inhibition of  $\alpha$ -glucosidase was evaluated by using  $\alpha$ -glucosidase and substrate solution, *p*-nitrophenyl  $\alpha$ -D-glucopyranoside. Identification and quantification of some natural compounds conducted by using UPLC TQ-MS/MS. Inhibitory activity of lyophilized apricot wine samples were in range 45.5-67.3  $\mu\text{g/mL}$ . The control was acarbose whit inhibitory activity 75.3  $\mu\text{g/mL}$ . It was estimated amount of phenolic compounds and its contribution to the  $\alpha$ -glucosidase inhibitory activity. Obtained results showed that apricot wine is good inhibitor of  $\alpha$ -glucosidase compared to acarbose. The  $\alpha$ -glucosidase activity depends from the synergistic and antagonistic effect of natural active compounds in the fruit wine.

**Keywords:** apricot, fruit wine, alpha glucosidase, polyphenols, hyperglycemia prevention



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## The effect of biopriming of pea seeds (*Pisum sativum* L.) with extracts of *Schizophyllum commune* Fr. 1815 on the enzymatic antioxidant activity of seedling

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Biopriming (BP) represents a new seed treatment technique that integrates biological and physiological aspects, ensuring increased resistance of the seed and young plant. Today, in BP, many species of fungi are used intensively, including *Trichoderma*, but the effect of filamentous fungi has not been described yet.

### Aim

The aim of this study was to examine the role of seed BP with polysaccharides (PSH) isolated from submerged cultures of two different strains of fungal species *Schizophyllum commune*, originating from Serbia (SRB) and Italy (IT), in the fight against oxidative stress in seedlings under optimal conditions.

### Methodology

Fresh extracts of pea were prepared in phosphate buffer pH 7.5, after seed BP with fungal exopolysaccharides (EPSH) and intrapolysaccharides (IPSH). *In vitro* enzymatic antioxidant activity of the following enzymes was determined: pyrogallol peroxidase (pPx), ascorbate peroxidase (aPx), guaiacol peroxidase (gPx) and catalase (CAT).

### Results

The strongest positive effect was observed with EPSH isolated from both strains, especially the SRB strain, which significantly increased the antioxidant activity of pPx (37.28 nmol min<sup>-1</sup> mg<sup>-2</sup>) and gPx (0.50 nmol min<sup>-1</sup> mg<sup>-2</sup>). This represents a 177-fold increase in activity compared to the control of pPx (0.21 nmol min<sup>-1</sup> mg<sup>-2</sup>). However, the EPSH extract from SRB did not affect the increase in aPx and CAT activity in the plant, most likely due to its significant influence on the previous two analyzed enzymes. On the other hand, EPSH isolated from the IT strain had a significant effect on increasing aPx (26.30 nmol min<sup>-1</sup> mg<sup>-2</sup>) and CAT (3.52 nmol min<sup>-1</sup> mg<sup>-2</sup>) activity.

### Conclusion

The results show that BP with PSH from *S. commune* has a positive effect on reducing the level of oxidative stress in pea and emphasize the complexity of the various mechanisms of PSH. They also highlight the enormous potential of PSH derived from filamentous fungi as antioxidants.

**Keywords:** *S. commune* Fr., *Pisum sativum* L., biopriming, peroxidase, catalase

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## Antimicrobial activity of *Pleurotus salmoneostramineus* fruiting body extracts co-cultivated with *Pleurotus* spp. and *Lentinus crinitus*

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The genus *Pleurotus* has a distinct economic and ecological value, as well as numerous medicinal properties, encouraging its further investigation.

### Aims

To search for the biological potential of fruiting body of *Pleurotus salmoneostramineus* co-cultivated with selected *Pleurotus* species or *Lentinus crinitus*, its methanol extract was prepared. The main tasks of the study were to determine the basidiocarp yield and investigate extract antimicrobial activity.

### Methodology

All co-cultures of *P. salmoneostramineus* with selected fungi (*P. ostreatus* var. *pulmonaris*, *P. cornucopiae* var. *citrinopileatus*, *P. djamor* var. *roseus*, *P. ostreatus*, *L. crinitus*) were prepared using the inoculums obtained from the culture collection of the Laboratory of Molecular Biology of the University of Parana, Brazil. For in vitro research of antimicrobial activity obtained methanol extracts were screened by microdilution method, determining minimal inhibitory and bactericidal/fungicidal concentration (MIC, MBC/MFC).

**Results** Comparing with solitary cultivated *P. salmoneostramineus* (control), co-cultivated fungi had extremely increased yield, with exception of the co-culture with *L. crinitus*. The highest yield was recorded in the co-culture with *P. cornucopiae* var. *citrinopileatus*. Concerning antibacterial effect, the most sensitive bacteria were *Bacillus cereus* isolates and reference strain *Listeria monocytogenes* (MIC 25-50 mg/mL, MBC 25-100 mg/mL). *L. monocytogenes* LMS isolate and the reference strains of *Staphylococcus aureus* and *Escherichia coli* were among the most resistant (both MIC and, MBC 100 mg/mL). The extracts' antifungal effect were characterized with the MIC and MFC values ranging 6,5-110,34 mg/mL and 10-153,34 mg/mL, respectively. The most sensitive micromycete was *Penicillium funiculosum* (MIC 6,5 mg/mL, MFC 10 mg/mL), while *Penicillium verrucosum* var. *cyclopium* was highly resistant (MIC 110,34 mg/mL, MFC 143,34 mg/mL).

### Conclusion

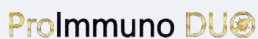
Methanol extract of basidiocarp of *P. salmoneostramineus* co-cultivated with *Pleurotus* spp. and *Lentinus crinitus* showed weak antimicrobial activity, with antifungal potential being more pronounced than antibacterial. However, its co-cultivation could be recommended due to notable yield increase.

**Keywords:** *Pleurotus* spp.; co-cultivars; methanol extracts of fruiting bodies; antibacterial activity; antifungal activity`



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