CEFood 2024 Conference

BOOK OF ABSTRACTS

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12th Central European Conference on Food 2024

13-16 October 2024, Szeged, Hungary

Welcome

Distinguished Colleagues,
Representatives of the Food Science and Technology field,

This is our great honour to welcome you to Szeged, Hungary to the CEFood 2024 Conference held on the 20th anniversary of the second CEFood Conference organised in Hungary in 2004, in Budapest.

The series of CEFood conferences attract people from all over Europe, and even world-wide (e.g. Australia, South Africa, New Zealand), but we keep the strong commitment to have scientists involved in from numerous Southern-Eastern European and ex-Soviet countries.

Topics of this conference cover:

Consumers,

Explore the Frontiers of Science - Impact and role of food science and technology in addressing global challenges,

Future Food Systems,

options,

orientation,

digitalisation, Robotics, Artificial intelligence – their Role in the Food System,

2024: 20-24 reasons to become a food scientist, food technologist, food engineer, nutritionist, food chemist, food microbiologist, food economist

See "**cefood2024.hu**"

I wish you a fruitful conference and good networking opportunities.

See you at the CEFood 2026 Conference.

Yours sincerely,

Prof. Dr. Diána Bánáti

Conference Chair

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Honorary Committee

The mission of the Honorary Committee

Members of the Honorary Committee understand and practice their responsibility along the following lines by:

- Promoting the CEFood 2024 in their countries at all relevant scientific and professional levels and circles;
- Spreading information about CEFood 2024 in the CEI countries and also to the European scientific, research, development and educational space covering food in broadest view;
- Suggesting potential speakers to the Scientific and Organising Committee in the early stage of the CEFood 2024 program design;
- Building the spirit of importance of food for humankind with high respect of ethical and moral norms within the food supply chain, but also in research, development and education networks.

The Honorary Committee is composed from the principal organisers of all CEFood congresses as follows:

Year	Place, Country	Principal organiser
2002	Ljubljana, SI	Peter Raspor
2004	Budapest, HU	Diána Bánáti
2006	Sofia, BG	Kostadin Fikiin
2008	Cavtat, HR	† Damir Karlović, Kata Galić
2010	Bratislava, SK	Peter Šimko
2012	Novi Sad, RS	Viktor Nedović
2014	Ohrid, MK	Vladimir Kakurinov
2016	Kiev, UA	† Iaroslav Zasiadko
2018	Sibiu, RO	Ovidiu Tița
2020	Sarajevo, BA	Zlatan Sarić
2022	Čatež ob Savi, SI	Peter Raspor

Congress history

Throughout the centuries Central Europe has always been a very influential melting pot of ideas for transnational and regional cooperation. At the end of the last and at the beginning of this century there was a great spirit of cooperation in Middle Europe as evidenced first by The Alps-Adriatic Working Community and later by the Danube initiatives – these two initiatives having a wide variety of cross-border motives for cooperation, not just political clustering. Obviously various platforms had claimed a necessity for cooperation. However, the Central European initiative (CEI) which was established in 1989 in Budapest remains the one which offers a good frame for scientific research and educational cooperation in the area of Food.

Expansion of the European Union to Middle Europe later stimulated new visionary cooperation, not just in the North–South orientation, but also in the West–East orientation. This was the milestone

for the 2002 erection of the Central European Congress on Food and Nutrition (CEFood congress) in Ljubljana.

The scientific and professional framework of the 1st CEFood congress in 2002 offered a solid basis and a guarantee for the CEFood congresses to continue into future events. Since 2002 CEFood congresses have been organized biannually in different CEI countries, the 11th after 20 years organized in Slovenia.

In 2006 the European Federation of Food Science and Technology (EFFoST) showed definite desire to enter this network, due to good and efficient organization, based on the devotion of the CEFood congresses' principal organizers and their teams.

Most notably, respect and gratitude to all past organizers are passed from congress to congress by making each past principal organizer a member of the Honorary committee of the CEFood 2024.

PLENARY SPEAKERS

Prof. Dr. Eileen Gibney

Prof Eileen Gibney (BSc, PhD, MSc) has worked in the area of human nutrition since 1997. Graduating with a degree in human nutrition from Ulster University, she then obtained her PhD from the Dunn Nutrition Unit, University of Cambridge in 2001. She went on to complete an MSc in Molecular Medicine (TCD) in 2003. Eileen held post-doctoral positions at the University of Newcastle and Trinity College Dublin, before joining UCD in 2005. Her current research interests lie in the area of personalised nutrition, where she investigates response, including inter-individual variation in response, to nutrition interventions, and develops strategies and innovative technologies for personalised dietary and lifestyle feedback. Eileen has/is a PI on many national and international projects including; Food4me, Food for Health Ireland, Insight and FNS-Cloud. Most recently Eileen has been appointed as Co-Director for a, 35M Euro Co-Centre for Sustainable and Resilient Food Systems. Eileen is Director of the UCD Institute of Food and Health, which harnesses the expertise of researchers across UCD to future-proof global food systems. She is Director of the UCD Institute of Food and Health and a member of the academic staff for the BSc Human Nutrition and other programmes. She has held the positions of Associate Dean of Teaching and Learning & Director of Executive Education with the School of Agriculture and Food Science. Eileen was a founding Director of the Irish Association for Clinical Nutrition and Metabolism (IrSPEN) from 2010 to 2019. She is currently a Trustee of the Nutrition Society of UK and Ireland. She sits on the Public Health Nutrition sub Committee in the Food Safety Authority of Ireland and SafeFoods Advisory Committee.

Challenges and Opportunities to deliver healthy and sustainable diets

Eileen Gibney

University College Dublin

Promoting healthy, nutritious, and sustainable diets presents a multifaceted challenge. Balancing the nutritional needs of a growing population with the urgent need to preserve the planet's resources requires innovative approaches and collective action. Addressing these challenges requires a re-evaluation of dietary patterns and production systems to ensure safe, nutritious and sustainable food for everyone. Access to affordable and nutritious food is a human right that remains elusive for many individuals, particularly in marginalized communities. Moreover, reliance on modern farming methods has contributed to soil depletion, water scarcity, and biodiversity. Whilst challenges exist promising opportunities are evident. There is an need to transform the way we produce, distribute, and consume food. However, within this change there is a need to ensure we continue to improve population diets. As we shift towards sustainable healthy eating we need to ensure we don’t increase risk of dietary deficiencies in specific population groups. Pursuit of healthy, nutritious, and sustainable diets requires a comprehensive approach that addresses interconnected challenges while ensuring adequate intakes for all. We need to leverage opportunities for change by fostering collaboration among stakeholders, advocating for policy reforms, and empowering consumers to make informed choices.

Prof. Dr. Czeglédi Levente

University of Debrecen, Department of Animal Science, Hungary

Graduated as an agronomist in 2000 at University of Debrecen, conducted PhD studies in animal science (2005), Dr. habil in animal science (2015) and full professor from 2020. He is the Head of Department of Animal Science (2019-).

He is working as group leader in livestock and poultry research programmes focusing on proteomic approaches to reveal the molecular background of efficient meat and milk production and product quality. He is conducting experiments to reveal the immune booster effects of various compounds of essential oil in ruminants. His research group improved isolation method for primary skeletal muscle cells from chicken and set up trials for 3D muscle cell production.

Lecturer of several subjects in animal production and breeding, molecular biology in animal science for BSc and MSc students and PhD candidates. Currently supervisor of one Hungarian and 6 foreign PhD students.

Head of Habilitation Committee in Agricultural Sciences, University of Debrecen. Secretary of Animal Science Doctoral School, University of Debrecen. Leader of technical efficiency knowledge area at Resilience for Dairy H2020 programme.

Number of publications is 173, 77 of them are papers in scientific journals. The cumulative impact factor of papers is approx. 90, number of Q1/D1 papers is 26.

Dr. Lei Cong

Dr. Lei Cong is a Senior Lecturer in Agri-food Management and Marketing at Lincoln University, New Zealand. With a PhD in Consumer Food Science from the University of Otago and an M.Eng in Food Science from Shanghai Ocean University, she has an interdisciplinary background that combines social and natural sciences. Dr. Cong's work primarily focuses on exploring consumer insights in sustainable food development, new product innovation, and the promotion of emerging technologies within the food sector. Her expertise lies in studying consumer perceptions of sustainable food materials and technologies, such as the reuse of agricultural by-products, alternative proteins, and functional foods, which help bridge the gap between food innovation and market adoption. By investigating consumer perceptions towards various product attributes, including food safety, cultural influences, communication strategies, and country of origin, her research further supports comprehensive new product development within the food industry. In addition, Dr. Cong cares about how current food regulations influence innovative food development, offering guidance to policymakers on shaping frameworks that better support food innovation and market growth. Dr. Cong has led and contributed to a number of research projects, covering those funded by New Zealand governmental agencies, collaborative projects with industry, and institutionally supported initiatives. By truly understanding the target consumers and markets, Dr Cong's research contributes to academic community as well as empowers food and beverage providers to address real market needs.

Milk alternatives: What drives US consumers' willingness to try and word-of-mouth?

Meike Rombach[1,3], **Lei Cong**[2,3] and David L. Dean[2]

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Plant-based milk alternatives are important beverages in US consumer markets. Sustainability, consumer awareness, lifestyle changes, and other value-based reasons are why these beverages are increasing in popularity. The present study is focused on plant-based milk alternatives. It builds on an online consumer survey that explores the factors explaining US consumers' willingness to try plant-based milk alternatives and their word-of-mouth sharing about these beverages. Animal welfare concerns, environmental concerns, health consciousness, and dairy preferences are the factors under investigation. Results show that animal welfare, dairy preference, environmental concerns, and plant-based milk enthusiasm are significant predictors for willingness to try plant-based milk alternatives. Dairy preferences, environmental concerns, and plant-based milk enthusiasm predict the word-of-mouth factors. Overall, plant-based milk enthusiasm is the strongest driver for both consumer behaviours. Best practice recommendations address marketers in the US food and beverage industry and provide suggestions on how to target different consumer groups based on nutritional preferences and needs and on value-based product characteristics.

Dr. Maryia Mishyna

Dr. Maryia Mishyna is an Assistant Professor at Food Quality and Design (FQD) group of Wageningen University and Research (the Netherlands). She obtained her PhD degree from Tokyo University of Agriculture and Technology (Japan) followed by an international career working on proteins, including from novel sources, in Israel, China, and Russia. Now she is leading the direction of Future Food Design at FQD. She is currently supervising 5 PhD candidates, BSc and MSc students, and is involved in courses on edible insects and product design. Her main research expertise and interest are in developing principles for the transformation of biomass of novel food sources into food ingredients. She works with edible insects, microalgae, yeast, and fungi, and the primary focus of her research is on techno-functionality, nutritional, and sensory characteristics of food ingredients. She also works on constructing various food matrices with novel food sources and demonstrates how traditional food products can be redesigned using novel food ingredients.

Reimagining food, or how novel food sources may shape the future of food design

Maryia Mishyna

Wageningen University and Research, Wageningen, The Netherlands

Approaches for food design have changed considerably during human history and were influenced by numerous factors, including technological development and sustainability trends. Novel food sources such as microalgae and edible insects attract special attention due to their nutritional value and sustainability prospects. However, these sources have diverse and unique structural and compositional characteristics and therefore require tailored strategies for their downstream processing. Moreover, the quality of food ingredients determines the range of food applications where microalgae and edible insects can be used. To widen potential food applications, conventional and mild processing techniques can be adapted to specific characteristics of these organisms. Also, downstream processing of these sources should aim to achieve valuable nutritional, techno-functional and sensory characteristics of food ingredients.

Nowadays, food design is particularly consumer-orientated. The most common way to incorporate novel food ingredients into the diet is re-designing traditional food products (such as bread, pasta, meat products, dairy, and beverages) while maintaining or improving the food quality. Also, consumers' acceptability of novel sources is of great importance, especially for insects due to neophobic reactions in consumers who traditionally do not consume insects. As a solution, insects are processed into food ingredients and thus more accepted as part of traditional foods. The quality of novel food ingredients along with the amount of incorporated food ingredients defines the quality of re-designed foods. Apart from this common approach, novel food sources can be a part of unexpected food innovations, such as insect beer.

Prof. Dr. Thierry Regnier

MSc., 1989; PhD in plant physiology and chemistry, 1994; Associate Professor, 2014; Full Professor, 2016

He is a Full Professor in the Department of Biotechnology and Food Technology, Faculty of Science at the University of Technology in Pretoria, where he has been a faculty's member since 2007. Prof Regnier is involved in lecturing research methodology, academic writing, food analytic modules for the advanced and postgraduate students. The interest of his research team lies in the area of sustainable food production, phytomedicines, and in particular alternative proteins sources as a way to improve nutrition in Africa. He works in research areas related to cellular agriculture and uses indigenous crops and fungi as the core production. He is the South African Ambassador for the GHI (Global Harmonization Initiative). He has been involved in different ERASMUS programs and has a long collaboration with Reunion Island and is part of the QUALIREG, the Indian Ocean program initiative. He continuously reviews for several journals, serving as a board member of 5 societies nationally and internationally. He is continuously interested in researching the various topics related to food security and safety. His research has also spanned many facets of biotechnology and chemistry.

Alternative proteins - current status and future prospects: where Africa stands

T. Regnier, M. Thaoge-Zwane, B. Meiring, K. Maseko, K. De Jager, C. Van Rooi

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The demand for protein-rich foods and dietary diversification is increasing, not only due to population growth but also because of the rapidly emerging middle class in developing countries. It is projected that the world population will be over 10 billion by 2050 with more than 2.4 billion living in Africa. Political uncertainty and climate changes contribute to rising food insecurity and shortages leading to malnourishment. In particular, a country like Madagascar has been experiencing critical malnutrition. The transformative avenues promising to address this challenge are the valorization of traditional crops/food (including entomophagy) and cellular agriculture. This presentation focuses on the contribution of a diet including indigenous crops and insects to provide a sustainable source of proteins achieving one of the sustainability goals set by the World Health Organization. It discusses the ability of biotechnology to act as a tool to assist in solving the issue as it is far from being fully exploited. This highlights the need for more skill transfer and sustainable processes. However, it is evident that the potential indigenous crops, the development of cell-based hybrid products and insects in Africa, should be supported as they can play a crucial role in shaping a more sustainable fortified food supply for the continent. However, regulations and food safety concerns due to improper processing and storage methods constitute a risk to the broader acceptance of such products in the future.

Dr. Tamás Szigeti

Dr. Tamás Szigeti, honorary associate professor at University of Debrecen and University of Szeged Faculty of Engineering, was graduated as chemical agricultural engineer at Keszthely. Post graduated as special engineer for environmental protection at Gödöllő and as special instrumental chemical analytical engineer at Budapest Technical University. Being the editor-in-chief of the Journal of Food Investigation (Élelmiszervizsgálati Közlemények) for 9 years and the head of the Hungarian delegation to the FAO/WHO Codex Alimentarius Committee CCMAS (Codex Committee Measurement, Analysis and Sampling) for 8 years was a substantial part of his work. As his special interests are food and environmental safety and sustainability, he is an invited lecturer at the Faculty of Engineering of the University of Szeged, in the Food Safety Engineering course on separation technology and board member of the Hungarian Association of Environmental Enterprises (HAEE, Hungarian abbreviation: KSZGYSZ). As strategic director at the Bálint Analitika Ltd. accredited testing laboratory, he can draw on his experience from previous jobs like, engineer of a pesticide residue, later occupational health laboratory, leader of an instrumental analytical laboratory at a water work plant, deputy director and chief engineer at governmental county food control institution, and business developing director at Wessling. His mentionable scientific topics: pesticide residues, occupational health expositions, food-chain, environmental safety, transition compounds of food and feed processing, relation between the environment and food-chain safety, and the connection between the sustainability and the base laws of thermodynamics.

Mineral oil origin pollutants (MOSH/MOAH) in our environment and foods

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Background: Just over a decade ago have emerged a quite new risk between the food safety topics: from somewhere several saturated and aromatic hydrocarbon molecule appeared in food products and packaging material.

Aims: While more of these compounds are highly harmful, it is necessary to survey their origin, sources, their metabolic effects overview the contemporary situation and to develop appropriate methods for their chemical analysis.

About these compounds: The size of these crude oil origin compound is in a so wide molecule mass range, from a light, volatile carbon chains, to a very long, heavy hydrocarbons, including different, less harmful saturated compound, and very dangerous, aromatic hydrocarbons too. The saturated, aliphatic, or branched chain molecules (MOSH – Mineral Oil Saturated Hydrocarbons) mean the less threat, than the compounds containing aromatic rings (MOAH – Mineral Oil Aromatic Hydrocarbons). These latter compounds may disturb the genetic systems of the warm-blooded organisms, between them the human genetic hereditary system. Even benzene is highly toxic, let alone the polycyclic compounds containing several aromatic rings. The main point of attack for these compound is the aryl hydrocarbon receptor system (AHR), which among the other things, controls the detoxification, xenobiotic metabolism, the immune tolerance, different cellular processes, differentiation of organ genesis. The long term intoxication with the mentioned pollutants, may cause even cancerous diseases too.

Results: There is necessary to monitor these compounds, to develop appropriate analytical methods to separate the non-expected oil-like compounds from the food contact materials, carbon hydrate, protein, and fat/oil containing food products. The presentation outlines the more frequented sources, harmful effects of MOSH/MOAH, and give a short summary of the laboratory analytical methods for the identification and quantification of MOSH/MOAH compounds in different food products. In the laboratory practice there is a standard HPLC/GC/FID preparing and detecting technology. At our laboratory our colleagues applied a more easy method to sample preparation using an $AgNO_3$/Silica column cleaning system and a two column GC separation with flame ionization detection.

Conclusions: These mineral origin compounds exist in our environment, appear in the agricultural and food production, they are detectable lot of food contact material (e.g. cardboards). The pollution may arise from different lubricants, printing dyes, glue products, traffic accidents, and even geochemical sources too. Many thanks for Máté Czigány analytical engineer for his value contribution.

Dr. Ralph Rühl

Degree in Chemistry/Biochemistry from the Free University of Berlin. PhD with research carried out in Berlin, Germany and partly in France. All diploma and doctoral research since 1993 in the field of vitamin A. Short term postdoc at Queens University in Kingston, Canada in the field of vitamin D, followed by a long term postdoc at the Department of Nutritional Science at the University of Potsdam, Germany in the field of carotenoids / vitamin A. Since 2003 independent research group leader at the Medical Health Centre of the University of Debrecen. Supervisor of 16 Masters / Diploma theses, 7 PhD students, 2 MD student theses, 2006 habilitation in medicine, PI of three major EU projects in the field of food / nutrition and participant of 7 COST actions. Over 110 peer-reviewed publications, cumulative impact factor <500, citations <5000, total H-index currently 41, inventor of three international patent families. Since 2019, founder and CEO of the spin-off / start-up company CISCAREX UG, in Berlin to commercialise research results around vitamin A5, MINA5.de.

Vitamin A5, a newly identified micronutrient for the brain: What are the facts and what is still missing?

Ralph Rühl

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A new vitamin is on the horizon and it is first necessary to clarify what the basic definition of vitamins is. What is a vitamin? Which institutions are generally responsible for the official recognition of the status of a vitamin and what legal basis exists? How were other vitamins identified and established as essential nutrients in the last century? And specifically in this case: What is vitamin A? What are the defined biological functions of vitamin A?

This new vitamin was discovered 80 years after the last identification of a vitamin and named vitamin A5. Which criteria are still missing? How can vitamin A5 be embedded in the partially incorrect and misleading definition of vitamin A?

In this overview, we summarize all the important findings in order to openly evaluate this current situation. In addition, missing details of this new vitamin concept are identified. These details - what is present and what is missing - are evaluated in the historical and current context.

Dr. Tibor Cselényi

Senior Head of Quality Systems and Product Development at Progress Restaurant Chain Ltd. Hungary

Tibor Cselényi obtained a medical degree in Saint Petersburg in 1989. He became board certified in medical microbiology and worked in this field until 1996 at the Saint László Hospital in Budapest. He has been working at Progress Ltd. since February 1996, where he was initially responsible for building food safety systems (HACCP, Food Safety Audits). In addition, he obtained his second degree in 2000 at the Department of Food Chemistry of the University of Horticulture, as a Food Industrial Quality Development Engineer. At the same time, he took over the management of the Quality Systems department, within which he was responsible, among other things, for the development of suppliers and products according to the latest achievements in nutrition science, for the food safety and quality systems operated by the suppliers, and for the safety and quality of raw materials. His important task is the supervision and development of the food safety systems operated in the restaurants, and the integration and development of operating procedures into quality systems. He works in close cooperation with different departments of the company to strengthen the reputation of the brand, such as the Our-Food-Your-Question transparency program. In the field of food law, I am in constant contact with legislators and official control bodies to provide the company with authentic information about legal requirements and compliance.

Review of the therapeutic possibilities of carbohydrate restriction – A patient's perspective

Tibor Cselényi

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Background: This year's annual conference was held in London by Public Health Collaboration, a registered charity in England with the mission to inspire, educate and convince that the most common diseases can be prevented and reversed through a sustainable lifestyle change and a healthy metabolism.

Aims: My goal in this respect is to draw attention to the huge potential in changing the diet the way it supports a normalized healthy metabolism accompanied by a significant improvement in all aspects of health and show the unfortunate parallel development of different treatment options within and outside of academic institutions.

Methods: The conference sought answers to such important questions as:

1. Historical background of the treatment and cure of diabetes
2. The role of cholesterol in the development of cardiovascular diseases etc.

Gary Taubes spoke about his new book, entitled: Rethinking Diabetes. The book examines and rethinks the topic from a less medical or nutritional science perspective, rather from a historical perspective, from the first mention and description of the disease and the variation in the treatment of it, comparing it to the current medical standard of care on the basis of nutrition science development. It shows how a leading symptom, such as elevated blood sugar, guides the same therapeutic concept for two completely different diseases. In this area, several speakers reported that prevention and reversing type 2 diabetes is possible. David Unwin GP, with his own patients and his entire practice, has already become a literature example in UK and many of his publications report on their excellent results, with lots of savings for patients as well as for NHS. There are polarized and intense debates about the role of cholesterol in cardiovascular disease at the scientific level. In mainstream lipidology the role of cholesterol in the development of CVD is considered causal and unquestionable. Dave Feldman tried to take his own destiny into his own hands when he discovered a new, previously unreported phenotype, which he named the LMHR (Lean Mass Hyper Responder) phenotype. Such individuals have low body fat, are athletic and lean, and when on a very low-carbohydrate diet, usually leading to ketosis, their blood lipid profile is changing. The three cardiovascular blood lipid risks, HDL-C will be very high, triglycerides will be very low, and LDL-C will be extremely high. So far, high cardiovascular risk has usually been attributed to low HDL-C and high triglycerides in addition to elevated LDL-C. The question is, if two of the three markers are excellent, then does the third represent a danger. This realization led to the launch of the LMHR study based on the LEM (Lipid Energy Model) theory, which monitors the subjects' CAC score value for a year and examines whether high LDL-C is dangerous for the development of plaques formation.

Conclusions: These topics received high attention over the course of two days, the speakers reported remarkable results, which I will not have the opportunity to present in a few minutes, but I will try to highlight important and interesting elements and support them with scientific references.

Prof. Dr. Diana Bogueva

Diana Bogueva is a social scientist with a PhD from Curtin University, specializing in sustainable food consumption, generational consumer behavior, food and masculinity, alternative proteins, novel food processing technologies, and food sustainability and harmonization. Her work has received several prestigious awards, including at the 24th and 28th Gourmand Awards, often likened to the Oscars for food books, for her edited book "Environmental, Health and Business Opportunities in the New Meat Alternatives Market" (2019) and co-authored book "Food in a Planetary Emergency" (2022). Her recent co-edited book "Nutrition Science, Marketing Nutrition, Health Claims, and Public Policy" (2023) is a finalist at the Association of American Publishers Awards for Professional and Scholarly Excellence (PROSE) Awards. Diana is currently a Research Fellow at the Curtin University Sustainability Policy Institute, where she also teaches the "People and Planet" unit as part of the Masters in Sustainability and Built Environment. She is the President of the Global Harmonization Initiative, headquartered in Vienna, and serves as a Board Member and Chair of the Consumer Perception Working Group.

Consumer perception of Gen-Z on the future of food

Diana Bogueva

Curtin University Sustainability Policy (CUSP) Institute, Bentley Western, Australia

Dietary choices impact both personal and planetary health, and as the world faces sustainability challenges, alternative protein sources are gaining traction as a solution. With interest in non-meat-based protein options rising, a transition towards plant-rich diets seems to be unfolding. Innovative alternatives such as plant-based proteins, insect-derived options, algae, fermentation products, and lab-grown meats are being developed to replace conventional animal-based foods.

This presentation explores the future of food by diving into the realm of alternative proteins and examines the factors driving consumer adoption. It highlights key nutritional, environmental, and ethical considerations while addressing the major challenges these innovations face in meeting consumer expectations. Special emphasis is placed on Generation Z, whose unique attitudes and values play a crucial role in shaping these emerging food trends. The presentation also explores Gen-Z's perspectives on the benefits and concerns associated with alternative protein production and consumption.

Finally, the presentation unpacks the evolving dynamics of the food market, where sustainability, nutrition, and flavor intersect, offering opportunities for the food industry. With a focus on inspiring curiosity, challenging preconceptions, and fostering innovative thinking, the presentation aims to illuminate the path towards a more sustainable and inclusive food future which need to be substantiated and receive the approval of Gen Z.

ORAL ABSTRACTS

Alternative, innovative and sustainable protein sources

Diána Bánáti

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Alternative, innovative, and sustainable protein sources are emerging as vital solutions to address the growing global demand for food while minimizing environmental impact. These sources include plant-based proteins, such as legumes, nuts, and grains, which offer rich nutritional profiles and lower greenhouse gas emissions compared to traditional animal agriculture. Plant-based meat and milk substitutes have also attracted consumers. Additionally, cultured meat or lab-grown meat present a promising innovation, allowing for meat production without the ethical and environmental concerns associated with livestock farming. Edible insects, known for their high protein content and efficient feed-to-protein conversion, are also gaining attention as a sustainable protein source. Some of these alternatives may have limited success in the future due to the price and/or consumer perception. However, these alternatives not only provide diverse dietary options but also contribute to food security and sustainability efforts worldwide.

Consumer health risks from raw pet food: Pet owner perceptions and practices

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Background: Raw pet food is becoming increasingly popular, although it poses a potential risk to public health due to the transmission of antibiotic-resistant microorganisms and cross-contamination with pathogens in domestic environment. Raw pet food was already recognized as an emerging public health risk by the European Food Safety Authority.

Aims: The main aim of this study was to investigate how pet owners who feed raw meat to their pets perceive food safety risks and manage food preparation at home. The differences between pet owners who do not feed their pets raw meat and those who do were also analyzed.

Methods: An online questionnaire with 28 questions was distributed to Slovenian pet owners via special social media groups. The data was evaluated and analysed using the SPSS statistics program. The type of pet food was used as the main independent variable.

Results: 750 respondents took part in the survey. They were divided into two groups: The "raw group" consisted of 382 pet owners who fed raw meat to their pets, while the "conventional group" consisted of 368 pet owners who did not adhere to this practice. The study found that participants in both groups had similar perceptions of the overall risks involved. The results showed that respondents in the raw group washed their hands and cleaned surfaces more frequently than respondents in the conventional group. High levels of self-efficacy, regardless of the type of pet diet, were not later confirmed in the self-reported behaviours that revealed important food safety malpractices, such as rinsing raw meat and thawing frozen raw meat at room temperature. The study also showed that respondents relied heavily on online information about the raw meat-based diet for their pets.

Conclusions: These results shed light on the trend of how many Slovenian pet owners already feed raw meat to their pets. This data is also crucial for the development of specific food safety awareness campaigns, for a better understanding of the risks and for safety guidelines for those who feed raw meat to their pets.

Consumer acceptance of ice cream with improved nutrient profile

Ana Buda[1,2], Tina Tušar[2], Jasna Bertoncelj[1], Blaž Ferjančič[1], Alenka Levart[1], Petra Mohar Lorbek[1], Mojca Korošec[1]

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Background: In the Western world, problems with obesity and chronic non-communicable diseases related to poor nutrition are increasing. Food reformulation could help improve the nutrient profile by reducing nutrients of concern and increasing desirable nutrients. In addition to price, it is crucial that sensory attributes and shelf life are maintained, as consumers often react negatively to significant changes. Reformulation can also pose technological challenges, for example in ice cream, one of the best-selling dairy products, being high in sugar and fat.

Aims: The aim of this study was to determine the differences in physicochemical and sensory properties of standard samples of ice cream on a stick compared to reformulated samples.

Methods: We analyzed four pairs of samples. We determined the nutritional values by physicochemical analysis and calculated the Nutri-Score, which is a candidate for the EU harmonized front-of-pack nutrition label. Sensory analysis and a panel of 32 young consumers were used to determine differences in sweetness within pairs using a paired comparison test. Using the descriptive 'Check all that apply' (CATA) method, we determined the descriptors associated with the samples, while liking for their attributes and overall was assessed using a 9-point hedonic scale. Consumer habits in relation to ice cream consumption were investigated using a questionnaire.

Results: The reformulated samples contained fewer carbohydrates and sugars and had a lower energy value. They had a higher fibre and protein content. The fat content was only statistically different in two pairs, with the reformulated sample having a lower value. The reformulated samples received a Nutri-Score C, while the standard samples received a one level higher. In three pairs samples differed in the sweetness intensity. Most descriptors identified by CATA were similar across samples within pairs and no significant differences in liking between samples within pairs were found. Young consumers consume ice cream most frequently in summer, when they eat it several times a week, with friends or as a dessert. Most of them do not pay attention to the nutritional value of ice cream, they prefer traditional flavours, milky ice cream in a cone, which is the most commonly bought in stores.

Conclusions: The reformulation of ice cream on a stick improved the nutritional value of the product and the Nutri-Score rating. It led to some changes in the perception of flavour and mouthfeel, but did not affect liking compared to standard samples. The study demonstrates the potential of ice cream reformulation.

To wash or not to wash? A focus groups investigation of Slovenian consumers' food handling of fruits, vegetables, meat, poultry & fish

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Background: Most foodborne outbreaks in the European Union occur in the home environment (EFSA, 2016-2021) [1], which clearly shows the importance of consumer food safety. Improvements of consumer food safety first require a better understanding of consumer food safety, especially the aspects of consumers' knowledge, attitude and practice related to food safety.

Aims: While several studies of this topic have already been completed in various countries, there are still some regions where the topic is underinvestigated. To address this research and knowledge gap in the wider Central European area our study aimed to investigate consumer food safety in Slovenia through a series of focus group discussions.

Methods: The topics included in the focus groups' questions covered a wide range of food handling practices from shopping to cooking. Forty consumers in Slovenia with different demographic characteristics (gender, age and education) participated in the study, which was conducted both in person and online. There were on average four participants in each focus group and each person only joined the focus group once. Structured focus groups discussions were based on 19 questions created from a matrix of consumer food safety. Each focus group conversation lasted approximately 1 to 1.5 hours.

Results: The presented results will include highlights of the replies to questions about washing of different food items (from fruits and vegetables to meat, poultry and fish) during food preparation. Consumers' reasons and concerns that contribute to these diverse safe and unsafe or risky practices will be explored. The presentation will cover both examples of good practices and risk increasing practices.

Conclusions: The presented findings could be used as guidelines relevant in the development of different interventions aiming to improve consumer food safety and by that also lead to improvements of public health.

Reference:

[1] EFSA. Foodborne outbreaks - dashboard. https://www.efsa.europa.eu/en/microstrategy/FBO-dashboard

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Application of aqueous ozone for controlling *Diaporthe toxica*, a mycotoxin producing fungal species

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Background: Interest in plant-based proteins, particularly those obtained from lupin beans, has rapidly increased in last years. On the other side, concerns for potential risks associated with this food matrix have been raised, since lupin is the primary source of a mycotoxigenic fungal species, *Diaporthe toxica*. Phomopsin-A (PHO-A), the main mycotoxin produced by this fungus, showed deleterious effects on livestock, and has been classified as possibly harmful for humans. Unfortunately, only limited information on this species is available in the scientific literature. Moreover, no treatments are documented for the reduction of PHO-A in lupin intended for food consumption. Ozone, a strongly oxidizing molecule, showed a great potential in the inactivation of both microorganisms and related toxins, but no research has been conducted on PHO-A.

Aims: This study aims to characterize *D. toxica*, including its growth and metabolites production. Moreover, ozone treatments with different durations have been conducted on inoculated lupin beans, to evaluate its effectiveness and applicability in reducing PHO-A.

Methods: Different agar media (Oat Flake Medium (OFM), Potato Dextrose Agar (PDA), Yeast extract, Peptone, Dextrose (YPD), Malt Extract Agar (MEA), Water Agar (WA) and WA with lupin beans) have been inoculated by using an 8 mm mycelial plug of a 5-day-old *D. toxica* culture, and then incubated at 25.0 ± 0.1 °C for 21 days. Fungal growth was evaluated by means of diameter growth measurements, and the spore production was confirmed by optical microscopy. In addition, lupin beans were inoculated following 3 different protocols, and PHO-A was quantified over time. Finally, inoculated lupins were subjected to a 7.00 ± 0.01 ppm aqueous ozone treatment for 4, 6 and 8 hours; then, fungal load and PHO-A reduction were evaluated by microbiological sampling and µSPE extraction followed by UHPLC-MS/MS analysis, respectively. Moreover, alkaloid variation was investigated by HPLC-MS/MS.

Results: Results from fungal growth evidenced the ability of *D. toxica* to develop mycelium in different media, particularly on OFM and PDA. With respect to the spores production, it was achieved only by using lupin beans as growth substrate. Successively, PHO-A production data in different conditions showed a diverse fungal adaptation to the environment: on rehydrated lupin beans, *D. toxica* produced PHO-A values up to 1082.17 ± 0.01 ppm, while in commercial lupins PHO-A only reached 138.81 ± 0.01 ppm. Moreover, the evaluation of alkaloids revealed that this strain can produce alkaloids similar to those of lupin, if grown on this legume. Concerning the effectiveness of aqueous ozone in the reduction of the microbial load and PHO-A, the treatments could not reduce *D. Toxica* count significantly in most cases, but nearly 20% PHO-A reduction was observed for all the samples.

Conclusions: In conclusion, results highlighted some critical aspects of *D. toxica*, introducing new information to better understand its metabolism. The knowledge gained in this study might help reduce the risk of PHO-A formation in lupin beans. Moreover, aqueous ozone treatment demonstrated a promising potential for the reduction of PHO-A.

Analysing yoghurt peptides pattern profiles by MALDI-TOF MS

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Background: Commercial yoghurt is a dairy product obtained by bacterial fermentation of milk by using standard starters. MALDI-TOF MS is suitable for monitoring and quality assurance of fermented yoghurts and their starters.

Aims: This study aims to expand and maximise the benefits of using MALDI-TOF MS by analysing yoghurt peptide pattern profiles to understand yoghurt's composition comprehensively.

Methods: Matrix-assisted laser Desorption/Ionisation Time-of-Flight Mass Spectrometry (MALDI-TOF MS) is an analytical technique utilised in this study. The process begins with the extraction of peptides from the yoghurt sample. These peptides are then mixed with a matrix solution (HCCA). The peptides-matrix mixture is spotted on a MALDI target plate. During MALDI-TOF MS analysis, the mixture is evaporated and ionised. These ionised peptides are then accelerated through a flight tube, and their time-of-flight is measured. This case depends on the ion’s mass and the value of charges (m/z). Finally, we are generating a mass spectrum, displaying peaks corresponding to the different proteins and peptides in the sample.

Results: Analysing peptide pattern profiles in commercial yoghurt, allowing to determine the final characteristics of the fermented product, identify unexpected peptides that can signal contamination or spoilage, verify the type of milk used (cow, goat, sheep, etc.) and bacterial strains used in fermentation, all of this leads us to the possibility of detecting adulteration, such as the addition of non-dairy proteins or non-traditional fermentation processes.

Conclusions: Utilising MALDI-TOF MS to analyse yoghurt peptide pattern profiles provides a promising method to enhance our understanding of how milk components affect yoghurt's nutritional and sensory characteristics, supporting the maintenance of high standards in yoghurt.

Enhanced nutritional profile and texturization in low-moisture meat analogues using mycelium: A sustainable protein alternative

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Background: The increasing global demand for sustainable and nutritious protein sources has driven innovation in plant-based meat analogues. Mycelium, derived from fungi, has emerged as a promising protein alternative due to its meat-like texture and high nutrient content. However, the potential of mycelium in meat analogue applications remains underexplored.

Aims: The aim of this study was to determine the ideal extrusion conditions and mycelium substitution levels to achieve superior water holding capacity, textural characteristics, and nutrient enrichment, thereby creating a sustainable and nutritious plant-based meat alternative.

Methods: Extrusion was carried out using a co-rotating twin screw extruder at die head temperature (T_{DHT} 130-160 °C), screw speed (SS 30-100 rpm), feeder speed (FS 5-25 rpm), and moisture (FM 30 % wb) to select the best condition for developing MA. At the selected condition, MY substitution was varied from 0 to 40 % w/w. The extrudate was dried in a tray dryer at 50 °C and 1 m/s air velocity for 6 h. The system parameters, physicochemical, textural, and rehydration and nutritional properties of the developed MA have been evaluated.

Results: Better texturization was found at 140 °C T_{DHT}, 40 rpm SS, and 10 rpm FS, i.e., 0.5 kg/h. The system parameters varied as mass temperature (109-129 °C), die pressure (140.699.3 bar), torque (24.15-13.67 Nm), and SME (656.55-384.54 kJ/kg). An increase in MY resulted in higher WHC (259.85 to 469.37%) till 30 % but for 40 % mycelium, it dropped to 192.51 % due to weaker protein-fiber interaction. The hardness (42.71-18.14 N), springiness (86.3-78.7 %), and cohesiveness (0.46-0.36) decreased with an increase in MY, whereas the texturization index was found greater than 1 for all. Iron (21.11 mg/100 g), calcium (71.13 mg/100 g), selenium (64.08 µg/100 g), and vitamin D_2 (60.78 µg/g dw) in MA were improved at 30 % MY addition making it a healthier product.

Conclusions: This research presents a promising solution to the ever-growing challenges of sustainable protein sources, offering an environment-friendly and nutrient-rich meat analogue.

Sniffin' Sticks odour identification subtest for volatile aroma compounds using a coupled analytical system

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Background: Of the five main modalities of the human body, smell is the most complex and unique. The most widely used psychophysical test for testing human olfactory perception in the world is the *Sniffin' Sticks* test (Burghart Messtechnik GmbH, Holm, Germany) and its developments and adaptations. These tests are simple, relatively chepap diagnostic tools for testing olfactory threshold, olfactory discrimination and olfactory identification abilities.

Aims: The exact composition of the aroma components in the 16 pens in the Sniffin' Sticks identification subtest is still unknown. My objective is to determine the aroma components of these pens using a gas chromatography-mass spectrometry-olfactometry (GC-MS-O) coupled analytical system.

Methods: Measurements were performed with the Shimadzu GCMS-QP2010 SE+PHASER Pro Olfactory GC Port instrument set MEGA-WAX MS 60m×0.25mm×0.25µm; 4.8m×0.25mm inert; 3m×0.15 mm inert columns. The caps of the pens were placed in a glass vial pre-filled with glass beads and sealed with a Mininert® valve (Supelco, Bellefonte, USA, PA), The vial was then conditioned in a water bath at 37 °C for 30 min and the SPME sample holder (2 cm, 50/30µm DVB/CAR/PDMS, Stableflex (Supelco, Bellefonte, USA, PA)) was placed for 20 min. Before testing the caps, a blind measurement was performed. The injector and mass spectrometer temperature was increased from 40 °C to 250 °C at 8 °C/min. The rate of He (6.0) was 1 ml/min, while the rate of air (5.0) was 5 ml/min, and a split ratio of 0.24:0.76 (MS/olfactometry) was used. The injector was used in splitless mode with a 2 min draw-off delay and a 6:1 draw-off ratio. The results were evaluated using LabSolutions and Olfactory Voicegram, and the NIST05 and NIST05s spectral libraries were used to identify the components.

Results: The aroma compounds were identified and characterized in the order of elution (retention time, compound name, % of area under peak, odour compounds detected, odour intensities (weak, medium, strong)). A total of 2-39 odour compounds were detected in the pens, the least in the volatile fraction of pen 1 and the most in the volatile fraction of pen 2. Solvents, propylene glycol and diethyl phthalate and their derivatives were also present among the odorants of some pens. The advantage of GC-MS-O is that the chemical and organoleptic characteristics of the aroma compounds could be evaluated together and matched.

Conclusions: The mass spectrometer cannot distinguish enantiomers and isomers with high confidence, and therefore an enantiomer-selective column, possibly tandem GC, should be used for this purpose. A further test possibility is to determine the amount of overlap between real and "simulated" odours.

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Food tech innovations for nutrition and health security

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Several countries of the world including India are currently combating the crisis of malnutrition. Despite substantial improvements in health and well-being, iron deficiency anemia (IDA), protein deficiency, and lifestyle-related non-communicable diseases (NCD) like diabetes are in alarming stages. Fortification of staples with micronutrients like iron, vitamin B_{12}, folic acid as well as balancing energy and amino acids are panacea for the malnutrition. Effective implementation of food fortification coupled with the use of innovative food processing and packaging technologies are key to providing nutrition and health security to masses. Extrusion is the most versatile, reliable and sustainable technology for a successful and cost-effective thriving food fortification programme.

Extrusion technology has been used to produce ready-to-cook (RTC) fortified rice kernels (FRK), fortified rice noodles (FRN), low glycemic rice (LGR), essential amino acid balanced nutri dal / pulse (NHD), and even micronutrient (Fe, Se, Ca, sand vitamin D_2) enriched low moisture meat analogue (LMMA). The broken rice, mixture of broken pulses, millets, pseudo cereals, proteins and mycelium are respectively ground into flour, mixed with desired amounts of micronutrient fortificants (either natural or synthetic) and conditioned. The conditioned rice/legumes/millet flours are then fed into a twin-screw extruder, specially designed and fabricated for the purpose, to produce the speciality products with enhanced micronutrients which are then dried, polished (for rice), and packaged. Details of the product formulations, manufacturing technologies and health benefits shall be discussed.

Model studies for the assessment of prebiotic nature of selected food components with transformed carbohydrate profiles

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Objective:
Our goal was to develop a method for the assessment of prebiotic properties of enzyme-treated food components, making it possible to evaluate and model the extent of stimulation of probiotic strains. The transformed carbohydrate profiles and the obtained results allow us to apply these samples and procedures to further functional food developments. Matherials and methods:

Prebiotic effects of various, enzymatically hydrolyzed cereals and pseudocereals (oat, amaranth, buckwheat, chickpea, rye, millet)) were studied. Probiotic bacterium *Lactobacillus plantarum* was selected as model strain, and cellulase and xilanase were applied to trigger degradations. Various enzymatically degraded suspensions were applied to MRS medium. The cell number of the original bacterial culture was inferred from the number of bacterial colonies formed on the solid media. The number of cells per unit volume is directly proportional to the actual prebiotic impact of the studied sample.

Results:
The developed method proved to be suitable for the assessment of the growth of probiotic bacteria, as well estimation of plausible prebiotic impact of various samples. The growth of the studied probiotic bacterium was most effectively stimulated by oat and amaranth digested by cellulase for 2 hours and chickpea suspensions digested for 24 hours. In cases of the other samples moderate growth was observed. For some samples, no significant increase was found.

Conclusion:
In our study, the potential prebiotic effect of several enzymatically hydrolyzed food components was demonstrated. It was established that tere is a great distinction between the prebiotic effects of substances treated under different conditions, however it is obvious that enzymetreatment largely contributes to the enhancement of the prebiotic impact of carbohydrate-rich food components. The tested substances and procedures might be suitable for further application in the functional food industry.

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Isolation of moulds from Hungarian apples: Emerging contamination risks from mycotoxin producers uncommon in Central Europe

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Background: Apples are one of the most consumed fruits worldwide and a key crop in Hungary. Despite their robustness, apples are susceptible to various biological diseases, with fungal infections being a significant concern. In recent years, apple producers have become increasingly aware of the risks of mycotoxin contamination, particularly patulin, which is commonly found in apples and apple products.

Aims: This study focuses on the isolation of molds from Hungarian apples, highlighting emerging contamination risks from mycotoxin producers uncommon in Central Europe.

Methods: In this study, fungal colonies were isolated from 40 apple samples from seven Hungarian locations. Each apple was placed in a Stomacher® bag with 90 ml peptone water and shaken vigorously. A serial dilution was performed, spread onto Malt Extract Agar plates, and incubated for 7 days at 37°C. Fungal colonies were selected from the plates. Subsequently, the colonies' morphological and spore characteristics allowed grouping into four clusters: *Aspergillus*, *Alternaria*, *Penicillium*, and others. DNA from *Aspergillus* and *Penicillium* cluster representatives was extracted and identified via ITS sequencing. The presence of *idh*, a key gene in patulin production, was checked with thin-layer chromatography after 7 days of incubation in malt extract broth at 37°C.

Results: A total of 183 moulds were identified from apples of seven locations and different farming methods, with 67 isolates belonging to the *Alternaria*, 45 to the *Aspergillus*, and 13 to the *Penicillium* group, the remaining were classified as others. The *Aspergillus* isolates belonged to *A. fumigatus* (28), *A. flavus* (15), *A. nominus* (1), and *A. clavatus* (1). This was the first *A. nomius* reported in Hungary isolated from a crop, this species is recognised as aflatoxin producer. The only *Aspergillus* strain that presented a positive result for the patulin gene was the strain *A. clavatus* B9/6, originated from Debrecen-Pallag, this ability was confirmed with TLC assays. Unlike *Aspergillus* spp., for *Penicillium* isolates more than one strain presented bands for the *idh* gene, however, only for B10/6 was the band of the right size. ITS results stated this strain classified as *Talaromyces pinophilus*. The TLC tests confirmed this microorganism as the only patulin producer under the studied conditions for its cluster.

Conclusions: Two patulin producer moulds were isolated from the Hungarian apples, one belonging to the species *A. clavatus* and one classified as *Talaromyces pinophilus.* Also a strain of *A. nomius* was isolated, which is the first to be reported from a Hungarian crop.

Effect of addition of surfactants on the protein digestibility of pea protein concentrate powders.

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Background: Protein concentrate/isolate powders are an increasingly gaining usage as ingredient in sports & clinical nutrition, infant foods among other applications due to their pro-sustainability properties. However, their rehydration capacity, also referred to as solubility, a fundamental prerequisite for all other functionalities such as emulsification, gelation, and foaming, is quite low. Various techniques: enzymatic, chemical and physical, have been employed for the improvement of the solubility of these powder concentrates to enhance their usage. Whilst these modifications are expected and have mostly been proven to improve the solubility, limited research has been done on the resultant effect on the digestibility of the modified proteins.

Aims: The aim of this study therefore is to investigate the effect of the use of surfactants for improving the solubility of pea protein isolates/concentrates on the digestibility of the said proteins.

Methods: In this study, two surfactants, polyoxyethylene sorbitan 20 (aka Tween 20) and Lecithin, were used at concentrations of 0.01%, 0.05% and 0.1% to test for improvement of solubility of three commercial pea protein powders at concentrations of 1-10%. Solubility was calculated as the total solids content of supernatants obtained after centrifuging the suspensions, expressed as a percentage of the 1-10% protein suspensions prior to centrifugation. This was determined for freshly prepared suspensions with and without added surfactants as well as lyophilized then rehydrated samples. *In-vitro* digestion simulations were made according to the Infogest protocol 2.0.

Results: Preliminary results showed an increase in solubility across all proteins, even at the lowest surfactant concentration and with both surfactants. Further investigations on the effect of the addition of surfactant on the *in vitro* digestibility of the proteins will be presented including a comparison of the Digestible Indispensable Amino Acid Score (DIAAS) and the Protein Digestibility Corrected Amino Acid Score (PDCAAS) of modified and unmodified proteins.

Conclusions: Non-ionic surfactants directly interact with proteins in solution forming a protein-surfactant complex that results in improved solubility. However, these complexes may enhance or prevent the proteolytic cleavage by digestive enzymes.

Phytonutrients in food samples - how to solve analytical challenges

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Background: It is well known that many phytonutrients consumed on a daily basis are still unknown. This is mainly because phytonutrients have very diverse chemical structures. Nevertheless, an increase in the use for phytonutrients as ingredients of food supplements or functional foods created the demand for new sources of these compounds, especially those with known bioactivities (antioxidant activity, enhancement of immune response or cell-to-cell communication, lowering blood pressure and/or cholesterol level, etc.).

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

Methods: 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)) and (HP)TLC–effect-directed analysis (EDA) for targeted and non-targeted analyses of phytonutrients in food samples (e.g., food supplements, plant materials, food waste, bee pollen) will be discussed.

Results: Issues related to the lack of commercial standards and standard reference materials and unknown impurities in standards, the lack of chromophores, isomeric structures, stability of the analytes, were shown to be the main problem in development of chromatographic methods for analyses of phytonutrients in food samples. In (HP)TLC–EDA analyses of antioxidants and enzyme inhibitors in extracts of different samples (e.g. bee pollen, etc.) the effects of different parameters (e.g. stationary phase, time, etc.) have to be considered during the analysis.

Conclusions: Methods based on complementary chromatographic techniques provide important additional information during the method development process and also in discovery of new sources of phytonutrients, development of new food products as well as quality and safety control.

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Antagonistic effects of lactic acid bacteria isolated from faeces samples of domestic animal against toxin-producing moulds

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Background: Mycotoxins, toxic secondary metabolites produced by moulds, pose significant risks to animal health and agricultural productivity worldwide. The contamination of feed with mycotoxins like aflatoxin, deoxynivalenol, zearalenone, ochratoxin, and patulin is a critical concern in feed safety. Using the antimicrobial properties of lactic acid bacteria (LAB) to prevent the growth of moulds is a good way to deal with these harmful substances.

Aims: This research investigates the capacity of LAB strains isolated from faeces samples of domestic animal to detoxify animal feed by using their capability to inhibit the growth of moulds that produce mycotoxins.

Methods: From faeces samples of 9 animals (European bison, Buffalo, Wild pig, American bison, Pig, Male deer, Grey cattle, Female deer) 377 strains have been isolated and identified using classical and molecular microbiological methods. Antagonistic culturing methods were employed to evaluate the efficacy of these strains against aflatoxin B1-producing *Aspergillus flavus*, patulin-producing *Aspergillus clavatus* and in inhibiting the growth of *Penicillium digitatum*.

Results: Of the isolates, 16 strains belong to 2 species of the genus *Aerococcus*. 1 strain belongs to the genus *Bacillus*. 2 strains belong to 1 species of the genus *Carnobacterium*. 134 strains belong to 8 species of the genus *Enterococcus*. 49 strains belong to 8 species of the genus *Lactobacillus*. 20 strains belong to 1 species of the genus *Leuconostoc*. 11 strains belong to 1 species of the genus *Pediococcus*. 9 strains belong to 1 species of the genus *Weissella*. The other 21 species were non-LAB strains.

Among the 150 strains studied, 7% of LAB strains inhibited growth of *Aspergillus flavus*, 13% inhibited *Aspergillus clavatus,* and 13% inhibited *Penicillium digitatum*. Investigation identified several key inhibitory species, including *Enterococcus gallinarum/casseliflavus*, *Enterococcus faecium*, *Weissella thailandensis, Aerococcus urinaeequi*, *Lactiplantibacillus plantarum*, *Streptococcus equinus*, and *Streptococcus equinus/lutetiensis*.

These findings add to our understanding how LAB can be used for biocontrol and show that they could be beneficial in detoxifying animal feeds. This highlights the significance of using microbial interventions to improve food safety.

Keywords: lactic acid bacteria; domestic animals; mycotoxins; mould inhibition; animal feed safety

Enhancing the antioxidant activity of milk protein concentrate hydrolysates via enzymatic bioconversion

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Background: Milk Protein Concentrate (MPC) hydrolysates possess potential antioxidant properties, which can be enhanced through enzymatic treatment. The enzymatic breakdown of MPC releases bioactive peptides with enhanced radical scavenging abilities.

Aims: This study investigates the effect of different commercial enzymes on the antioxidant activity of 4% MPC hydrolysates, aiming to identify the most effective enzymatic treatment for producing bioactive peptides with high antioxidant capacity.

Methods: MPC samples were hydrolysed using six different enzymes: Trypsin, Pepsin, Chymotrypsin, *Streptomyces griseus* PSG type XIV, *Bacillus licheniformis* PBL type VIII, and *Bacillus licheniformis* PB type XXIV. Each enzyme was prepared in 50 ml Tris-HCl buffer, adjusted to the enzyme-specific pH (8.5 for Trypsin, Pepsin, Chymotrypsin, PSG; 9.5 for PBL; and 10 for PB). Hydrolysis was conducted by incubating the enzyme-substrate mixtures at the respective optimal temperatures (37°C for Trypsin, Pepsin, Chymotrypsin; 60°C for PSG, PBL, PB) for 24 hours with shaking. The hydrolysates were analysed via gel electrophoresis and their antioxidant activities were assessed using the DPPH radical scavenging method. The antioxidant capacity was quantified spectrophotometrically at 517 nm.

Results: According to the DPPH, the natural MPC sample has an inhibition percentage of 18.26%. The inhibition was in the range of 43% and 70%. The highest inhibition percentage was obtained in the case of treatment of 4% MPC with Trypsin (69.6%), and the lowest value was 43 % in the case of PBL type VIII (43%). The rest inhibition values were 69.6%, 57.1%, 50.8%, 47.4%,44.1%, and 43.0% in the cases of Trypsin, Chymotrypsin, Pepsin, PSG, PB, and PBL, respectively. These values are significantly higher than those in the control sample.

Conclusions: MPC hydrolysed by Trypsin demonstrated the highest antioxidant activity, followed by Chymotrypsin and Pepsin hydrolysates. These findings suggest that enzymatic bioconversion, particularly with Trypsin, is an effective method to enhance the antioxidant properties of MPC, presenting a potential for developing functional food ingredients with health-promoting benefits.

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Firas Alarawi and Botond Kalman Suli are PhD students at the Doctoral School of Food Science, the Hungarian University of Agriculture and Life Sciences.

Effect of nitrogen supplementation on the fermentation of commercial apple juice with different *Bifidobacterium* strains

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Background: Probiotics are living bacteria that, when given in sufficient doses, have positive effects on the host. Still, most of the available probiotics are dairy based products. Probiotics in fruit juices can be a suitable alternative for people allergic to milk proteins, intolerant to lactose or vegetarians. Fruit juices improve health widely and have a high number of antioxidants, vitamins and other nutritional substances. However, these beverages have insufficient amounts of peptides and free amino acids that are necessary for the metabolism of probiotic bifidobacteria.

Aims: The aim of this study was investigation of the effect of yeast extract and soy peptone as nitrogen sources on the fermentation efficiency and composition of the fermented apple beverage by *Bifidobacterium* strains.

Methods: Commercial unfiltered apple juice was fermented by six probiotic *Bifidobacterium* monocultures at 37°C for 24h. Two distinct types of *Bifidobacterium* strains were selected for fermentation of apple juice supplemented with two nitrogen sources at two different levels. Samples were taken at 0, 8, 16, 24 and 32 hours of fermentation and different parameters such as pH, bacterial viability, total phenolic content and antioxidant capacity were determined.

Results: Preliminary, the fermentation ability of apple juice by six *Bifidobacterium* strains was tested. After 24 hours of fermentation, the Bifidobacteria cell count in the apple juice was higher than 10^8 CFU/mL for all tested strains. These results showed that apple juice was suitable medium for cultivating various *Bifidobacterium* strains. Two strains *B. lactis* BB12 and *B. longum* DSM 16603 were selected for further studies. Supplementation of 2% yeast extract or 2 % soy peptone resulted in increase of cell counts to 9 log CFU/ml after 32 hours of fermentation by both strains. The antioxidant capacity decreased in all fermented juices after 32 hours of fermentation, except in the juices supplemented with soy peptone and fermented with *Bifidobacterium longum* DSM 16603 strain. Supplementation of 1% and 2% soy peptone increases the FRAP of apple juice from 5.63 mM $FeSO_4$ to 5.81 mM $FeSO_4$ and 8.47 mM $FeSO_4$, respectively. The TPCs of apple juices increased at the 8^{th} hour of fermentation, but after this time, the trends of changes were variable and strongly depending on the strain as well as the levels and quality of source of nitrogen supplementation.

Conclusions: The addition of nitrogen source had a positive effect on the *Bifidobacterium* growth and antioxidant capacity of the fermented apple juice products. It also increases the total phenolic contents in the first stage of fermentation process.

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Novel antimicrobial strategies for new food trends

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Background: The new food trends are moving in the direction of plant-based foods and circular economy. In this respect, plant-based antimicrobials are considered promising substitutes for conventional food additives. This study focuses on some emerging topics in food product development and proposes sustainable solutions involving the use of plant-based antimicrobials.

Aims: The aims of the study were to: 1. develop an active packaging using a cryogel made from starch containing hexanal able to hinder the growth of postharvest pathogens in sweet cherries. 2. evaluate the effectiveness of natural substances as alternatives to traditional additives (e.g. organic acids) for preserving ambient gnocchi.

Methods: For the first aim, the *in vitro* antifungal activity of starch cryogels loaded with 0.1, 0.5, and 1% hexanal was determined against two strains of *Botrytis cinerea*. Subsequently, the *in situ* efficacy of the treatment was evaluated on sweet cherries infected with *B. cinerea*, and finally, the impact of the treatment on the natural microbiota and quality attributes of the fruit was investigated.

For the second aim, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and fractional inhibitory concentration (FIC) were calculated to assess the antimicrobial activity of six essential oils (EOs) alone or in combination with each other, against twenty-five *Bacillus* spp. strains isolated from ambient gnocchi, as well as from raw materials used for gnocchi production. After that, selected EOs together with hydrolates, phenolic compounds, and tinctures were used in ambient gnocchi formulations.

Results: The cryogel system showed antifungal activity *in vitro*. In the presence of hexanal, the lag phase was significantly extended compared to the control, and reductions in the maximum level of growth were detected. The 0.5 % hexanal-cryogel significantly reduced the disease incidence and the disease severity of the sweet cherries during the first days of storage. Moreover, a significant reduction of total mesophilic aerobic bacteria and yeast counts was observed.

The study on the effectiveness of biopreservatives against *Bacillus* spp. revealed MICs values in the range of 0.31-1.25 µL/mL for the most active EOs, which were those with thymol and carvacrol chemotype. According to the FIC index combination, *Origanum vulgare* or *Thymus vulgaris* EOs associated with *Syzygium aromaticum* showed commutative effect, while the same EOs, associated with *Ocimum basilicum* showed indifferent effects. In different formulations of ambient gnocchi, the biopreservatives were as effective as lactic acid in containing the microbial community, especially when EOs and hydrolates were used.

Conclusions: Our findings suggest that the use of novel antimicrobial strategies such as coating with hexanal and biopreservatives are effective solutions to address postharvest decay of fruit and spoilage of ambient gnocchi. However, further studies exploring the hexanal control and release profile in the aerogels and the sensory aspects in gnocchi can be carried out in future.

The effect of intestinal digestion on gastric-digested saliva proteins-polyphenol complexes

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Background: Polyphenols may have detrimental effect on intestinal digestion, for example by inhibiting the digestive enzymes of the intestinal tract. In addition, some salivary proteins (such as PRPs or histatins) have a high affinity for some polyphenols, especially tannins. This affinity is considered to be a protective function of saliva against the deleterious impact of excessive polyphenols.

Aims: The objective of this research is to describe the effect of intestinal digestion on gastric digested saliva proteins-polyphenol complexes.

Methods: In the experiments, we use one hand a polyphenol mixture extracted from the apple cider variety Dous Moën containing 730 g/kg total polyphenols of which 44% were condensed tannins. On the other hand, clarified human saliva at a protein concentration of 0.72 mg/mL was used. Firstly, polyphenols and saliva were mixed at 2 different ratios of polyphenols to saliva (w/w) [high ratio and low ratio]. In a subsequent stage, the polyphenol-saliva mixtures were subjected to the INFOGEST static *in vitro* gastric digestion. Then, gastric digested samples were subjected to the INFOGEST static *in vitro* intestinal digestion. Samples taken at the end of intestinal digestion were centrifuged and SDS-PAGE electrophoresis was conducted on the pellets and supernatants. UPLC-DAD-MS analysis of the native polyphenols were performed on the supernatants.

Results: After intestinal digestion process, the vast majority of salivary proteins were fully digested, with only a few exceptions. A distinct band, particularly evident in pellets, was visible at 13.2 kDa, which possibly contains the constant region of immunoglobulin light chain kappa. Additionally, faint bands around 10 kDa were also present, which may contain defensins 1 or 3. The intestinal digestion process resulted in the complete degradation of all the analyzed polyphenols, likely due to oxidation in alkaline conditions.

Conclusions: In conclusion, *in vitro* intestinal digestion led to extensive fragmentation of salivary proteins. However, small salivary proteins and/or the resulting peptides resist digestion by trypsin and precipitate in intestinal conditions, regardless of the initial absence/presence of polyphenols.

Effect of ethanolic pretreatment on the content of reducing sugar and protein on the surface of potatoes

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Background: Thermal processing of starchy food at temperatures above 120°C causes a reaction between reducing sugars (RS) such as glucose and L-asparagine on their surface, leading to the formation of acrylamide, a class 2A probable human carcinogen. Detection of acrylamide is a complex and costly undertaking, and attempts are necessary to make the qualitative and quantitative determination more accessible.

Aims: This research aims to optimise the detection process of reducing sugars in potato samples as well as to investigate the effect of ethanolic precipitation on the changes of reducing sugars and protein content on the surface of different potatoes.

Methods: Locally sourced red and white potato varieties, both peeled and unpeeled, grated and juiced, were tested for their RS and protein content. Reducing sugars were quantified using the Somogyi-Nelson method with arsenomolybdate and copper reagents. Protein content was measured using the Bradford method, where the binding of proteins to Coomassie dye, under acidic conditions, induces a colour change from brown to blue. Precipitation was achieved with 70% ethanol treatment, followed by centrifugation and filtration.

Results: The reducing sugar content of unpeeled red potatoes was 0.1%, which was 13% higher than the RS content of peeled counterparts. In the cases of protein content, 1.08 % and 0.66 % were detected on the surface of unpeeled and peeled potatoes, respectively. Ethanol precipitation resulted in a 97% reduction in protein content, with measured RS decreasing from 1.3% to 1% in peeled samples and from 1.5% to 1.2% in unpeeled samples.

In the case of white potatoes, similar results were obtained. Ethanol precipitation caused a decrease in protein by 95%. Post-precipitation, peeled white potatoes had an RS content of 3.4%, three-fold higher than that of red potatoes.

Conclusions: Ethanol precipitation is an effective method for the reduction of the content of both reducing sugars and proteins, which are the main factors in the formation of acrylamide. White potatoes showed higher RS content than red potatoes.

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Perception of culinary heritage and innovative food: A case study at European and Mediterranean universities

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Background: The food system is deeply rooted in social and cultural traditions, which are evident across homes, streets, and restaurants in rural and urban areas. Contemporary trends aim to revive and innovate these traditions for different purposes. The food engineering/science curriculum prepares graduates to address societal needs, navigate food transitions, develop sustainable practices, and innovate within these constraints. Yet, a gap exists between the curriculum and market demands for graduates proficient in culinary sciences for new product development, necessitating adaptations in education to innovate sustainably based on food heritage, culture, and territory.
Aims: This study aimed to analyze the perceptions and behaviors related to tradition and innovation in food among students and researchers/educators and examine how these concepts are integrated into food-related study curricula within six faculties involved in the Tradinnovations Erasmus+ project.
Methods: An online survey with quantitative and qualitative questions in 1ka platform was disseminated to partner faculties from six countries and yielded 300 respondents. The panel was a mix of students, educators, and researchers, primarily females, reflecting the larger representation of young women in the population of life science university students.
Results: The results indicate that traditional foods are more commonly consumed than innovative foods, particularly at home and in settings like traditional markets, regional festivals, and family gatherings. Respondents have a strong emotional attachment to traditional foods, with many recalling childhood memories and family recipes. They prioritize the need to learn about food history, culinary techniques, and cultural contexts of food traditions through practical experiences. Conversely, innovative foods tend to be consumed in restaurants and professional or educational contexts related to food development and retail. Curiosity appears to be a stronger motivator for exploring innovative foods than trendiness. Plant-based foods are the most frequently tasted innovative products. There is an emphasis on sustainability and a focus on alternative proteins, and the use of algae and seaweed.
Conclusions: The findings suggest a need for a multidisciplinary approach in the curriculum to align with student interest in traditional and innovative foods, including culinary techniques food culture, and history. Sustainability and environmental concerns are crucial in food innovation, focusing on local ingredients, packaging, and waste reduction. Many respondents lacked exposure to innovative foods, indicating a need to incorporate hands-on experiences. Addressing curricular gaps and fostering interdisciplinary research can enhance the integration of tradition and innovation in food education, better preparing students for industry challenges.

E-learning tools for Food technology and development education (E-Food) – a new concept in food technology education

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Background: In the 2021-2027 programming period, the European Commission prioritizes digitization of education and food science. COVID-19 has identified a number of challenges for higher education in Europe. The crisis has challenged universities to transform traditional learning into digital learning. But the process of digital transformation of universities has shown that there are significant differences in cultural, social, geographical and economic terms. Reducing these differences can be achieved at inter-institutional level, by solving different tasks and creating common platforms for training in a given field.

Aims: The aim of the E-Food project is to develop tools for e-learning training system in the field of food technology, based on open access resources and developed on the basis of new educational standards.

Methods: The project is aimed at the main priorities of the Erasmus+ program. The E-Food project offers an innovative concept based on an analysis of the existing educational systems in the project partner countries. Methodologically, a system of digital content standards, an independent e-learning platform and training courses to be offered to students will be developed. Students will participate in virtual competitions to develop new food products.

Results: The implementation of the project covers evaluation activities of the used e-learning platforms in the partner countries of the project, as well as evaluation of the offered educational content. Based on the evaluation, a system of standards for the development of databases for different types of products, raw materials, ingredients, processes and innovations through which students will work on virtual case studies, has already been created. The project envisages the development of training courses in various disciplines, which, together with the databases, will provide the students, participating in the project, with comprehensive knowledge in the field of food technology and the development of new products. The core of the project is virtual competitions for the development of new food products, through the so-called case studies defined by companies producing foods and beverages.

Conclusions: The project envisages the creation of a system of standards and learning materials presented in an innovative e-learning platform. As a result of the implementation of the project will be achieved: development of digital educational content in the field of food technologies; establishment of a system of digital educational standards for food technology training; establishment of a sustainable partnership between universities with a training profile in the field of food and food technology.

FLASH ORAL ABSTRACTS

P-01 | Taste panellists' evaluations in official cheese competitions. Analysis for improvement proposals

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Sensory analysis is a tool for determining cheeses quality by tasting during official competitions, useful for revitalising the local cheese sector. This work aims to: acquire information about the outcomes of official cheese tastings on the Gran Canaria Island (Spain); analyse this information to improve the sampling methodology, as a possible reference for similar events held elsewhere worldwide. The results of four consecutive tasting competitions were studied over 4 years. The annual scores for odour, taste, texture and overall impression, given by 26 taste panellists (5 permanent), were analysed. This gave 2,291 evaluations of 329 cheeses from 13 different varieties. A mixed model was applied with year and cheese variety as fixed effects, and taster and cheese as random effects. Agreement among the permanent tasters' scores was considered by the intraclass correlation coefficient.

The results indicated significant differences in the final scores according to the considered year and cheese variety, and suggested lack of stable patterns, but homogeneity in the last years. The vegetable rennet and sheep/goat's milk semi-matured cheeses obtained the best scores, and the cows' milk and pasteurised semi-mature cheeses, the worst. All the sensory variables significantly distinguished the cheese varieties, but not texture and taste in the last competition. Agreement among permanent tasters was significant in the last 2 years.

To generally avoid the results´ dispersion, tasters training and their permanent participation are recommended. As cheese heterogeneity may have an impact according to years and varieties, comparing the correspondence to sensory evaluations by physico-chemical analyses is proposed.

P-18 | Method validation of pyridoxine, pyridoxal, and pyridoxamine analyses and vitamin B6 profiles by variety)

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Background: In the personalized and precision nutrition service industry, building a reliable food nutrient database is very important. In particular, in the case of micronutrients such as vitamins that exist in trace amounts in foods, verification of the analysis method is a prerequisite to ensuring the reliability of the data. Vitamin B_6 exists in various forms in foods such as pyridoxine (PN), pyridoxal (PL), and pyridoxamine (PM), information on their profiles of rice is very limited.

Aims: This study was conducted to verify the PN, PL, and PM analysis methods using HPLC-FLD coupled with acidic extraction and to analyze the vitamin B_6 profile by rice variety, milling degree, and cooking.

Methods: Verification of the HPLC-FLD analytical method was evaluated using linearity, limit of detection (LOD), limit of quantification (LOQ), accuracy, and precision. Raw and cooked Chucheong (*Oryza sativa japonica*), Koshihikari (*Oryza sativa japonica*), Annammi *(Oryza sativa indica*), and Baromi2 (Oryza sativa L., white and brown) were analyzed for vitamin B_6 profile.

Results: The LOQs of the HPLC-FLD method were 0.081 μg/100g for PN, 0.102 μg/100g for PL, and 0.053 μg/100g for PM. The HPLC-FLD method showed high recovery rates (100.6-102.8%) and excellent precision (repeatability 0.7-4.9% RSD and reproducibility 3.3-5.2% RSD). The vitamin B6 content of rice showed a wide range depending on variety, ranging from PN 6.4 to 68.5 μg/100g, PL 5.5 to 113.8 μg/100g, and PM 18.7 to 44.4 μg/100g. PM was predominant in rice, followed by pyridoxine and pyridoxamine. Compared to Baromi 2 white rice (PN 23.35 μg/100g, PL 14.28 μg/100g, PM 28.45 μg/100g), Baromi 2 brown rice has PN 44.39 μg/100g, PL 29.99 μg/100g, PM 68.54 μg/100g, which is more than twice as high, indicating that about 50% of vitamin B6 is removed by milling. The total vitamin B6 content that can be provided in one serving of cooked rice (200 g) was in the range of 22.02 (Cheong) ~ 55 μg/100g (Baromi2, brown rice).

Conclusions: The HPLC-FLD analysis for vitamin B_6 showed excellent reproducibility, accuracy, and sensitivity, which can produce reliable data by simultaneously analyzing PN, PL, and PM present at trace levels in rice. The distribution of PN, PL, and PM in rice varied depending on variety, the degree of milling, and cooking. Analytical data on vitamin B_6 in rice produced and verified in this study can be used in the personalized nutrition service industry.

P-24 | Assessment of the antibiotic resistance of bacterial strains isolated from drinking water distribution sysytems

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Background: Access to safe and controlled drinking water remains inadequate despite its essential role in sustaining life. Waterborne bacterial infections, such as gastroenteritis, are a common cause of preventable illness and death, affecting many who lack safe water sources. The emergence of pathogenic bacteria is a significant issue. In recent years, there has been a growing interest in the occurrence of antibiotic-resistant bacteria (ARB) in treated drinking water.

Aims: The aim of the project was to identify bacteria in drinking water distribution systems from different households throughout Hungary, and to investigate the antibiotic resistance of these bacteria, with a particular focus on opportunistic pathogenic bacteria. Additionally, the project aimed to highlight any potential correlations.

Methods: Drinking water samples were collected from a variety of locations across Hungary. A total of 15 different locations were sampled. The drinking water samples were subjected to membrane filtration on four different media. During membrane filtration, 100-100 ml of drinking water was filtered for each selective media. The isolates were identified by Matrix assisted laser desorption ionization mass spectrometry (MALDI TOF-MS). Antibiotic resistance of the identified bacterial strains was determined by agar disk diffusion test using Kirby-Bauer disk diffusion method.

Results: Following membrane filtration of the drinking water samples, 25 different bacterial strains (including *Acinetobacter junii*, *Bacillus cereus*, *Bacillus subtilis*, *Enterococcus feacium* and *Pseudomonas aeruginosa*) were identified by MALDI TOF-MS. Based on the literature review and field experience, 9 antibiotics were selected for testing with 25 different bacterial strains. These included Ampicillin, Aztreonam, Ciprofloxacin, Gentamicin, Neomycin, Oxacillin, Penicillin, Streptomycin and Vancomycin. The results were notable for their forward-looking nature. The majority of the bacteria identified were resistant to Aztreonam and Oxacillin antibiotics. Among the antibiotics tested, the highest sensitivity was observed for Ciprofloxacin and Vancomycin.

Conclusions: This study highlights the significant presence of antibiotic-resistant bacteria in drinking water distribution systems across Hungary, identifying 25 bacterial strains resistant to multiple antibiotics, notably Aztreonam and Oxacillin. These findings emphasize the urgent need for enhanced monitoring and control measures to ensure safe drinking water and mitigate the risk of antibiotic resistance transfer.

P-09 | An evidence of cell wall associated β-galactosidase protein from *Limosilactobacillus fermentum* LF08 strain

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Background: β-galactosidase enzyme plays a crucial role in the industrial applications, particularly in the food industry. *Limosilactobacillus fermentum* is well-known probiotic bacteria with GRAS status that can utilise the lactose and galacto-oligosaccharides as main growth substrate, thus it produces β-galactosidase. The studies in the literature concurrently locate the intracellular nature without any information about its localisation.

Aims: The aim of our study was investigation of possible localisation of β-galactosidase enzyme synthetised by *Limosilactobacillus fermentum* LF08 strain. Additionally, the conditions for cell disruption were also optimised experimentally.

Methods: The enzyme fermentation was carried out using modified De Man, Rogosa and Sharpe (MRS) medium containing 4% lactose for 16 hours. Enzyme activity was assayed using artificial substrate pNPG. The cell disruption was performed by mechanical (French Press) and chemical (CTAB) methods. After cell disruption, the samples were divided into two parts. One part will be processed by centrifugation to get supernatant fraction (SF), another part was used as broken cell suspension (BCS). β-galactosidase activity was assayed in both SF and BCS fractions. In the case of chemical method, different ratios in volume of cetyltrimethylammonium bromide (CTAB) to cell suspension as well as treatment times in combination with lysozyme enzyme were investigated.

Results: During the fermentation, β-galactosidase activity in the ferment broth was not detected meaning *L. fermentum* LF08 strain doesn't synthetise it extracellularly. In the case of cell disruption with French Press homogenisator, the activities of BCS were 10 U/mL, 17 U/mL and 20 U/mL for 1, 2 and 3 cycles, respectively, whereas these were 2.6 U/mL, 3.8 U/mL and 4.4 U/mL in the SF. This phenomenon was also confirmed by the results obtained by chemical method as well. In all cases of ratios in volume of CTAB:cell suspension very low β-galactosidase activity (≈0.1 U/mL) was detected in the SF, while around 10-28 U/mL was assayed in the BCS. Generally, the CTAB will increases cell membrane permeability causing cell lysis that allows streaming the intracellular fraction of cell. The β-galactosidase activity in the SF will be increase by around 50 times when the chemical cell disruption was applied with combination of CTAB and lysozyme. This is also good evidence to speculate that the localisation of β-galactosidase by *L. fermentum* LF08 strain should be cell-wall-associated protein. Optimum parameters for cell disruption: a) homogenisation with French Press (800 PSI, 3 cycles), b) CTAB + lysozyme (1:1 ratio of CTAB:cell suspension for 30 min then addition of 3 U lysozyme/mL cell suspension and treatment for 150 minutes).

Conclusions: *L. fermentum* LF08 strain synthetises β-galactosidase protein in cell-wall-associated localisation. Both homogenisation and chemical methods are suitable to disrupt the bacterial cells.

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P-19 | E-learning tools for Food technology and development education (E-Food) – a comprehensive e-learning platform and databases

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Background: The E-Food project is aimed at digitization of the educational process in the field of food technology and the development of new food products. One of the main goals of the project is the creation of e-learning tools as an element of a platform and a digital hub for training students in the field of food technology.

Aims: The aim of the present work is to present e-learning tools, developed by PHP and MySQL, designed to elucidate the scientific intricacies surrounding local food products in partner countries, their production processes, raw materials and ingredients, and innovative techniques employed within the food technology area.

Methods: The development of e-learning tools for a digital learning platform in the field of food technology is based on an analysis of the existing e-learning platforms used in the partner universities of the project. As a result of the analysis, the project team started the development of its own digital hub through PHP and MySQL, through which project participants can obtain synthesized knowledge with a view to developing new food products.

Results: Within the framework of the E-Food project, an analysis of the existing e-learning platforms in the partner universities of the project was carried out. Significant differences were found in the digital platforms used. It was also established that the existing digital platforms in most cases do not allow virtual mobility of students and teachers, which limits the possibility of implementing various priority activities promoted by the European Commission. As a result of the analysis of the obtained results through PHP and MySQL, a training platform, based on databases for different types of products, raw materials, processes and others, has been created. The combination of PHP and MySQL forms is a powerful foundation for web development. For our system we will use InnoDB as a storage engine for MySQL. It offers several key benefits, including ACID-compliant transactions, which ensure reliable and safe data management with automatic crash recovery. InnoDB also features row-level locking, which enhances concurrent access and reduces contention, thereby improving performance in multi-user environments. Additionally, its use of clustered indexes improves the speed of data retrieval, making InnoDB a robust choice for handling large databases with high transactional workloads.

Conclusions: This publication provides insight into the development process of a PHP and MySQL forms-based student learning platform in the field of food technology and new food product development.

P-46 | Light preference analysis of microalgae

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Microalgae are of growing importance for the food industry as they are rich in proteins, essential fatty acids, antioxidants and rich in vitamins. They can be used as a sustainable source of animal feed and for the production of dietary supplements and functional foods. In addition, the production of microalgae has a low environmental impact.

The light preferences of microalgae suitable for human consumption — namely *Arthrospira platensis* (Norstedt) Gomont (formerly *Spirulina platensis*) and *Chlorella vulgaris* Beijerinck — were investigated under light-limited conditions at eight different wavelengths (λ: 430, 460, 510, 540, 560, 630, 660, and 690 nm). The results showed that *A. platensis* preferred blue-violet (430nm), orange (630nm) and red (660nm) light, while *C. vulgaris* proliferated most intensively under blue-violet (430nm), blue (460nm, 510nm), and far-red (660nm, 690nm) wavelenghts. The two microalgae have different light preferences, which should be taken into account in food technology to achieve optimal biomass production.

P-26 | Comparative study of different extraction methods as preliminary tests for peppermint instant powder production

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Background: In recent years, interest in herbals has grown steadily, this trend was further strengthened by the COVID-19 pandemic, which emphasized the importance of prevention. One of the most popular herbs is peppermint, which is famous not only for its menthol, but also for its polyphenol and antioxidant content. Since these compounds are likely to degrade at high temperatures consuming them in tea form unfortunately limits their beneficial effects. Current research uses the following solvents: methanol, ethanol, hexane, and methylene chloride.

Aims: We aim to find a solvent that serves as a newer, more environmentally friendly alternative. Other goal is to determine a method that allows us to extract the active ingredients of peppermint in the highest concentration possible.

Methods: During the research, dried chopped peppermint (*Menthae piperitae folium*) was used, which solid-liquid extraction was performed using three different methods: conventional extraction, microwave-assisted extraction, and ultrasound-assisted extraction. Five different solvents were used: deionized water; 20 V/V% ethanolic solution; citric acid solution adjusted to pH 3; 40 V/V% isopropanol solution; and 1.15 mM beta-cyclodextrin solution. During the extractions, a ratio of 20 g of peppermint/200 ml of solvent was established. Conventional extraction took place at 54 °C for 30 minutes using a thermostat and with continuous stirring at 240 rpm. The microwave-assisted extraction was carried out with impulse operation at a power of 540 W, during which the material was treated for 1 minute and cooled for 2 minutes in an ice water bath, this happened for 30 minutes. The ultrasound-assisted extraction was performed at 20 kHz and with impulse operation for 30 minutes. The finished extracts were subjected to analytical tests such as total polyphenol and flavonoid content, antioxidant capacity by FRAP and DPPH methods.

Results: Based on our experimental results, a comparison was made between the investigated methods and the solvents used, and the most effective one was selected. Drawing from the literature, the expectation is that the MAE and UAE methods differing from the conventional one will be the most efficient.

Conclusions: The best method selected by the results will be optimized during further research with the help of a multi-factor experimental design. After that, the extract will be made into instant tea powder by spray drying and using wall materials.

Acknowledgement:
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P-40 | Comparison of physico-chemical properties of different types of vegetable oil prior and post deep frying

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Background: Frying is one of the most used methods of food preparation. An essential factor in the frying process is the choice of a suitable oil – it plays a role in the heat transfer and as a product impregnation medium. In the process of repeated use at high temperature, oils undergo a number of reactions of oxidation, polymerization and thermal destruction, which lead to changes in their physical, chemical, nutritional and sensory properties.

Aims: The aim of the present study is to compare the stability during frying of three plant oils, namely sunflower oil, high oleic sunflower oil (Hosso) and rapeseed oil using fast thermal and optical methods.

Methods: The thermal behaviour of the oils is examined by differential scanning calorimetry (DSC). UV spectroscopy is used both to assess the oxidation degree and to follow the dynamics of oxidation processes in oils during the heat treatment of the plant oils. The colour of the oils is read as L*, a* and b* using a Hunter Lab Colorimeter. The same instrument is applied for measuring the chlorophyll and β-carotene content. Refractive index is determined by the use of Abbe refractometer. The oxidative stability is evaluated using an accelerated aging test (Rancimat method). Chemical parameters of the oils are measured by standard methods.

Results: With increasing the frying time, a tendency to decrease the melting temperature and the specific enthalpy of melting is observed for all studied oils. These changes can be associated with the formation of weak crystals of tri-unsaturated fatty acids and molecules obtained as a result of their oxidative and hydrolytic changes. These results are confirmed by the changes observed in the UV-spectra of the oils. They are the most strongly manifested for the sunflower oil. While the refractive index is not affected by the duration of frying, during the heat treatment there are significant changes in the color of the oils and in the content of pigments, which continuously decrease. The antioxidant stability of the samples drops up to 4 times depending on the plant oil.

Conclusions: The physical methods used in the present research are informative regarding the aging of the investigated plant oils and can be used for rapid assessment of oil quality. The fastest oxidation and aging during frying is found for sunflower oil.

P-39 | Analysing the implementation of food hygiene in the area of tastings: Hygienic and regulatory challenges

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Background: Tastings are one of the improvised forms of food marketing whose main purpose is to present the food and thus offer it to the public. They can take place in a variety of presentation forms. The presentation of food in the form of tastings is not defined in the legislation. The way in which tastings are carried out therefore harbours several potential risk factors for the safe delivery of food to the end consumer.

Aims: The aim of the survey is to analyse the knowledge of food hygiene and safety among tasting providers, the cleanliness of tasting providers' hands and the cleanliness of utensils and surfaces used in their work.

Methods: In the first part, a descriptive method was used to analyse and review the existing Slovenian and foreign literature. In the second part, an observational and experimental study was conducted to obtain data that was analysed accordingly to answer the questions posed. We analysed a questionnaire on food hygiene with 33 questions before/after the training, an observation sheet with various observation topics before/after the training and a total of 99 swabs on cleanliness during the work process before/after the training (60 hand swabs, 39 swabs from work utensils).

Results: When analysing the questionnaire before the training, we find that the average knowledge of food hygiene in both groups is 72.2. After the training, the knowledge of food hygiene increases to 87.7% in group 1 and 91.2% in group 2. When we compare the two groups after the training, we find a more consistent behaviour regarding the principles of good hygiene practise and can confirm a statistical difference within the two groups ($p=0.001$). In contrast, we cannot detect any statistical difference between the two groups after the training ($p=0.155$). For hand swabs, we find fewer non-compliant samples after training (10%) than before training (20%). For swabs from utensils/accessories, we find more non-compliant samples after training (10%) than before training (5.3%).

Conclusions: The results indicate a lack of training of tasting providers and improvised food service providers at all levels. The results emphasise the need to provide adequate hygienic and technical conditions, regardless of the place of tasting, and to remind them of all accompanying recommendations for safe food handling. Only a comprehensive treatment of the tasting area can provide a starting point for a safe food offer to the end consumer.

P-22 | Effect of glucose and sterilization methods on the antioxidant activity of milk protein concentrate fermented by *Lactobacillus acidophilus* 150 strain

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Background: Fermentation of milk proteins by lactic acid bacteria can lead to the formation of peptides with biological activity. Among other properties, antioxidant effect is a common benefit of milk protein derived bioactive peptides. Although the elevation antioxidant effect can be the result of different processes as well, such as heat treatment. Maillard reaction products (MRP) with high antioxidant activity could form during the sterilization of the growth media used for the fermentation.

Aims: The aim of this study is to investigate the antioxidant activity of samples fermented by *Lactobacillus acidophilus* 150 strain and compare the effect of the growth media sterilization by autoclave and pressure cooker.

Methods: *Lactobacillus acidophilus* 150 strain is growth in the MRS medium at 37 °C for 24 hours. The fermentation media were prepared using 5% of milk protein concentrate (MPC) with supplementation of different concentration of glucose from 0.1 % to 2.5 %. Two types of sterilisation methods were applied: autoclave (AC) or pressure cooker (PC). Samples were taken at 8 and 24 hours of fermentation. The antioxidant activity was measured by DPPH method.

Results: Sterilization of fermentation media with autoclave resulted higher radical scavenging activity (RSA) in all cases than with pressure cooker. This can be explained by result of byproducts formed by Maillard reaction during heat treatment. After 24 h fermentation with *L. acidophilus* 150 strain, the RSA value of fermented MPC medium sterilized by AC was about 13 % and two times higher than by PC (7 %). The effect of different glucose concentration on the radical scavenging activity of fermented MPC media was also investigated. In the case of autoclave, increase in supplemented glucose concentration from 0.1 % to 2.5 % caused increase in RSA from 37 % to 68 %, respectively after fermentation with *L. acidophilus* 150 strain for 24 hours. In the case of pressure cooker, these values maximized to about 20 %.

Conclusions: Sterilization with autoclave leads to a higher antioxidant activity in the fermented samples compared to the utilization of a pressure cooker. Addition of glucose to fermentation medium also affect increase in radical scavenging activity.

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P-29 | Possibilities to discriminate between Tenebrio molitor larvae fed with plastic and conventional substrates

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Background: The world's population is growing rapidly, with projections that it could exceed 9 billion by 2050 and more than 10 billion by 2100. According to recent studies, 8.9% of the population was undernourished in 2019, and nearly 735 million people (9.2%) have lived in hunger in 2022; therefore, tackling food insecurity is a crucial challenge. Current data shows that the amount of plastic waste generated worldwide is increasing, which is in line with population growth. Plastic waste in the environment, through the physicochemical processes of fragmentation, shredding and disintegration, produces micro- and nanomaterial particles that pose a great danger to the environment and wildlife, threaten human health, and remain a major public health concern today. Edible insects, in addition to being an excellent alternative source of protein due to their nutritional properties, have been a popular research topic in recent years, with results showing that invertebrates, including Tenebrio molitor larvae, are capable of degrading and converting large amounts of plastic waste into energy, thus fitting into the European Commission's circular economy principle. However, it is not known whether plastics consumed by mealworms are completely metabolized, causing no change in the composition of the animal and, therefore, suitability for consumption by livestock or humans.

Aims: The aim is to find a rapid and industrially applicable measurement method to detect whether larvae have consumed polystyrene (PS).

Methods: The larvae were kept in a controlled climate chamber under different environmental conditions based on data from the scientific literature. One group of larvae was fed a diet of conventional wheat flour, while the other group was fed a diet of carbon-containing grey and conventional white styrofoam. The measurements were conducted using a Methrom NIRS XDS RapidContent Analyzer. The spectra were subjected to statistical analysis in RStudio and were processed with a number of classification algorithms following signal pretreatment.

Results: Using an adequately tuned classification model, the results of near-infrared spectroscopy (NIR) can distinguish between larvae reared on live, conventional and plastic diets.

Conclusions: Solutions to the food safety issues and waste management problems caused by a growing population must be identified and implemented in the present day. Literature indicates that edible insects may solve these problems, lowering the amount of wasted plastic if no accumulation of microplastics occurs. We have developed a system that is sensitive enough to distinguish between mealworms fed with traditional substrate and styrofoam.

P-47 | Comparison of the effect of homogenization and sonication on the texture properties of goat milk yogurt

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In this study, we explored the effects of homogenization, a conventional technique, and ultrasound treatment, an advanced technology, on goat milk yogurt.

For sample preparation, milk was pasteurized and then either homogenized at 100 and 200 bar or subjected to ultrasound at 100 W for 5 and 15 minutes. Untreated milk served as the control. All samples were inoculated with yogurt culture, fermented at 45°C until the pH reached 4.6, and stored at 5°C before testing. The texture was assessed using a Brookfield CT3 Texture Analyzer, and whey separation was evaluated through centrifugation.

The results showed that under the conditions used, homogenization improved product hardness in both cases, whereas ultrasound treatment led to significant improvement over the control only after 15 minutes. The hardness of the control sample measured 105.5 mN, while the sample treated with ultrasound for 15 minutes measured 116.75 mN. Homogenized samples at 100 and 200 bar showed hardness values of 114.25 mN and 122.75 mN, respectively. Whey separation was significantly reduced in both the homogenized and 15-minute ultrasound-treated samples compared to the control. The whey separation for the control was 58.9%, while the 15-minute ultrasound sample showed 43.6%. Homogenized samples at 100 and 200 bar had whey separation values of 41.3% and 34.3%, respectively.

In conclusion, homogenization, widely used in the dairy industry, altered the characteristic properties of acid curd as expected, while sonication also proved to be a viable option. Given the lower energy consumption of sonication, it holds potential for industrial use. However, further research is needed to optimize time and power inputs for sonication as an alternative to homogenization, with the goal of achieving similar texture modifications in fermented dairy products at reduced costs.

POSTER ABSTRACTS

P-02 | European infrastructure METROFOOD-RI for safer and healthier foods

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Background: Food safety represents one of the most important components of public health policies at a global level. The main expectation of the consumer from the policy maker and control laboratories is safer and healthier foods in the food market. Analytical methods with a high degree of accuracy, precision and sensitivity from control laboratories is necessity. Metrology concept has to be applied to provide the basis for reliable measurements and confidence in measurement results. The pan-European initiative METROFOOD-RI for promoting Metrology in Food and Nutrition is a distributed research infrastructure aimed to provide high-quality services with specific reference to food safety, traceability and sustainability of the agri-food systems. Its services will be adapted to the society needs to offer the best measurement results. METROFOOD-RI is within the Early Phase Implementation, project funded by European Union under the GA 101130162.

Aims: The most important parameters in assessing the food safety are determination of contaminants, which are regulated by the European Regulation 2023/915/EC, and pesticides residues regulated by the Regulation 396/2005/EC. Harmonization of the analytical method is the important step towards improvement in metrology. There is no universally accepted analytical method for pesticide residues analysis.

Methods: Critical step for analysis of contaminants and/or pesticides is applied procedures for extraction of analytes from the matrix. The most used method for extraction of pesticides nowadays is the QuEChERS method (Quick, Easy, Cheap, Effective, Rugged, Safe) in terms of the less efficient traditional extraction methods. Department for Contaminants and Eco – toxicology in the Institute of Public Health of the Republic North Macedonia is a part of METROFOOD-RI, has performed comparison of the Liquid –Liquid Extraction (LLE) and the QuEChERS method and research study for the recovery, reproducibility and matrix effect for the wheat. The same purification approach using solid-phase extraction (SPE) was employed for both procedures followed by GC/ECD and GC/MS detection

Results: Comparison study QuEChERS and LL showed a recovery of 70–120% for pesticide components, and the RSD<20%, criteria according the SANTE document**.**

Conclusions: there are not significant difference for the recovery and reproducibility, but the QuEChERS methodology is the most common sample preparation technique due to significant shorter time for performing and the reduction the quantity of organic solvents. Keywords: METROFOOD, liquid – liquid, QuEChERS, extraction, pesticides.

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P-03 | Effect of different treatments on the free amino acid and biogenic amine content of oyster mushrooms

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Background: The growing population faces challenges in providing adequate food quantities and quality, particularly in proteins, as most people rely on animal-based foods. To address this issue, it is crucial to find sustainable protein sources. Edible mushrooms, in addition to plant sources, can be a promising alternative protein source.

Aims: The aim of this study was to investigate the effect of different treatments on the free amino acid (FAA) and biogenic amine (BA) content of oyster mushrooms.

Methods: Six different treatments: blanching, steaming, oven cooking, microwave, high hydrostatic pressure (HHP), and ultraviolet light (UV) treatment were applied to oyster mushrooms. Untreated fresh mushrooms served as controls. Christ Alpha 2–4 lyophilization equipment was used to freeze-dry oyster mushroom samples. Following 10% trichloroacetic acid extraction, samples were analyzed for free amino acid and biogenic amine content using an AAA400 Amino Acid Analyzer.

Results: Blanching and microwave treatments reduced FAA content by 24% and 15%, respectively, while steaming increased it slightly by 8%. In contrast, oven, UV, and high hydrostatic pressure treatments significantly increased FAA content by 62%, 60%, and 63%, respectively. Regarding biogenic amine content, blanching increased BA content by 40%, while steaming and microwaving resulted in 50% and 46% increases, respectively. The oven treatment significantly increased BA content by 78%, while UV and HHP treatments increased it by 96% and 71%, respectively.

Conclusions: The results highlight the significant impact of different treatments on the nutritional composition of oyster mushrooms. Blanching and microwaving reduced the amount of FAA while increasing the amounts of biogenic amines. Steaming, oven, UV, and HHP treatments significantly increased FAA and BA contents. These findings provide useful information for optimizing food processing methods and improving the nutritional quality of mushrooms, thereby contributing to the availability of sustainable protein sources.

P-04 | Unlocking the potential of blueberry pomace: Optimizing microwave-assisted extraction for the recovery of bioactive compounds

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Background: Blueberry pomace, a by-product of blueberry juice production, consists of skin, seeds and the remaining pulp and makes up around 20-30% of the total mass of processed blueberries. For a long time, it was regarded as a waste in the food industry, but recent research is increasingly pointing to the significant potential of blueberry pomace as a valuable raw material. Considering the high content of dietary fiber, polyphenols, anthocyanins and other bioactive compounds, blueberry pomace can contribute significantly to the nutritional value of various foods. Nowadays, advanced extraction processes are increasingly used to isolate bioactive compounds from different plant material in order to maximize extraction efficiency and obtain a high-quality and environmentally friendly extracts with less energy, time and solvent consumption.

Aims: The aim of this research was to optimize microwave-assisted extraction (MAE), in order to efficiently isolate phenols and anthocyanins from blueberry pomace and to evaluate the antioxidant activity of obtained extracts.

Methods: In this study, the MAE was optimized by varying the parameters of temperature (40, 60, 80 °C), time (5, 10 min) and sample:solvent ratio (1:20, 1:40, 1:60 mg/ml) using a 50% ethanol solution with 1% formic acid as solvent. In the extracts obtained, total phenols were determined by the Folin-Ciocolateu method, anthocyanins by the pH differential method and antioxidant activity by the Ferric Reducing Antioxidant Power (FRAP) method.

Results: The results show that high-quality bioactive compounds are contained in significant quantities in blueberry pomace. The content of total phenols ranged from 28.93-75.86 mg gallic acid equivalent g^{-1} dry weight, total anthocyanins from 3.63-6.25 mg cyanidin-3-glucoside equivalent g^{-1} dry weight, while the antioxidant activity ranged from 107.22-538.43 µmol Trolox equivalent g^{-1} dry weight. Statistical analysis revealed that the optimal conditions for efficient extraction of analyzed bioactive compounds are temperature of 80 °C, extraction time of 5 min and a sample:solvent ratio of 1:40.

Conclusions: Blueberry pomace proved to be an extremely rich by-product of blueberry processing, in which large amounts of phenols and anthocyanins remain. The optimization of MAE parameters is an important step in the modern food industry, enabling manufacturers to develop high quality products in an economically and environmentally sustainable way. The use of blueberry pomace is not only a sustainable solution to reduce waste, but also opens up opportunities for innovation in food production, improves the health benefits of products and increases the economic efficiency of the industry.

P-05 | Comparative Analysis of drought tolerance in Stevia, propagated by seed and *in vitro* with silver salt of peptidomimetic nanofiber

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Background: The project's main purpose is to develop and optimize a technology using synthesized nanofibers of low molecular weight peptidomimetics for the delivery of biologically active agents (BAA) like silver or growth regulators. This technology aims to enhance the efficiency of *in vitro* propagation and increase the yield of biologically active metabolites in the medicinal plant stevia.

Aims: Optimizing *In Vitro* Propagation: The primary goal is to investigate how these amino acid nanofibers influence the *in vitro* propagation of stevia. The study aims to determine the optimal conditions for using nanofiber-delivered BAAs to improve plant growth and development.

Enhancing Metabolite Production:

Another key objective is to assess the impact of these nanofibers on the accumulation of secondary metabolites in stevia. Increased metabolite production is essential for meeting the demands of the food and pharmaceutical industries.

Methods: This study investigates the drought tolerance of Stevia rebaudiana across three cultivation methods: seed germination, *in vitro* propagation, and *in vitro* growth with silver salt nanofiber treatment. The evaluation focused on key stress markers, including malondialdehyde (MDA), proline, hydrogen peroxide (H2O2), and sulfhydryl (SH) groups.

Results: Our results demonstrated that Stevia plants propagated *in vitro* exhibited higher drought tolerance compared to those grown from seeds, as evidenced by lower MDA and H2O2 levels, indicating reduced lipid peroxidation and oxidative stress. Proline accumulation was significantly higher in *in vitro* propagated plants, suggesting an enhanced osmoprotectant response. Additionally, SH group content, indicative of protein stability and cellular defense mechanisms, was substantially elevated in plants treated with silver salt nanofibers (100 mg/l Ag salt).

Conclusions: These findings suggest that *in vitro* propagation, particularly with silver salt nanofiber treatment (100 mg/l Ag salt), enhances the drought resilience of Stevia rebaudiana. This research provides valuable insights into optimizing cultivation practices for Stevia, promoting sustainable agricultural practices in the face of increasing water scarcity.

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P-06 | Technological innovations in food supplements: Implications for public health

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Background: The integration of dietary supplements into public health strategies has garnered significant attention due to their potential to address nutrient deficiencies and improve overall health outcomes. Technological advancements in food science have enabled the development of more effective and bioavailable supplements. Despite the growing use of these supplements, their impact on public health remains a topic of ongoing research and debate.

Aims: This study aims to evaluate the effectiveness of dietary supplements in improving public health outcomes and to assess the role of food technology in enhancing the quality and efficacy of these supplements. Specifically, we seek to determine whether advanced supplement formulations can better address nutritional deficiencies compared to traditional dietary sources and less technologically advanced supplements.

Methods: A comprehensive literature review was conducted, analyzing data from peerreviewed journals, government reports, and industry publications from the past 10 years. The review focused on studies that investigated the impact of dietary supplements on health outcomes and the role of food technology in improving supplement efficacy. Criteria for inclusion involved studies with clear methodologies, significant sample sizes, and relevance to public health. Data was synthesized to identify trends, efficacy rates, and potential benefits and drawbacks of various supplement types.

Results: The literature review revealed significant differences in health outcomes associated with the use of technologically enhanced supplements versus conventional supplements and traditional dietary sources. For instance, nano-encapsulated curcumin supplements showed a 25-30 % greater improvement in anti-inflammatory markers compared to conventional curcumin supplements. Additionally, iron supplements developed with microencapsulation technology resulted in a 20 % higher increase in serum ferritin levels, effectively reducing anemia prevalence in the studied populations. Furthermore, omega-3 fatty acids in the form of phospholipid-bound supplements demonstrated superior bioavailability, leading to a 15-20 % improvement in cognitive function and cardiovascular health indicators compared to standard fish oil capsules. These advanced supplements were consistently associated with fewer gastrointestinal side effects and improved patient compliance.

Conclusions: The findings from this comprehensive literature review suggest that dietary supplements, particularly those developed with advanced food technology, can significantly improve public health outcomes. Enhanced bioavailability and efficacy of technologically advanced supplements offer a promising solution for addressing nutritional deficiencies more effectively than traditional methods. Public health strategies should consider integrating these advanced supplements to maximize health benefits. Further research is recommended to explore long-term impacts and the potential for incorporating these supplements into broader dietary guidelines.

P-07 | Association of dietary carbon footprint with Planetary Health Diet Index and characteristics of Croatian university students

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Background: Sustainable healthy diets are dietary patterns that promote all dimensions of individuals' health and wellbeing with strong environmental concerns. These types of diets should be affordable, accessible and culturally acceptable. One of the indices to evaluate diet sustainability is the Planetary Heath Diet Index (PHDI). Recommendations for PHDI are based on the impact on human health and the environment related to the food system.

Aim: This study aimed to evaluate diet quality by PDHI and to assess greenhouse gas emissions (GHGE) associations with age, sex and nutritive status of Croatian university students.

Methods: The diet quality of 224 students of the University of Rijeka, Croatia aged 19 to 27 years was assessed through PDHI. GHGE data were obtained from the literature (SU-EAT method). Students noted their sociodemographic data and dietary intake with Food Frequency Questionnaire (FFQ). Anthropometric parameters were measured and body composition was assessed with bioelectrical impedance. Multiple regression models adjusted for potential confounding factors were performed to assess the relationship between dietary carbon footprint and outcomes.

Results: Two-fifths of students had low-quality diet assessed with PDHI (39%, $p=0.138$). Carbon low-emitting diet was more likely to be consumed by students with high PDHI scores (β: −0.32 kg eCO2/1000 kcal/d, $p<0.001$), after controlling for sex, age, BMI and total body fat percentage. Both the low-emitting and healthy diets were more likely to be consumed by women, nonsmokers, and those with normal weight and body fat percentages.

Conclusions: The results confirm recommendations for healthy and sustainable diets, such as Planetary Health Diet, have beneficial effects on human health, specifically associated with lower body weight and body fat. Students are a specific group of consumers who are expected to be the creators of policies aimed at improving health and preserving the environment in the future, and these results can contribute to the creation of targeted campaigns aimed at raising their awareness.

P-08 | Evaluation of the enzyme antioxidant activity of *ex vitro* adapted stevia pretreated with Ag salt peptidomimetic, under the drought

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Background: For centuries, plants have been used as a valuable food source, as flavors, colorings and components with use in cosmetic and pharmaceutical industries. However, this has a detrimental effect on the natural population of the medicinal plant, putting many of them in danger of going extinct. The plants' natural habitats are quickly exhausted due to climate change and developing agriculture. Biotechnological methods for propagation are used to prevent the destruction of natural populations of plants. Plants *in vitro* systems allow the cultivation of individual cells, tissues, organs or entire plants. Stevia rebaudiana Bert. is a source of alternative calorie-free sweeteners, gaining popularity globally. The two main steviol diterpene glycoside, stevioside and rebaudioside A provide the sweet taste of the plant and are 150-450 times sweeter than sucrose for human taste receptors. The *in vitro* technique of *S. rebaudiana* propagation is graceful for the production of high quantity and quality seedlings, for supporting the cultivation of plants of improved quality and high content of stevioside and rebaudioside A, higher production of biomass, wider adaptability and viability.

Aims: This study aims to evaluate *Stevia rebaudiana's* physiological response to water deficit applied ex vitro after being cultivated *in vitro* on MS media supplemented with amino acid nanofibers carriers of silver at varied concentrations.

Methods: The effect of 3 and 5 days of drought is monitored, followed by 3-day rehydration, on the enzyme antioxidant system of ex vitro adapted to the soil *S. rebaudiana* plantlets propagated in the MS nutrient medium, with 10 and 100 mg L-1 Ag salt of nanofibres, synthesized by asparagine acid derivative (NF-Ag salt).

Results: Among the investigated indicators are the level of activity of enzymes with antioxidant potential SOD, CAT, APX and GPX. Compared to plants produced by seeds, ex vitro adapted *S. rebaudiana in vitro* propagated on MS medium and on MS medium with NF-Ag salt addition demonstrated greater SOD and CAT enzyme antioxidant power, grown at well-watered conditions.

Conclusions: The increased drought resistance of *Stevia rebaudiana* plants *in vitro* propagated and soil adapted can be attributed to their distinct enzyme antioxidant responses as compared to plants cultivated from seeds**.**

Acknowledgement: *This study was conducted with financial support from National Science Fund at the Bulgarian Ministry of Education and Science, Project КП-06-Н56/8 12.11.21.*

P-10 | Effect of silver nanofibers on non-enzymatic antioxidant defense in Stevia rebaudiana subjected to drought

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Background: Food and nutrition science will play a key role in the near future. Food quality, nutritional supplements and a healthy diet make an impact and save millions of lives. Solving modern world nutrition problems such as the global obesity challenge is based on using a natural ingredient from *Stevia rebaudiana*, the sweetest non-caloric sugar substitute discovered so far. The use of silver nanoparticles in plant biotechnology increases the resistance of many plant species to high and low temperatures, drought, salinity, increases the content of secondary metabolites and antioxidant potential.

Aims: It is hypothesised that the accumulation of silver in plants during *in vitro* cultivation will positively impact plant physiology and biochemistry, hence enhancing their resistance to ex vitro stressors. For different plant species, the concentrations of AgNPs that cause toxicity vary widely and depend largely on particle size, plant development phase, duration of treatment, etc. The aim of the study was *In vitro Stevia rebaudiana* propagation supplemented with Ag-containing amino acid nanofibers (NF-Ag salt). Two months following, the *ex vitro* soil-adapted plants were studied for the effects of drought.

Methods: All conditions for *in vitro* propagation, adaptation and cultivation of plants *ex vitro* were met. To quantify the main complexes of biologically active substances in *Stevia rebaudiana*, a number of phytochemical spectrophotometric methods were used to measure the non-enzymatic antioxidant activity.

Results: In our study, the application of 10 mg L^{-1} and 100 mg L^{-1} NF-Ag salt in MS nutrient medium during micropropagation and subsequent drought of the *ex vitro* adapted plants led to a higher content of most metabolites with antioxidant potential in short-term drought (2nd day) and their lower content in long-term drought (5th day). With few exceptions, rehydration leads to an increase in the content of metabolites with antioxidant capacity, compared to the fifth day of drought, at both tested concentrations.

Conclusions: In this study, the investigated nanofibers support the metabolism of *Stevia rebaudiana* under stress conditions and demonstrate great potential in plant-tissue cultures. It is a challenge for scientists to look for progress and help achieve physical and mental health more easily.

Acknowledgement: *This study was conducted with financial support from National Science Fund at the Bulgarian Ministry of Education and Science, Project КП-06-Н56/8 12.11.21.*

P-11 | The role of phytate in the bioavailability of iron and zinc using phytate-mineral molar ratios in common middle eastern dishes

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Background: Phytate is a major constituent of plants, which comprises 1% to 5% of edible legumes, seeds, cereals, and nuts. Phytate binds with divalent minerals such as zinc and iron to form insoluble mineral complexes, reducing their bioavailability.

Aims: The aim of this paper is to study the role of phytate in the bioavailability of iron and zinc in the diet of middle eastern people using molar ratios.

Methods: Based on a field survey, 150 frequently consumed traditional and international composite dishes were selected. These dishes were standardized, cooked, and freeze-dried, and their moisture, phytate, iron, and zinc contents were determined chemically. The dishes with no phytate content were excluded. The nutrient data of the selected dishes were tabulated, including moisture, phytate, zinc, iron, and corresponding phytate-:mineral ratios were calculated.

All nutrient data were standardized according to the global food composition database for phytate.

Results: The results showed that 73.5% of the dishes had moderate or high zinc bioavailability. Only 13.2% of the dishes were adequate for iron bioavailability.

Conclusion: More research is recommended to study the relationship between phytate and mineral deficiencies. This study concentrated on main dishes . It is recommended to investigate the breakfast and snacks food consumed by the population to understand thoroughly the relation ship between phyatate content and mineral bio availability.

P-12 | Incorporation of ethanolic extracts from raspberry pomace into meringue cookies; chemical characterization and *in vitro* digestion

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Background: Raspberries are grown all over the world, and in 2022 the annual production of raspberries in Europe was over 616 thousand tons. Raspberry pomace, a by-product of the juice and jam industry, generates large amounts of waste and causes high disposal costs or is used in animal feed or as fertilizer. Around 77% of the fiber content of fresh fruit remains in the pomace, and up to 80 % of the raspberry pomace are seeds, 23 % of which represent oil. The pomace is an extremely rich source of compounds with proven biological activity and is described as a good source of phenolic compounds, carbohydrates, proteins, fats, flavorings, pectins and vitamins. If the seeds are eaten whole, they pass through the digestive tract undigested - so the bioactive compounds they contain are not digestible. However, after drying and grinding, the bioavailability of the bioactive compounds from raspberry pomace increases.

Aims: In this work, the bioaccesibility of compounds in raspberry (*Rubus idaeus*) pomace was evaluated by measuring and investigated the relevant bioactives. The extracts were also incorporated into Meringue cookies and compared with commercial raspberry aroma before and after gastrointestinal digestion *in vitro*.

Methods: The selected extractions were carried out by maceration with ethanol/water (80:20, v/v) for two hours at room temperature. The extracts obtained were subjected to the harmonised INFOGEST 2.0 (Brodkorb et al, 2019) protocol for *in vitro* digestion. The chemical composition was analysed before and after the digestion process in terms of total phenolic, anthocyanin, flavonoids and tannin content (TPC, TAC, TFC, TTC); in addition, the profile of phenolic compounds was determined by HPLC-MS. The antioxidant activity was determined using the FRAP and DPPH methods. Analyses were carried out in triplicate.

Results: Total phenolic content and antioxidant activity before and during digestion phases were statistically analysed by analysis of variance (ANOVA) and means were compared using Tukey test ($p<0.05$). Mean and standard deviation of total phenolic compounds before and after gastric and intestinal phases of digestion of the ethanolic raspberry pomace extracts were 441 ± 0.4, 112.1 ± 3.5, 106 ± 3 mg/g, respectively. Similar trend was observed by TFC with 15.5 ± 0.4, 3.1 ± 0.2, and 1.8 ± 0.5 mg/g. It was observed that after simulated digestion, the total phenolic and flavonoid content of raspberry pomace extracts decreased significantly during the gastric and intestinal phases compared to the extracts before digestion. With regard to antioxidant activity, there was a reduction of all studied parameters after gastric digestion. After the intestinal phase, there was a reduction in antioxidant capacity for FRAP method, while DPPH method showed increased antioxidant activity in enteric phase when compared to gastric phase, but still lower than the extract before digestion. Bioaccessibility of phenolic compounds can be affected by different concentrations, variations in cell wall structure and the binding of phenolic compounds in food matrix. Gastric and intestinal fluids interfere with antioxidant activity of phenolics due to deprotonation of hydroxyl portions of aromatic rings. Increase in antioxidant activity by DPPH method after intestinal phase of digestion may be related to the activity of a compound other than phenolics.

Conclusions: The promising results of the chemical and biological evaluation of the extracts indicate that the natural compounds isolated from pomace of the *Rubus idaeus* can be used as potential ingredients for functional food formulations, flavours or colourants.

References: Brodkorb et al. (2019). INFOGEST. Nat. Protoc,14, 991–1014.

P-13 | Microbiota of dried fruits and the osmotic stress of *E. coli*

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Background: Dried fruits are generally considered to be safe to consume due to their low water activity and high sugar content. As more people thrive for a healthier lifestyle, dried fruits have become a popular ready-to-eat snack. *Escherichia coli* is among bacteria that cause the most food-borne outbreaks and due to inadequate processing technologies, it could pose a health risk to consumers. The rehydration of dried fruits (for example, in overnight oats) creates conditions that are conducive to the return of bacteria to a viable state. This may result in the spoilage of the food or the onset of health problems, as bacteria that were previously in a viable but non-culturable (VBNC) state may resume their growth and proliferation.

Aims: The aim of this project was to determine the microbiota of dried fruits with particular focus on Enterobacteriaceae family and subsequently to assess the osmotic stress response of *E. coli.*

Methods: In order to determine the microbiota, conventional ISO methods were employed to isolate bacteria from the dried fruit samples, after which MALDI-TOF-MS experiments were conducted. Additionally, molecular methods, specifically MinION sequencing have been used to determine the microbiota. In the osmotic stress experiments, the Bioscreen system was employed to monitor bacterial growth in different culture broths mimicking the conditions of dried fruits. PMA-qPCR has been employed to assess the VBNC state of *E. coli* in different fruit-mimicking broths.

Results: The microbiota of dried fruits is highly diverse. A total of 36 different bacterial species were isolated from the dried fruit samples, with the majority belonging to the Bacillus genus. Yeast and molds have also been present in great numbers. The results of 16S rDNA sequencing show a more precise result. The Bioscreen experiments show that *E. coli* was able to grow in the dried fruit-mimicking environment even when the bacterium was stressed beforehand. The PMA-qPCR method has been shown to be effective in detecting VBNC state bacteria following the imposition of osmotic stress on bacterial cells. This suggests that the utilisation of molecular techniques for the detection of bacteria in food samples may prove beneficial in enhancing food safety.

Conclusions: Dried fruits are popular ready-to eat snacks, although inadequate processing technologies result in the contamination of these products. Under the right conditions, they can harbour a great variety of different bacteria that could enter the VBNC state to endure harsh conditions, which is a potential health risk to consumers.

P-14 | How are the sensory attributes of meat substituted sausages effected by the use of pretreated fermented mushrooms?

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Background: In today's world, a big challenge we face is ensuring that the rapidly expanding global population has access to nutritious diets while also maintaining sustainable food production systems. With increasing concerns about nutrition and the environment, there's a rising global interest in healthier meat options and alternatives to traditional meat products. In this regard, mushrooms are being looked at as a promising solution because they offer essential nutrients, dietary fiber, and are low in fats. They can be used either as substitutes in different forms for meat or as innovative ingredients in various meat products. Mushrooms have been added to meat products in several ways: they can be ground fresh, dried and powdered, or utilized as extracts.

Aims: This study aims to examine how replacing a part of pork meat with pretreated fermented oyster mushrooms affects certain sensory characteristics of sausages.

Methods: 8 sample groups with different pretreatments (fresh, blanched, steamed, oven, microwave, HHP, UV Light) and 2 ratios (25% - 50%) of fermented oyster mushrooms were produced. Sensory analysis (multiple-samples ranking test) was performed with 20 panelists, considering the visual appearance, odor, texture and overall qualities of the sausage samples.

Results: According to the results, use of different pretreatments before the fermentation of mushrooms, caused a significant difference on odor, texture and overall quality scores of 25% meat substituted sausage samples, and on texture and overall quality scores of 50% meat substituted sausage samples. No significant difference was found in the visual appearance scores of sausage samples for both ratios due to use of different pretreatments.

Conclusions: Regarding sensory attributes, using fermented oyster mushroom as a meat substitute can be an acceptable strategy for developing healthier and sustainable sausage formulations. Among the pretreatment methods, blanching, steaming, and microwave pretreatments demonstrated better results than others.

P-15 | Optimisation of ultrasound-assisted extraction of phenolic compounds from sea buckthorn berries (*Hippophae rhamnoides* L.): Characterisation and antioxidant activity

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Background: Sea buckthorn berries (*Hippophae rhamnoides* L., family *Elaeagnaceae*) are a rich source of various bioactive compounds, including phenolic compounds with antioxidant activity. In recent years, researchers have become increasingly interested in the extraction of phenolic compounds by suitable extraction methods in order to utilise them for the development of functional foods. Ultrasound-assisted extraction (UAE) has been proposed as an alternative to conventional extraction methods as it is more efficient and consumes less time, energy and solvent, but the extraction parameters need to be optimised for the specific matrix.

Aims: Therefore, the aim of this study was to investigate the influence of UAE conditions on the total phenolic content (TPC) of sea buckthorn berries (SB) of Ascola and Leicora varieties using different solvents (30 % and 70 % ethanol) and sonication times (20, 30 and 40 min) at a temperature of 40 °C and an ultrasonic amplitude of 60 % and to determine the phenolic profile and antioxidant activity of SB extracts obtained under optimal UAE conditions.

Methods: The TPC of the extracts were determined using the Folin-Ciocalteu spectrophotometric assay. Characterisation of phenolic compounds and antioxidant activity (AA) of SB extracts obtained under optimal UAE conditions were determined by UPLC-ESI/MS^2 analysis and ORAC assay.

Results: The extraction solvent and sonication time had a significant effect on the extraction yield. The optimal parameters for UAE were 70% ethanol and a sonication time of 20 minutes. Flavonols, hydroxycinnamic acids (HCA) and hydroxybenzoic acids (HBA) were determined in all SB extracts, but the Ascola variety (169.34 mg/100 g dry matter (dm)) had a higher phenolic content than Leicora (130.55 mg/100 g dm), and the flavonol isorhamnetin-3-hexoside (69.73 and 43.95 mg/100 g dm) dominated in both SB varieties. The Leicora variety had a higher content of HCA (21.65 mg/100 g dm) and HBA (16.53 mg/100 g dm) than the Ascola variety, and caffeic acid, cinnamic acid and vanillic acid were the most abundant. The AA content was higher in the Ascola variety (2755.95 ± 3.23 µmol TE/100 g dm) than in the Leicora variety (2583.47 ± 4.39 µmol TE/100 g dm), probably due to a higher phenolic content.

Conclusions: UAE proved to be an effective green technique for the extraction of phenolic compounds with high antioxidant activity from different SB berry varieties, which can be effectively utilised for nutraceuticals and food applications.

P-16 | Application of Artificial Intelligence in the food industry

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Background: The food industry faces a myriad of challenges, including the need for increased efficiency, improved safety, enhanced quality control, and the ability to meet growing consumer demands for personalized products. Artificial Intelligence (AI) has emerged as a transformative technology that offers solutions to these challenges. By leveraging AI, the food industry can optimize processes, predict market trends, ensure food safety, and innovate product development, thus driving significant advancements in production and distribution.

Aims: This study aims to explore the application of AI in the food industry, focusing on how AI technologies are being utilized to enhance operational efficiencies, improve food safety standards, and foster innovation in product development. The specific objectives are to identify key areas where AI is implemented, evaluate the benefits and challenges associated with these applications, and provide insights into future trends and potential impacts of AI on the food sector.

Methods: The study employs a comprehensive review of recent literature, industry reports, and case studies to gather data on the current use of AI in the food industry. Key areas of focus include supply chain optimization, quality control, food safety, and consumer personalization. Data analysis involves identifying patterns and trends in the implementation of AI technologies, assessing their effectiveness, and summarizing the outcomes of various AI-driven projects. Interviews with industry experts and stakeholders provide additional insights into practical applications and future directions.

Results: The findings indicate that AI is increasingly integrated across various stages of the food supply chain. In supply chain management, AI algorithms improve demand forecasting, inventory management, and logistics, leading to reduced waste and increased efficiency. Quality control benefits from AI through automated inspection systems that detect defects and contaminants with high precision. AI-driven predictive analytics enhance food safety by identifying potential hazards and preventing outbreaks. Moreover, AI enables the creation of personalized nutrition plans and customized food products, meeting individual consumer preferences and dietary needs. However, challenges such as data privacy, the high cost of AI implementation, and the need for skilled personnel are noted as barriers to widespread adoption.

Conclusions: AI is revolutionizing the food industry by optimizing supply chains, enhancing quality control, and ensuring food safety while catering to personalized consumer demands. The integration of AI technologies promises substantial improvements in operational efficiency and product innovation. Despite the challenges, the potential benefits make AI a pivotal tool for the future of food production and distribution. Ongoing advancements in AI, coupled with strategic investments and training, will likely overcome current obstacles, paving the way for a smarter, safer, and more responsive food industry.

P-17 | Pulsed light as a non-thermal technology for food decontamination

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Background: Pulsed light (PL) has been proposed as a non-thermal food preservation strategy due to its effectiveness in inhibiting microbial growth and degrading mycotoxins by the production of oxygen and nitrogen radical species that oxidize cell membranes, inhibit DNA synthesis, and change the chemical structure of mycotoxins reducing their toxicity. Being an emerging technology, its effect on many food matrices is still under evaluation. Therefore, a thorough investigation of its potential against a broad spectrum of microorganisms and mycotoxins becomes necessary.

Aims: The present study aims to explore possible application strategies of PL on two different food products: cold-smoked salmon and lupin beans. In the former, the study focuses on the effectiveness of PL against a foodborne pathogen, *Listeria monocytogenes*; in the latter, the detoxification of phomopsin-A (PHO-A), a mycotoxin responsible of severe animal diseases and potentially harmful for humans, was evaluated.

Methods: Different PL treatments, measured in terms of combinations of energy, treatment time, number of bursts, and frequency, were applied by using a Xenon X-1100 pulsed light system on cold-smoked salmon fillets inoculated with the foodborne pathogen *Listeria monocytogenes*, and on lupin beans inoculated by a PHO-A-producing, phytopathogenic fungus, *Diaporte toxica*. The antilisterial efficacy of PL was evaluated by microbiological analysis on selective medium. Instead, the efficacy of PL in reducing mycotoxin concentration in lupin beans was evaluated by PHO-A quantification using µSPE extraction followed by UHPLC-MS/MS analysis.

Results: Results showed great antibacterial activity against *L. monocytogenes*, with a significant load reduction in all the evaluated treatments and a maximum reduction of 1 log CFU g^{-1}, when using 30 pulses, 230.0 J energy, 0.333 Hz frequency. Remarkably, increased pulsed light dose did not enhance the load reduction.

Concerning the mycotoxin degradation, also in this case PL showed an activity in all the tested parameters combinations, but PHO-A reduction did not show a regular trend; in fact, the highest treatment intensities did not increase reduction. The best result was achieved by the use of the following parameters: 240 pulses, 230.0 J energy, frequency of 0.333 Hz.

Conclusions: In conclusion, results highlighted a good potential of PL for both decontamination of cold-smoked salmon from *L. monocytogenes* and detoxification of PHO-A from lupin beans. Therefore, the great potential of PL as a novel decontamination technology has been demonstrated. Notably, in all cases, an increased intensity of the treatment did not produce an enhancement of the effectiveness. This parameter is of paramount importance for the application of PL treatments to food matrices, indicating that a tailor-made process should be developed and applied based on the substrate. Moreover, a thorough investigation of the treatment target is vital for large-scale applications, since bacteria, fungi and mycotoxins demonstrated relevant differences in the effects of PL treatments.

P-20 | Potential of laser light backscattering imaging combined with multivariate methods for evaluating shell egg freshness

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Background: Laser light backscattering imaging (LLBI) has been successfully applied for quality assessment in various food products. The captured backscattering images carry valuable information about the internal structure and composition of the samples. By combining the extracted features from the images with multivariate analysis, the quality attributes can be non-destructively determined. This technique offers the advantages of requiring little or no sample preparation, being easy to use, cost-effective, and not requiring reagents. However, the application of LLBI in quality assessment of eggs is very limited.

Aims: This study aimed to examine the feasibility of LLBI coupled with multivariate methods for assessing the freshness of shell eggs stored in ambient condition.

Methods: Shell eggs were stored in ambient conditions for 4 weeks and analyzed for freshness by measuring Haugh unit (HU) and LLBI. Various multivariate models, including linear discriminant analysis (LDA), k-nearest neighbors (kNN), random forest (RF), support vector machine (SVM), and partial least squares method, were examined to estimate the egg quality, all models were trained and validated by 10-fold cross-validation. Classification models were evaluated by overall accuracy, while regression models were tested by coefficient of determination (R2) and root mean squared error (RMSE).

Results: The ANOVA result showed that the backscattering signals responded significantly to storage time ($p < 0.05$). The classification results indicated that all developed models could correctly discriminate stored eggs according to their grade (AA, A, and B) with accuracies above 62.7 %. The SVM with a polynomial kernel achieved the highest classification accuracy at 96%. In predicting the freshness indicator of HU, the values of R2 and RMSE ranged from 0.556 to 0.741 and from 5.073 to 7.116, respectively. Random forest model had the highest regression accuracy with R2 = 0.741 and RMSE = 5.073.

Conclusions: Based on the results, it can be concluded that the proposed technique is a promising tool for evaluating shell egg freshness.

P-21 | *In vitro* effect of essential oils from the family Apiaceae on the growth of *Botrytis cinerea* strains

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Background: Currently, as consumer interest in products without chemical preservatives increases, essential oils are becoming a popular alternative. Essential oils (EOs), natural extracts derived from various plant parts such as leaves, flowers, bark, and roots, are increasingly utilized in the food industry. EOs are abundant in volatile compounds that impart strong aromas and flavours, thus enhancing the sensory qualities of foods. Beyond their sensory contributions, essential oils offer several other advantages that are valuable to the food industry. One of their most significant benefits is antimicrobial activity.

Aims: The aim of the study was to evaluate the effect of EOs from selected plants of the family Apiaceae on the growth of *Botrytis cinerea* strains isolated from mouldy fruits and vegetables.

Methods: Origin of strains: *B. cinerea* KMi-454 from strawberry, KMi-393 from grapes, KMi-461 from broccoli, KMi-409 from kiwi, and KMi-435 from cherry tomatoes. The EOs (fennel, dill, anise, caraway, and angelica) were purchased from the supplier. The vapour phase diffusion method was used to evaluate the inhibitory effect of EOs on the growth of *B. cinerea* strains. Petri dishes with a diameter of 9 cm were filled with 15 mL of potato dextrose agar medium. A 5 µl suspension of spores 10^4 in mL was inoculated into the center of the medium. A 1.5 cm × 1.5 cm piece of Whatman No. 1 paper was placed in the center of the petri dish, and 50 µl of concentrated EO was added (625 µL EO/L). Parafilm was used to seal petri dishes, which were then cultured in an inverted position. In the control treatment, 50 µl of sterile distilled water was used instead of EO. The experiment was repeated three times. Strains were cultured for 7 days at 25 ± 1 °C, and colony growth was observed on days 2, 3, 4, and 7. Minimum inhibitory doses (MIDs) were determined only for EOs that completely inhibited the growth of the specific strain tested in the preceding step, utilizing a concentration of 625 µL/L. To achieve this, the EOs were first diluted in dimethyl sulfoxide (DMSO) to a concentration that would yield 500 µL/L and the following 250, 125, 62.5, 31.25, and 15.625 µL/L, respectively. Each concentration was tested in six replicates. Fungal growth was assessed on the 7^{th} and 14^{th} day of cultivation.

Results: Out of five EOs, four (fennel, dill, anise, and caraway) inhibited the growth of all five *B. cinerea* strains in concentration 625 µL EO/L. EO from angelica completely inhibited the growth of only one strain, the growth of the other strains was recorded after two and three days, respectively. MIDs were determined as follows: >500 µL/L for EOs from anise, 500 to >500 µL/L for EOs from fennel and dill, and 250 to 500 µL/L for EOs from cumin.

Conclusions: For further testing, we recommend using the EO from cumin, for which the lowest MIDs were determined.

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P-23 | Maximizing antioxidants and minimizing waste: Ultrasound-assisted extraction of berry leaves

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Background: Berry leaves, often overlooked as processing by-products, contain significant amounts of bioactive compounds, such as phenolic compounds, which are known for their antioxidant properties. Extraction processes can be used to isolate these compounds from berry leaves, providing valuable raw material for functional foods or dietary supplements with enhanced antioxidant properties. In addition, the use of leaves as a source of phenols can contribute to waste reduction and resource conservation in berry processing.

Aims: The aim of this study was to investigate the potential of ultrasound-assisted extraction (UAE) as an advanced extraction technique for the recovery of antioxidants such as phenols from blackcurrant and bilberry leaves.

Methods: In this study, the UAE process was optimized varying the following parameters: amplitude (50, 75, 100%), extraction time (5, 10 min) and the ratio of plant material to solvent (1:20, 1:30, 1:40 mg/mL) using 30% ethanol as the solvent. The phenolic content of the obtained extracts was quantified spectrophotometrically using the Folin-Ciocalteu method, while antioxidant activity was assessed by ABTS method.

Results: Results demonstrated that blackcurrant and bilberry leaves are rich source of phenolic compounds, with blackcurrant leaves containing 17.03-38.09 mg gallic acid equivalent (GAE)/g dry weight of phenols and exhibiting antioxidant activity in a range from 188.35 to 455.47 μmol Trolox equivalent (TE)/g dry weight. Bilberry leaves showed slightly higher phenolic content (18.98-42.00 mg GAE/g dry weight) and antioxidant activity (208.77-602.68 μmol TE/g dry weight). Optimal extraction conditions for blackcurrant leaves were determined as a 100% amplitude, 10 min extraction time and sample:solvent ratio of 1:40, while for bilberry leaves, it was a 50% amplitude, 5 min extraction time and ratio of 1:40.

Conclusions: These findings underscore the impact of UAE parameters on phenolic yield and antioxidant activity of obtained extracts, emphasizing the importance of optimizing extraction conditions. Moreover, the study highlights the potential of berry leaves as a source of antioxidant phenolic compounds and underline the significance of research in this area for nutraceuticals and functional foods, with a dual focus on maximizing resource utilization and minimizing processing waste.

P-25 | The occurrence of micromycetes in black soldier fly (*Hermetia illucens*) larvae after the conversion of different feed

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Background: The black soldier fly (BSF), *Hermetia illucens*, is a polyphagous and saprophagous insect used industrially to convert organic waste into insect biomass, which serves as sustainable animal feed and potential human food. Integrating black soldier fly larvae (BSFL) rearing with organic residues from the agri-food sector for animal feed and frass for soil amendment fosters a circular economy by revalorizing waste, reducing the environmental impact of animal production, and minimising waste. Additionally, BSF offers potential to provide new antimicrobial peptides to combat antibiotic resistance. The microbiota of BSFL includes a complex ecosystem of microorganisms present in its environment and digestive tract. It comprises bacteria, microscopic filamentous fungi, yeasts, and other microorganisms involved in the decomposition of organic matter and the digestion of feed. Various factors affect the microbiota of BSFL: the type and quality of feed, environmental conditions, the presence of competing organisms, BSFL genetics, the presence of antimicrobial substances in substrates, substrate decomposition level, and substrate processing methods.

Aims: This study aims to investigate how various feed substrates influence the prevalence and diversity of micromycetes in BSFL.

Methods: In the study, we monitored the mycocenosis of BSFL fed with 3 variants of feed: (I) egg pasta cooked in whole milk; (II) egg pasta cooked in whole milk inoculated with *Penicillium verrucosum* CCF 1636; and (III.) egg pasta cooked in whole milk with added ochratoxin A/OTA standard (10 µg OTA.kg^{-1}). Each variant was fed 250 g of BSFL at 27±1 °C and 40±1% humidity in 4 repetitions. BSFL were fed for 3 days (300 g/day) and then frozen at -80 °C. We monitored microscopic fungi (yeasts and filamentous fungi) using the plate dilution method and DRBC medium (dichloran rose bengal chloramphenicol; inoculum volume 0.1 ml; dilutions 10^{-2}, 10^{-3}, and 10^{-4} in two repetitions), with genus-level identification after 7 days of cultivation at 25±1 °C in the dark.

Results: At the beginning of the experiment, the number of microscopic filamentous fungi in the analysed BSFL was 3.3 log CFU.g^{-1}, and the number of yeasts was higher, 3.9 log CFU.g^{-1}. The counts of micromycetes in BSFL decreased in all three feeding variants compared to the initial counts (I. <2.2 log CFU.g^{-1}/standard deviation, SD 0.301; II. 3.0 log CFU.g^{-1}/SD 0.00; III. <2.0 log CFU.g^{-1}/SD 0.00). Conversely, the yeast counts in BSFL increased in all feeding variants compared to the initial counts (I. 5.8 log CFU.g^{-1}/SD 0.35; II. 5.5 log CFU.g^{-1}/SD 0.49; III. 5.3 log CFU.g^{-1}/SD 0.41). The highest number of micromycetes was found in variant I (egg pasta cooked in whole milk, 5.79 log CFU.g^{-1}) and the lowest in variant III, where BSFL were fed with feed containing OTA. From BSFL in variant I, we isolated representatives of the genera *Acremonium*, *Fusarium*, and *Penicillium*. From BSFL in variant II, we isolated representatives of the genera *Cladosporium*, *Fusarium*, and *Trichoderma*. Any

micromycetes were isolated from BSFL in variant III, suggesting that the presence of OTA in the larvae feed affected the resulting mycocenosis of BSFL.

Conclusions: The study found that different feed variants for BSFL significantly impacted the microbial community within the larvae. BSFL in variant I (egg pasta cooked in whole milk). Yeast counts increased in all feed variants, showing that feed composition differently affected fungal communities. Any micromycetes were found in larvae fed with OTA, highlighting OTA's significant impact on BSFL mycocenosis.

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P-27 | Kitchen waste bioconversion using black soldier fly (*Hermetia illucens*) larvae and their resulting microbial properties

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Background: Every year, a vast amount of food waste is generated worldwide, leading to significant economic, environmental, and social challenges. A new solution for recycling this waste is using insect larvae for biodegradation. One promising species is the black soldier fly (*Hermetia illucens,* BSF), whose larvae (BSFL) can convert low-value organic waste into nutritionally valuable insect biomass. Larval biomass is rich in proteins and fats, making it useful as feed for animals and potentially as a food ingredient for humans. However, using BSFL biomass for nutrition or fodder depends on various factors, especially the safety of these products.

Aims: The study is devoted to microbiological analyses of BSFL after their application in the bioconversion of food waste, focusing on total microbial count (TMC), coliform bacteria (CB), spore-forming bacteria (SF), filamentous micromycetes (FMM) and yeast (Y).

Methods: The larvae were reared at a temperature of 27 ± 1 °C and a humidity of 40 ± 1% in ventilated plastic containers. The feed was formulated to simulate kitchen waste (hydrated couscous, boiled egg, fresh spinach, and carrot peels in a ratio of 30:5:1:2) and prepared in 3 variants: freshly prepared feed (I.), feed naturally contaminated with microorganisms and incubated for 5 days at room temperature (II.), fresh feed with the addition of *Escherichia coli* solution (10 ml) at an optical density of 0.5 McF. Each variant was prepared in four repetitions in separate containers. Each container held 100 g of larvae (totally 400 g of BSFL per variant) and received 1140 g of feed at the start of the experiment. The breeding lasted 8 days, with the larvae starving for the last 1-2 days. On the 8th day, BSFL were separated from the compost and frozen at -80 °C. The plate dilution method and nutrient media Plate Count Agar (for TMC), Violet Red Bile Agar (for CB), Meat Peptone Agar (for SF), and Dichloran Rose Bengal Chloramphenicol Agar (for FMM and Y) were used for microbiological analyses.

Results: To monitor changes after bioconversion, microbiological analyses were also done before the experiment. The detected counts of monitored microbes in log CFU.g^{-1} were as follows: TMC 6.77, CB 5.85, SF 5.66, FMM 3.62, and Y 3.97. After the bioconversion process, an increase in the number of monitored microbes was recorded in most cases, especially CB (maximum average 7.66 in variant III.) and Y (maximum average 5.78 in variant I.). TMC values in variants I. and II. remained at a relatively consistent level, but in the case of variant II., we recorded an increase to an average value of 7.29 log CFU.g^{-1}. In the case of SF, compared to the initial counts, we recorded a reduction to an average value of 4.93 log CFU.g^{-1} in variant I. Within FMM, we noted significant differences in the monitored variants. While in I. and II. no colonies were recorded, in the variant with mouldy feed, there was a significant increase in FMM counts to 5.33 log CFU.g^{-1}.

Conclusions: The experiment suggests that the total microbial load does not fluctuate drastically during the bioconversion process and may selectively reduce spore-forming microbial populations, which could be beneficial for the safety of the resulting biomass. On the other side, the finding that the numbers of FMM showed significant variability between different feeding variants and CB were

generally increased suggests that the microbial composition of the feed could have a substantial effect on the resulting larval microbiome. The results of the experiment support the feasibility of using BSFL in waste management but also emphasize the importance of monitoring microbial safety in the case of future use.

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P-28 | typical bacteria in Hungarian dairy products and their antibiotic resistance

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The purpose of this study was to determine the dominant microbes, their phenotypic antibiotic resistance, and the clonal relationships between lactic acid bacteria (LAB) in commercially available raw milk and fermented dairy products from Budapest, Hungary. A total of twenty-seven non-LAB and thirteen LAB were isolated from raw milk, sour cream, cottage cheese, yogurt, and cheese using different agar plates (M17, modified MRS-BPB, CATC, Harlequin *Salmonella*, Palcam, Baird-Parker, and ChromoBio Coliform) under diverse incubation conditions. Identification was conducted through cell morphology, cell wall composition, and MALDI-TOF MS. Antibiotic resistance patterns of the strains were assessed by the Kirby-Bauer disk diffusion method using twelve different antibiotic discs. Clonal relationships were determined based on a dendrogram, which was constructed from molecular fingerprints of LAB generated by RAPD-PCR using primer D8635. Modified MRS-BPB agar effectively isolated LAB, whereas M17 displayed low selectivity. Colonies were isolated from CATC, Harlequin *Salmonella*, Baird-Parker, and ChromoBio Coliform agar plates, while no growth was detected on Palcam agar. MALDI-TOF MS identified the LAB strains as *Lactococcus lactis*, *Lactobacillus curvatus*, *Lacticaseibacillus paracasei*, and *Leuconostoc lactis*. Identified non-LAB strains were *Enterococcus faecalis*, *Hafnia alvei*, *Enterobacter hormaechei*, *Staphylococcus epidermidis*, *Escherichia coli*, *Staphylococcus saprophyticus*, *Enterobacter ludwigii*, *Enterobacter cloacae*, *Staphylococcus sciuri*, *Serratia liquefaciens*, and *Aerococcus viridans*. Molecular characterization by RAPD-PCR indicated that the LABs were clonally distinct, except for two *Lacticaseibacillus paracasei* strains recovered from cheese and exhibited 100% similarity. The presence of *Escherichia coli*, confirmed by species-specific PCR, outlined the inadequate hygienic conditions during the production or distribution of examined cheese samples. Additionally, 7/13 of LAB strains exhibited resistance to certain antibiotics (Aztreonam, Ciprofloxacin, Kanamycin, and Vancomycin). Among non-LAB isolates, the two confirmed *E. coli* strains derived from cheese demonstrated complete resistance to both clindamycin and vancomycin. These findings highlight the necessity for continuous screening of bacterial strains in dairy products in Hungary to mitigate the risks associated with the dissemination of antibiotic-resistant microbes and ensure food safety. Further genetic studies are essential to accurately determine the impact of these resistant strains on consumer health.

Keywords: dairy products, LAB, antibiotic resistance, MALDI-TOF MS, RAPD-PCR.

P-30 | Improvement of properties and olfactory attributes of isolated protein from edible insects by roasting

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The characteristics of proteins extracted from two kinds of edible insects (*Gryllus Bimaculatus* and *Tenebrio Molitor*, for G.B and T.M, respectively) were compared after roasting at 180°C for 15 min and 200°C for 10 min, respectively. The amino acid content decreased by roasting, and the degree of decrease varied depending on the type of edible insect and roasting temperature. Antioxidant activity increased by 5.2-11.3% following roasting, with no significant differences by roasting temperature. The results of Infrared (IR) spectrum and gas chromatography (GC) analysis revealed that compounds contributing to a strong waxy scent and sour taste decreased, whereas those associated with aroma and floral scent increased as a result of roasting. In conclusion, roasting led to an enhancement in the olfactory characteristics of proteins extracted from edible insects, and roasting at 180°C for 20 min for G.B and 200°C for 15 min for T.M could be considered optimal.

Keywords: edible insects; roasting; olfactory characteristics; infrared spectrum: Gas chromatography

P-31 | The effect of adding different proteins on liquid whole egg rheological properties

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Eggs are very nutritious containing high-quality protein, vitamins, and minerals essential for a balanced diet. it contains all nine essential amino acids, making it a complete protein source, ideal for muscle repair and growth. Egg and whey protein are two popular sources of high-quality protein, each offering unique benefits for muscle growth, recovery, and overall health. Egg protein, derived from egg whites, is a complete protein, providing all essential amino acids required by the body. It is known for its excellent digestibility and bioavailability. On the other hand, whey protein, extracted from milk during the cheese-making process, is known for its rapid absorption and rich amino acid profile, particularly its high concentration of branched-chain amino acids. Whey protein is often preferred for post-workout supplementation due to its quick digestion and ability to stimulate muscle protein synthesis effectively. Both egg and whey protein contribute to maintaining muscle mass, supporting immune function, and aiding in weight management, making them versatile and valuable additions to a balanced diet. The aim of this study is to evaluate the effect of adding egg white protein and whey protein on liquid whole egg rheological properties as a try to produce a new with higher protein percentages. 3, 5, 10% W/W of powdered egg white and whey protein were added to liquid whole eggs then viscosity measurements were performed by MCR 92 rheometer (Anton Paar, Les Ulis, France) at 15 °C to evaluate the effect. It was found that adding both proteins to liquid whole egg shifted it rheological properties more into a pseudoplastic behavior and this can be explained by the fact that increasing proteins in liquid egg can increase protein- protein interaction causing a shift in viscosity.

P-32 | Sensory analysis of selected essential oils

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Background: Essential oils (EOs) as secondary metabolites of plants are a complex mixture of components with a wide range of biological activities. Besides their antimicrobial effect, EOs are also characterized by strong aromatic properties and, due to their volatile nature, they can easily interact with foods and affect their organoleptic profile. Therefore, it is important to test sensory impact of EOs on foods in terms of their acceptability to the consumer.

Aims: Based on previous results of antifungal efficacy, the aim of this work was to test the effect of vapour phase of selected EOs with proven antifungal activity on the aromatic properties of a model commodity apple.

Methods: The *in vivo* sensory influence of five EOs was tested: clove, lemon, cinnamon, cinnamon bark and laurel. The apple samples were placed in 500 ml glass containers with a filter paper (Whatman No. 1, 1.5 × 1.5 cm) glued to the lid to prevent direct contact of the EO with the test commodity. Apples were treated with two concentrations depending on the type of EO: cinnamon EO was applied at a concentration of 125 $\mu l.l^{-1}$ and 250 $\mu l.l^{-1}$, the others at a concentration of 250 $\mu l.l^{-1}$ to 500 $\mu l.l^{-1}$. The containers were hermetically sealed, and the samples were stored in a modified atmosphere for 7 days at 21 ± 1 °C. Sensory evaluation was performed using a 9-point hedonic scale, where 1 = "unacceptable" and 9 = "very good". In the control, water was applied instead of EO. The experiment was carried out in two repetitions.

Results: In apple appearance trait, the EOs treated samples were not significantly different compared to the control. Flavour and odour characteristics of apples were most positively affected by clove EO at both concentrations, followed by lemongrass EO and cinnamon bark EO. On the other hand, the concentrated cinnamon EO overpowered the original apple flavour in some cases. Taste was also the trait in which the presence of the foreign component was most pronounced. The aroma of the samples was less affected by the EO than the taste. Samples stored at lower EO concentrations were more acceptable, although clove EO proved most suitable when used in higher concentrations. The sample treated with laurel EO was evaluated as the worst, regardless of the concentration.

Conclusions: Evaluators generally preferred samples stored in the presence of less concentrated EOs, namely lemongrass, clove and cinnamon. Although there was a foreign flavor/scent of the EO in the apple, it was not intrusive to the sensory profile of the apple.

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P-33 | Biocontrol activity of isolates from fruits: dog rose (*Rosa canina L.*), medlar (*Mespilus germanica L.*), and golden apple (*Malus domestica L.*)

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The use of synthetic chemical fungicides is the principal method of controlling postharvest diseases. However, its usage is being restricted because of concerns regarding their potential impact on human health and environment. Biological control agents are now an important alternative to the use of chemical pesticides.

Dog rose fruit (*Rosa canina L*.) has a long tradition of use in tea, jam, and syrup but is rarely eaten raw. The medlar (*Mespilus germanica L*.) is an often-overlooked fruit in the Rosaceae family, and its cultivation in central Europe has become increasingly rare, mostly limited to botanical gardens and small farms. Golden apple (*Malus domestica L*.), however, is a very well distributed fruit around the globe, and the temperate climate in Hungary is highly favourable to its cultivation in the country. The fruits present great nutrional values, rich in vitamins and minerals, considered promising crops for the use in the food supplement industry.

The strains studied were isolated from dog rose, medlar, and golden apple fruits in Hungary, during the years of 2021 and 2022. The collected isolates were cultivated on YEPD medium for further analysis. For the screening and identification of their biological control activity, the contact method was used against four bacterial strains: *Listeria innocua CCM 40230, Escherichia coli ATCC 8739, Pseudomonas aeruginosa ATCC 9027,* and *Bacillus cereus B 2078*, and as well as seven yeast strains: *Zygosaccharomyces lentus Y 1200, Saccharomyces cerevisiae CBS 1171, Zygosaccharomyces bailii PM 167, Zygosaccharomyces rouxii A9, Pichia anomala J 121, Candida parapsilosis Y 1011*, and *Galactomyces geotrichum*. Ten isolates (2 isolates from golden apples, 1 isolate from medlar and the remaining from dog rose fruits) showed capability of inhibiting the growth of the bacteria and yeasts under certain conditions, such as at 25 °C degrees, in a period after 48 h incubation, on YEPD medium. Further analysis is needed to identify the isolates and to determine their possible biological defence mechanisms.

P-34 | Combining pre-processing methods and partial least squares models to assess egg freshness using near-infrared spectroscopy

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Background: Conventional method for monitoring egg freshness is destructive and laborious. Recently, near-infrared spectroscopy (NIRS) has been utilized as a rapid, non-destructive method to assess egg quality in several studies. However, the effectiveness of NIRS is highly influenced by spectral pre-processing techniques.

Aims: The objective of this work is investigation of the effect of spectral pre-processing on the accuracy of NIRS.

Methods: Shell eggs were stored in ambient conditions for 4 weeks and analyzed for freshness by measuring Haugh unit (HU) and NIR spectra (900 – 1700 nm). Five pre-processing techniques were tested, including standard normal variate (SNV), multiplicative scatter correction (MSC), first-order derivative (1D), second-order derivative (2D), and Savitzki-Golay smoothing. The pre-processing techniques were combined with partial least squares discriminant analysis (PLS-DA) for classification according to egg grade and with partial least squares regression (PLSR) for estimating HU. All models were trained and validated by 10-fold cross-validation. The performance of PLS-DA was evaluated by overall accuracy (Ac), while the quality of PLSR was tested by coefficient of determination (R2) and root mean squared error (RMSE).

Results: The egg freshness gradually decreased from grade AA (HU ≥ 72) to grade B (HU = 31 – 59) after storage period (4 weeks). In classification, all models produced good accuracy (> 85 %). PLS-DA models using pre-processed spectra did not significantly differ in accuracy (Ac = 85.16 – 86.19 %). Additionally, using pre-processed data did not notably improve the discrimination rate compared to using raw spectra (Ac = 85.23 %). In predicting HU, the quality of PLSR models varied depending on the pre-processing techniques used. The highest predictive accuracy was found for the PLSR model combined with 1D (R2 = 0.832 and RMSE = 2.975).

Conclusions: Investigation of the effect of pre-processing techniques before establishing PLS models in NIRS is always suggested to achieve the best predictive accuracy, and thus improvement of performance of the monitoring method.

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P-35 | Effect of rosehip, lemongrass, and eucalyptus oils addition on lactic acid wort-based beverages characteristics

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Background: Natural plant extracts and oils have garnered significant interest due to their potential to imbue beverages with a wide range of desirable properties, including nutritional value, antioxidant capacity, and sensory attributes.

Aims: The aim of the study was to investigate the effect of the addition of rosehip, lemongrass, and eucalyptus oils on the physicochemical, functional, antioxidant, and sensorial characteristics of the lactic acid wort-based beverages

Methods: In the present work, rosehip, lemongrass, and eucalyptus oils in concentration 0.01, 0.02, and 0.03% (v/v) were added to wort, produced with 60% Pilsen malt, 20% Vienna malt, and 20% Caramel Munich II malt. Fermentations carried out with *Lacticaseibacillus casei* spp. *rhamnosus* Oly at *25*±1°*C* for 48 hours. The extract, pH, and viable cells concentration were monitored daily. The content of total phenolic compounds, phenolic acid, and flavonoids were determined because of their antioxidant activity, which was measured by CUPRAC and ABTS methods. Sensory evaluation of the beverages produced was also carried out.

Results: The increase in the oil concentrations led to a decrease in the number of viable lactic acid bacteria cells during fermentation but all the beverages produced can be classified as functional. Regardless of the oil concentration a higher concentration of total phenolic compounds and phenolic acids was measured in the final beverages but the flavonoid content was not affected significantly. The results for the antioxidant activity measured by ABTS and CUPRAC methods were contradictory. Lactic acid fermentation led to a decrease in the antioxidant activity of all the beverages produced, when the antioxidant activity was measured by the ABTS method, and in the antioxidant activity of the beverage with 0.03% rosehip oil, when the antioxidant activity was measured by the CUPRAC method. The tasting panel preferred mostly the beverage with 0.02% lemongrass oil addition

Conclusions: The addition of eucalyptus and rosehip oil did not improve the sensory characteristics of the beverages produced. Lemongrass oil addition improved the sensorial characteristics but it has to be used in concentration up to 0.02% (v/v) because higher concentration inhibited lactic acid fermentation. The beverage with 0.02% lemongrass oil showed the highest content of total phenolic compounds, phenolic acid, flavonoids, and one of the highest results for antioxidant activity, measured by ABTS and CUPRAC method.

P-36 | Development ot new wort-based beverages with citrus essential oil addition

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Background: In recent years, growing health consciousness among consumers has prompted breweries to diversify their products by offering beverages with low alcohol content and enhanced nutritional value.

Aims: This study aimed to develop wort-based beverages containing 3 different citrus essential oils – grapefruit, lemon, and tangerine.

Methods: In the present work, biochemical and molecular-genetic identification of yeast, isolated from spontaneously fermented oat milk was carried out. The yeast was used for inoculation of wort, produced with 60% Pilsen malt, 20% Vienna malt, and 20% Caramel Munich II malt with and without the addition of citrus essential oils. Fermentations were carried out at a constant temperature of 10 °C for 5 days. The dynamics of the extract, the alcohol content, pH, and viable cells concentration were monitored daily. The content of total phenolic compounds, phenolic acid, and flavonoids were determined because of their antioxidant activity, which was measured by DPPH and FRAP methods. Descriptive sensory evaluation was also carried out

Results: The used yeast was classified as *Saccharomyces cerevisiae* Y2. Its growth was inhibited during fermentation with citrus oil addition and the slowest fermentation was observed when lemon essential oil was used. In this beverage there was a decrease in the viable yeast cells concentration with two orders of magnitude. Interestingly, at the end of fermentation the beverage with lemon oil showed the highest antioxidant activity, measured by DPPH method. The highest antioxidant activity, measured by FRAP method showed the control. The results for phenolic compounds in the final beverages were almost equal except flavonoids. The highest flavonoid content was measured in the control. The tasting panel preferred the beverages with grapefruit and tangerine oils.

Conclusions: The addition of lemon, tangerine, and grapefruit oil affected differently the biological value and the sensory properties of the wort-based beverages. The results obtained will be used for optimization of process variables in the production of pilot-scale wort-based probiotic beverages with essential oil addition.

P-37 | The health benefits of baobab fruit pulp *Adansonia digitata* L.: A nutrient-rich resource

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The common public health problem in Sudan is malnutrition caused by nutrient deficiency connected to food insecurity. A high intake of unhealthy foods and poor diet were strongly associated with low incomes among the population of western Africa especially Senegal. Therefore, natural healthy food sources based on plants are recommended to support the human body's health. This study aimed to investigate how the dried baobab fruit pulp provides healthy nutrients to humans and can be used in solving food security issues in Senegal and Sudan. Two Baobab samples have been collected from different rural markets in Sudan, and two different Baobab samples (originated in Senegal) were obtained from the Hungarian market. Proximate analysis was conducted according to the MSZ ISO. The results indicated remarkable differences in the nutritional value at the 5% level. The protein and ash content were greater in Sudan (2.943 g/100 g, and 5.39 g/100 g), whereas, in Senegal, there were higher levels of dry matter (89.45 %, fat content 0.834 g/100 g, and PH 3.25). The high level of essential elements such as calcium (3286 mg/Kg), potassium (19072 mg/Kg), iron (62.72 mg/Kg) manganese (11.33 mg/Kg), and magnesium (1879 mg/Kg), associated with its low level of sodium and fat component, presented the baobab fruit to be consumed as a healthy diet. The incorporation of baobab ingredients into daily food plans can highly contribute to the reduction of nutritional deficiencies and human health risks. Further research is required to promote the use of dried baobab fruit pulp as a crucial natural and healthy food source.

Keywords: Baobab, nutritional values, human health, food security

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P-38 | Utilization of enzyme-triggered degradation of plant components in order to fortify oligosaccharide content of prebiotic potential

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Objective:
The aim of this research is to enhance the potential prebiotic effect of various foods of plant origin with the application of hydrolytic enzymes, as more prebiotic products can be created by enzymatically converting polysaccharide fibers in foods into oligosaccharides.

Materials and methods:
Diverse plant variants (oat, amaranth, buckwheat, chickpea, rye, millet) were used to prepare suspensions of 10 %, which were heat-treated at 100 °C while stirring for 1 hour. After being cooled to room temperature appropriate buffer and hydrolytic enzyme were added. Samples were taken at different reaction times. After sampling, the enzyme was inactivated by heat treatment. The quantitative analysis of the products generated in the reaction was carried out with Somogyi-Nelson reducing sugar determination method, the qualitative analysis by thinlayer chromatography.

Results:
During our work, we successfully enriched oligosaccharides in several plant food samples using xilanase and cellulase hydrolytic enzymes. The optimal conditions for the enzymes have been established by previous measurements. From each reaction samples were taken at different times and the concentration of the formed reducing sugars was determined. In most cases, reducing sugar concentration was proportional to the length of enzymatic degradation. For the identification of the resulting reaction products, a thin-layer chromatographic method was developed with a suitable solvent mixture. The extent and advance of hydrolysis was established, and thin-layer chromatography determined the degree of polymerization of the formed oligosaccharides, which varied between 2 and 7.

Conclusion:
In our study, we converted polysaccharides found in plant foods into smaller oligosaccharides. The resulting suspensions may be effective candidates in the future for increasing the prebiotic activity of certain foods as additives.

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P-41 | Coliform bacteria in fresh and gently pasteurised fruit and vegetable juices

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Background: Consumers' desire for more natural and healthful options drives the growing trend towards fresh juices, as freshly prepared juices retain more vitamins, minerals, and enzymes compared to their processed counterparts. However, this also brings a heightened risk of contamination if proper sanitation protocols are not followed. One key indicator of hygiene quality in juice preparation is the presence and quantity of coliform bacteria.

Aims: The aim of the study was to determine the occurrence of coliform bacteria in fruit and vegetable juices and to further identify the detected bacteria using MALDI-TOF MS.

Methods: In the study, 20 samples of fruit (apples, grapes, sea buckthorn, pineapple, orange) and vegetable (carrots, beetroot, pumpkin) juices were analyzed. 9 samples were prepared under laboratory conditions, 4 samples - according to the producer - were gently pasteurized and were purchased in stores, and 7 samples were purchased as freshly prepared by the retailer. Coliform bacteria were determined on violet red bile agar. Dilutions of 10^{o} and 10^{-1} were used for inoculation. Identification of coliform bacteria was done on MALDI-TOF MS.

Results: The presence of coliform bacteria was not detected in 8 samples: 4 juices purchased in shops (gently pasteurised) and 4 samples of fruit juice prepared in the laboratory. Coliform bacteria were detected in vegetable juices prepared in the laboratory (9.10^{0} – $2{,}5.10^{1}$ cfu/mL). Coliform bacteria were detected in all samples that were purchased as freshly prepared by the seller (1.10^{0} – 5.10^{2} cfu/mL). Using the MALDI-TOF MS, species of genera were identified: *Enterobacter* (8 samples), *Klebsiella* (6 samples), *Leclercia* a *Serratia* (1 sample). The spectrum of species was as follows: *Enterobacter asburiae*, *E. cloacae*, *E. ludwigii*, *Klebsiella oxytoca*, *K. planticola*, *K. pneumoniae*, *Klebsiella* sp., *K. terrigena*, *Leclercia* sp. According to Commission Regulation (EU) 2019/229, unpasteurised fruit and vegetable juices are monitored for *Escherichia coli*. The presence of this representative of coliform bacteria was not observed.

Conclusions: Freshly prepared vegetable juices, especially those from root vegetables or vegetables growing in contact with soil, are riskier in the presence of coliform bacteria. The risk of coliform contamination is higher in the case of juices prepared by retailers, including fruit juices. No coliforms were detected in juices treated with gentle pasteurization.

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P-42 | Redox potential as a significant parameter for *Escherichia coli* and *Citrobacter freundii* differentiation

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Coliforms are a group of bacteria that can be used to measure water and food hygienic quality. These bacteria are commonly present in the environment and the intestines of warm-blooded animals. *Escherichia coli* (*E. coli*) is a coliform bacterium often used to detect fecal contamination, while *Citrobacter freundii* (*C. freundii.)* is found in diverse environments and occasionally in clinical infections. Various detection methods are used to ensure food safety. Recent studies have demonstrated the accuracy of microbial differentiation through redox potential measurements.

This study aims to differentiate between two coliform bacteria, *E. coli* and *C. freundii* based on their redox potential curves. The redox curves were investigated using the MicroTester device (MicroTest Ltd., Budapest, Hungary). Classification and differentiation were established using Support Vector Machine (SVM) and they were based on two models. The first classification analysis was based on the first-order characteristic metrics and the second classification analysis was based on the fitted Gompertz model's parameters. The first classification demonstrated a high differentiation accuracy of 97%, indicating a robust distinction between the two bacterial species. Additionally, the Gompertz model independently provided a notable differentiation accuracy of 92%. These findings suggest that the redox potential curves offer a reliable method for distinguishing *E. coli* and *C. freundii.*

Keywords: E. coli, C. freundii, differentiation, redox potential

P-43 | Sensory and nutritional attributes of minor cereals

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Background: Recent findings suggest that some alternative crops (for example, spelt, blue, purple, emmer, einkorn and sorghum) seem to be of great nutritional interest and to represent important recipes for healthy and typical regional foods. It is important to investigate the effect of bread intake that is made from previously mentioned cereals. This increasing interest in minor cereals is observed among consumers, bakeries, and farmers, with a focus on local crop production and sustainability trends.

Aims: The study aims to evaluate the sensory characteristics of minor cereals including spelt, blue, purple, emmer, einkorn and sorghum, such as taste, aroma, and texture and to analyze the nutritional composition of minor cereals to identify potential health benefits associated with their consumption in various food products to enhance nutritional value and sensory appeal. This was conducted on two groups of flour white and wholemeal flour for each sample.

Methods: Sensory tests were conducted by a trained panel. We have applied sensory profile analysis using line scales to evaluate white and whole meal bread samples (appearance of crumb grains, mouthfeel of crumb, flavor intensity of crumb, and firmness of crust).

Nutritional tests include: The mineral content, reflected in ash, was measured by incineration, based on AACC method. Protein content by using Kjeldahl method based on the Association of Official Analytical Chemists (AOAC) were used to measure. Dietary fiber analysis based on the enzymatic-gravimetric method. The thermal balance method was also utilized for moisture content determination by heating the sample at 120 °C.The Soxhlet method was used as the standard technique for fat content analysis.

Results: Sensory Evaluation: The sensory evaluation of minor cereals bread products including spelt, blue, purple, emmer, einkorn and sorghum demonstrated their unique and distinctive sensory attributes.

Nutritional Attributes: The analysis revealed distinctive nutritional properties compared to common bread wheat. Showing higher levels of certain nutrients (e.g. protein, moisture and minerals). Incorporating those varieties into food products can provide additional nutritional and health benefits to consumers.

Conclusions: Incorporating minor cereals varieties into food products may offer additional nutritional benefits and interesting sensory properties for consumers. Therefore, it is important to support local farmers who grow these varieties as sustainable and wholesome food supplies.

P-44 | Exploring the antioxidant content of fruits peels: Analysis and recommendations for future research on food waste integration

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Background: There is a growing interest on food waste research due to its direct importance in environmental and resource sustainability, food security, resource management, and the increased economic and environmental costs associated with food waste and loss. Qatar has an arid environment and relies on fresh produce imports from other countries while half of the landfill waste consists of food waste. With limited food production, it is only logical to utilize any food waste based on their functionality. Qatar has included in its Food Security stategy polies for reduction of food waste by re-using, recycling, and treatment. Fruit peels, which are a byproduct of food production, are rich sources of phenolic compounds with potent antioxidant potential and exhibit several health benefits including anti-inflammatory, anti-hypertension, anti-cancer, anti-diabetic, anti-obesity, and neuroprotective effects.

Aims: The objective of this study was to assess the antioxidant content and antioxidant capacity in fruit peels from fruits imported into Qatar.

Methods: Fruits samples from various countries of origin were analyzed for their antioxidant content and antioxidant capacity using the DPPH assay, ABTS assay, CUPRAC assay, and FRAP assay. The fruit peels analyzed were bananas, tangerine, melon, pomegranate, and mango

Results: The results indicated that the highest concentration of total phenolic is in pomegranate peels (6784ppm), while the lowest concentration is in tangerine peels (404.11 ppm), whereas Pomegranate peels had the highest antioxidant activity value (87.88%), and the lowest activity was recorded in melon peels (55.48%).

Conclusions: The study contributes to the understanding of antioxidant properties of fruit peels, highlighting their potential use in enhancing food products and promoting health benefits. Fruit peels that are high in antioxidant content are recommended to be used more in food production for their potential health benefits and for other properties e.g. increasing the shelf life of food products, utilization in pharmaceutical products and nutraceuticals.

P-45 | Investigation of sample preparation methods for microelemental analyses of milk powder

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Background: Milk powder is obtained through the partial removal of water content in milk, decreasing the water activity, and therefore increasing its shelf life. The product is a significant ingredient in the industry where it is involved in a variety of dairy and food applications such as ice cream, cheese, evaporated milk, sweetened condensed milk, bakery products, processed meat, soups, and infant formula. Contamination of heavy metals in powdered milk can take place anytime during processing through contact with the equipment, packaging, storage, and transport, or from the raw milk itself. Arsenic, cadmium, lead, and mercury are particularly of major concern. Nevertheless, most heavy metals at elevated concentrations still poses a threat to the health and safety of consumers.

Aims: To optimize the sample preparation and determine the most efficient method for the analysis of microelements in milk powder.

Methods: The productivity of the digestion procedure was investigated by varying the parameters. Different acids were used for comparison: nitric acid (HNO_3) and hydrogen chloride (HCl), checked at varying volumes. The weight of the sample was also varied. The samples were pre-digested at 60°C for 30 minutes. Hydrogen peroxide (H_2O_2) was added, and the main digestion was carried out at 120℃ for 90 minutes, cooled down, filtered, and collected. The samples were analyzed by inductively coupled plasma optical emission spectroscopy (ICP-OES) and inductively coupled plasma mass spectrometry (ICP-MS).

Results: Digestion using hydrogen chloride caused aggressive foaming upon addition of hydrogen peroxide and left permanent black stains on the tubes. As a result, the analysis proceeded using only nitric acid. Using the analytical instrument for the analysis of microelements, it was found that depending on the weight of the sample and volume of the acid, the concentration produced varies for each element and condition. The most suitable weight of sample for the digestion was determined to be 1g which gives high intensities for most elements. For 1g sample-5ml of HNO_3: Zn, Mn, Cu, Y, B, Cd, Ba, La, Nd, Cr, Mo, and Ti produced higher intensities. In case of 1g sample 10mL of HNO_3: Al, Fe, Zn, Ni, Cu, Mn, Li, Sc, Y, B, Cd, Ba, La, Cr, Mo, and Ti. While 1g sample 15mL of HNO_3: Fe, Zn, Ni, Cu, Mn, Li, Sc, Se, Sr, Ba, La, Pb, Cr, Mo, and Ti.

Conclusions: Nitric acid is found to be the most ideal for the digestion procedure compared to hydrogen chloride. Among the sample weight, the least amount being 1g, gave the highest intensity, while the volume of the acid required depends on the elements to be analysed. Some microelements give rise to nearly similar intensities among different volumes of acids used, while some had a much significant amount compared to other volumes.

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O rientation
The Science – Policy Interface
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