BOOK OF ABSTRACTS

XXIII European Conference on Food Chemistry

EUROFOODCHEM XXIII

June 11 – 13, 2025, Bratislava, Slovakia

BOOK OF ABSTRACTS
XXIII European Conference on Food Chemistry
EUROFOODCHEM XXIII
June 11 – 13, 2025, Bratislava, Slovakia

ORGANIZED BY:
European Chemical Society, Division of Food Chemistry
Slovak Chemical Society
National Agricultural and Food Centre, Food Research Institute in Bratislava
Faculty of Chemical and Food Technology of the Slovak University of Technology in Bratislava

EDITED BY:
Zuzana Ciesarová, Lukáš Kolarič, Irena Vovk, Karel Cejpek

PUBLISHED BY:
National Agricultural and Food Centre, Lužianky, Slovakia, 2025

Location of e-print: https://eurofoodchem2025.schems.sk/

Slovak National Library
ISBN 978-80-89162-96-3
EAN 9788089162963

Content

WELCOME MESSAGE

Dear Colleagues and Friends,

On behalf of the Slovak Chemical Society, the National Agricultural and Food Centre, and the Faculty of Chemical and Food Technology at the Slovak University of Technology in Bratislava, it is my pleasure to welcome you to the XXIII European Conference on Food Chemistry – EUROFOODCHEM XXIII – taking place in Bratislava, Slovakia, from 11 to 13 June 2025.

EUROFOODCHEM is the flagship congress of the Division of Food Chemistry of the European Chemical Society. Since 1981, it has served as a leading platform for researchers, technologists, and professionals in food chemistry to share advances, foster collaboration, and support young scientists.
We are honored to host this prestigious event in Slovakia for the first time. Bratislava, our capital city on the Danube River, offers a vibrant mix of history, accessibility, and hospitality – an ideal setting for scientific exchange and networking.

EUROFOODCHEM XXIII is bringing together more than 250 registered delegates, coming from 37 countries from Europe, Asia, America and Africa, which demonstrates the worldwide interest of academia and industry in food chemistry. This year's programme will feature 7 plenary lectures, 6 keynote lectures, 76 oral presentations, 16 flash presentations, 158 poster presentations and 3 workshops, and focused discussions around the central theme of WINSAF – Waste-less Innovative Safe Attractive Food Production. A highlight of the event is the dedicated workshop for early-career scientists "How to Be Successful in Science and Business," offering valuable insights into building a scientific career, securing funding, and exploring innovation and entrepreneurship.

We warmly invite you to join us for a stimulating scientific experience and the opportunity to connect with colleagues from across Europe and beyond. Let us work together to advance food chemistry and address the pressing global challenges of food systems and health.

We look forward to welcoming you to Bratislava in June 2025!

Warm regards,

Zuzana CIESAROVÁ
President of EUROFOODCHEM XXIII

Organized by:

Division of Food Chemistry of the European Chemical Society
Slovak Chemical Society
National Agricultural and Food Centre, Food Research Institute in Bratislava, Slovakia,
Faculty of Chemical and Food Technology of the Slovak University of Technology, Bratislava, Slovakia

EuChemS
European Chemical Society
Division of Food Chemistry

NATIONAL AGRICULTURAL AND FOOD CENTRE
FOOD RESEARCH INSTITUTE

STU FCHPT SLOVAK UNIVERSITY OF TECHNOLOGY IN BRATISLAVA FACULTY OF CHEMICAL AND FOOD TECHNOLOGY

Under the auspices

Ministry of Agriculture and Rural Development of the Slovak Republic with a special support of the National Focal Point of EFSA in the Slovak Republic

MINISTERSTVO PÔDOHOSPODÁRSTVA A ROZVOJA VIDIEKA SLOVENSKEJ REPUBLIKY

efsa KONTAKTNÝ BOD

BRIEFLY ABOUT THE ORGANIZERS:

Division of Food Chemistry of the European Chemical Society (DFC EuChemS) aims:

- to represent food chemical societies (or food sectors of chemical societies) at a European level
- to be recognised as a European authority in all matters concerning food chemistry
- to encourage national chemical societies to promote food chemistry in their countries by forming appropriate structures (Divisions, Working groups)
- to promote and harmonize the teaching of food chemistry within food science across Europe
- to promote an effective and continuing cooperation between universities, research centres, food control laboratories and food industries in order to improve the development of food chemistry
- to offer an authoritative and correct view about food chemistry and food chemists to the general public
- to promote the challenges and opportunities of a career in food chemistry in Europe to students and school children.

Slovak Chemical Society (SChemS) stands as the largest and oldest society in Slovakia, which was established in 1929. It proudly holds memberships in European Chemical Society (EuChemS), consortium Chemistry Europe, and International Union of Pure and Applied Chemistry (IUPAC). Presently, it unites around 900 chemists and workers who are distributed among 28 professional groups from various regions across Slovakia. Our primary objective is to foster unity among all chemists in Slovakia who are dedicated to education, science, research, and industry. This is achieved through the organization of conferences and seminars, active support for popular lectures, the Chemistry Olympiad, and other initiatives. SChemS is also committed to acknowledging and awarding talented chemistry students through various competitions.

The National Agricultural and Food Center (NPPC) is a contributory organization of the Ministry of Agriculture and Rural Development of the Slovak Republic. It was established in 2014 by merging several institutions providing sectoral agricultural and food research. It ensures comprehensive research and collection of knowledge in the field of sustainable use and protection of natural resources, especially soil and water for plant cultivation and animal husbandry, ensuring the quality, safety, innovation and competitiveness of food and non-food products of agricultural origin, the production and non-production impact of agriculture on the environment and rural development, and the transfer of agricultural research knowledge to users.

Food Research Institute (VÚP) as one of four agrifood institutes included in NPPC, conducts scientific research and development activities in the field of food chemistry, analytical chemistry, microbiology, molecular biology, genetics, food informatics and the entire complex of technologies, including hygiene and sanitation processes for various sectors of the food

industry. A significant part of the institute's activities is the solution of international and national projects focused on the current issues of food quality and safety. The institute also performs consulting and expert activities, e.g. in the form of verification of food technologies in the pilot plant department at the Biocentrum Modra workplace.
Since 2016, the Institute has also included the now-discontinued Research Institute of Wine and Viticulture. We therefore also provide services focused on assessing the health of vines, consulting in the area of wine quality, and the Institute is the custodian of a valuable collection of autochthonous wine yeasts.

Faculty of Chemical and Food Technology of the Slovak University of Technology, Bratislava (FCHPT) has an exceptional position: it is the only faculty in the system of Slovak university education providing complete university education for all fields of chemical and food processing industry. It is a respected faculty having educated more than 19 thousand Masters of science and 2 000 Philosophiae doctors for the whole spectrum of chemical and food processing industry. The Accreditation Committee of the Slovak Republic as well as the independent agency ARRA have granted FCHPT the first place among the technical universities in Slovakia.

EUROFOODCHEM XXIII Organising Committee
would like to thank and acknowledge the partners

PLATINUM PARTNER

GOLD PARTNERS

SILVER PARTNER

SUPPORTERS

BRONZE PARTNER

MEDIA PARTNERS

SCIENTIFIC COMMITTEE

Zuzana **Ciesarová** (Slovakia)
Conference Chair
Joana **Amaral** (Portugal)
EuChemS-DFC Chair
Cristina **Todasca** (Romania)
EuChemS-DFC Secretary
Irena **Vovk** (Slovenia)
EuChemS-DFC Treasurer
Renata **Oriňáková** (Slovakia)
EuChemS Executive Board Member
Ľubomír **Švorc** (Slovakia)
President of the Slovak Chemical Society

Livia **Simon-Sarkadi** (Hungary)
Marco **Arlorio** (Italy)
Tanja Cirkovic **Velickovic** (Serbia)
Hans-Jacob **Skarpeid** (Norway)
Karel **Cejpek** (Czechia)
Matthias **Wüst** (Germany)
Małgorzata **Starowicz** (Poland)
Michael **Murkovic** (Austria)
Reto **Battaglia** (Switzerland)
Ľubomír **Valík** (Slovakia)

LOCAL ORGANISERS

Zuzana **Ciesarová** (Slovakia)
Ľubomír **Švorc** (Slovakia)
Lukáš **Kolarič** (Slovakia)
Katarína **Ženišová** (Slovakia)
Michal **Procházka** (Slovakia)
Martin **Polovka** (Slovakia)
Milan **Čertík** (Slovakia)
Tatiana **Klempová** (Slovakia)

PROGRAMME AT GLANCE

10 June 2025		
15:00	17:00	**Registration**
16:00	17:00	**PRE-CONFERENCE WORKSHOP:** **State of the art search in research – purpose and strategy**
11 June 2025		
7:30	18:00	**Registration**
9:00	9:20	**OPENING CEREMONY**
9:20	12:30	**Plenary Lectures**
12:30	13:10	Lunch Industry Symposium | NATURES s.r.o. – Platinum Partner
12:30	13:30	LUNCH BREAK
13:30	17:00	**Keynote and Oral Lectures in Parallel Sessions**
17:00	18:00	**POSTER SESSION WITH DRINKS**
18:30	19:30	**CLASSICAL MUSIC CONCERT**
19:30	21:00	**WELCOME RECEPTION**
12 June 2025		
8:00	18:00	**Registration**
8:00	8:30	MORNING COFFEE – MEET THE SPEAKERS
8:30	12:00	**Keynote and Oral Lectures in Parallel Sessions**
12:00	12:30	**Plenary Lecture**
12:30	13:30	LUNCH BREAK
13:00	13:20	Lunch Industry Symposium | Shimadzu – Gold Partner
13:30	14:30	**MID-CONFERENCE WORKSHOP:** **How to be successful in science and business**
13:30	15:00	POSTER SESSION WITH COFFEE
15:00	17:00	**Keynote and Oral Lectures in Parallel Sessions**
17:00	18:00	**POSTER SESSION WITH DRINKS**
20:00	22:00	**GALA DINNER**
13 June 2025		
8:00	11:00	**Registration**
8:00	8:30	MORNING COFFEE – MEET THE SPEAKERS
8:30	10:00	**Keynote and Oral Lectures in Parallel Sessions**
10:00	10:30	COFFEE BREAK
10:40	12:00	**Plenary Lectures**
12:00	12:30	**EUROFOODCHEM AWARDS**
12:30	13:30	**CLOSING CEREMONY**
14:30	17:00	**POST-CONFERENCE WORKSHOP:** **Wiley Journal: Best practices and pitfalls in publishing**
13 June 2025		
14:30	17:00	**49th Annual Meeting of Division of Food Chemistry (DFC) of the European Chemical Society**
14 June 2025		
9:00	13:00	

CONGRESS TOPICS: CHEMISTRY OF W IN S A F

WASTE REDUCTION: byproducts valorisation, rework and recycling, food stability during storage, packaging and labeling

INNOVATION: new sources of raw material for food production, minor food ingredients, novel foods, smart sensors and new methods in food analysis

SAFETY: occurrence, migration and mitigation of chemical and biological contaminants in foods, exposure/risk assessment, health aspects of food consumption, food legislation

ATTRACTIVENESS: quality of food production, food sensory hedonic and instrumental analysis, nutritional aspects of foods

FOOD PRODUCTION: sustainability and effectiveness of food production, detection of adulteration, traceability, foods for future

PLENARY SPEAKERS

VINCENZO FOGLIANO

Professor of Food Quality & Design group at Wageningen University and R&D director of Arterra Bioscience, Wageningen, The Netherlands.

Professor Vincenzo Fogliano is a food scientist. After 20 years of career at the University of Naples as a Professor in Biochemistry, Food Chemistry and Functional Foods, from 2013, nowadays a Professor of the Food Quality & Design group at Wageningen University. Professor Fogliano has published more than 530 publications in indexed journals covering many aspects of food science. These papers received more than 23.000 citations.

The focus of his research is on the design of innovative healthy foods adopting a food system perspective and the focus on gastrointestinal health. His challenge is to use a food design approach to tackle the two main issues of the food sector: feeding the planet in 2050 and counteracting obesity

MICHAEL MURKOVIC

Czedik Eysenberg Lecture

Professor at the Graz University of Technology, Institute of Biochemistry, Austria

He studied Technical Chemistry at Graz University of Technology with a focus on Biotechnology. After a postdoc position at ETH Zürich he worked in the R&D department of an antibiotics' producer. He started at Graz University of Technology in 1993 as food chemist, became Docent and associated Professor in 2002 and was awarded as University Professor in 2024. His research focus was on the formation of carcinogens during food processing. He retired in 2024.

PETER ŠIMKO

Professor of Food Chemistry and Technology at the Slovak University of Technology in Bratislava, Faculty of Chemical and Food Technology, Institute of Food Science and Nutrition.

He participated in the Joint FAO/WHO Expert Committee on Food Additives of FAO/WHO activities and the European Commission in the preparation of the first package of legislative rules and regulations regarding food contaminants.

He has elaborated an original theory about elimination of hazardous compounds from foods based on noncovalent physicochemical interactions between the compounds and package materials.

VURAL GÖKMEN

Professor at the Food Engineering Department at Hacettepe University, Turkey.

He has made substantial contributions to the understanding of process-induced effects on the quality and safety of foodstuffs through his expertise in food science. His research has resulted in over 300 articles published in peer-reviewed journals, including 22 book chapters and the editing of a book.

Currently, he holds the position of editor for Food Chemistry. In recognition of his outstanding contributions, Gökmen was awarded the title of Outstanding Young Scientist by the Turkish Academy of Sciences in 2004. He subsequently became an academy member in 2023. Gökmen received the Science Award from the Scientific and Technological Research Council of Türkiye in 2022.

MICHAELA MUSILOVÁ

President of XtremeFrontiers, Slovakia

Dr. Michaela Musilova is an award-winning astrobiologist, explorer, keynote speaker and author. Michaela has been conducting space-related research at institutions around the world, including NASA, ESA, CalTech, University College London, Chiba University (Japan), Canada-France-Hawaii telescope and many others. She was also the Commander of over 30 simulated missions to the Moon and Mars, the most missions led on record, in collaboration with NASA and many international organizations.

Currently, Michaela is the President and Founder of the non-profit XtremeFrontiers. She is pioneering a unique global project: Astro Seven Summits. It represents a world-first in combining expeditions to the highest mountain on each continent together with scientific research in cooperation with NASA and institutions worldwide, educational activities and filming documentaries.

Michaela's work has been recognised through numerous awards, including Forbes Slovakia's Most Promising 30 Under 30; Top 100 Aerospace and Aviation Professionals on LinkedIn in 2021 & 2022; and the Emerging Space Leaders Grant. She was even selected to journey to Antarctica with the largest all-female in STEM expedition.

A great part of Michaela's work is teaching and giving keynote presentations to audiences of all ages around the world. Her outreach work, work with international media and her biography, A Woman from Mars, aim to help educate and empower young people worldwide. Furthermore, she is helping others succeed in the space sector as Global Faculty at the International Space University, Ambassador for Space ScAvengers and the Head of Research of NEEDRONIX.

ROBERT WOLFF

Researcher at the Foundation for Industrial and Technical Research (SINTEF), Norway, since 2011 and currently holds a position as Senior Business Developer. SINTEF is one of Europe's largest independent research organisations.

He studied chemical engineering and process technology at Norwegian Institute of Technology. After graduating he has had several positions within the bio marine industry and has in depth skills on omega-3-production and marine ingredients. He has served as university lecturer at University College in Ålesund, teaching food chemistry, quality assurance and safety. He has a great overview of the seafood industry in Norway.

Since 2015, Dr. Wolff has acted as the Secretary of Nordic Lipidforum, an industrial and academic network for people dealing with lipids. He also holds a position as member of the board of Euro Fed Lipid, and Division Chair for Marine and Microbial lipids.

MANUEL A. COIMBRA

Full Professor at the Department of Chemistry of University of Aveiro, Portugal.

He graduated in 1985 in Biochemistry at the University of Porto and got his PhD in Chemistry at the University of Aveiro in 1993, in a collaboration with the Institute of Food Research, in Norwich, UK.

He is Professor of Food Chemistry and Biochemistry, Director of the BSc graduation in Biochemistry and Coordinator of the Research Unit LAQV/REQUIMTE-Aveiro.

The scientific expertise and interests of Manuel A. Coimbra are focused on carbohydrate chemistry, polysaccharide structure and applications, food chemistry, and industry by-products valuation under a circular economy. The research has been based in Aveiro, allowing to rule over 80 research projects funded by different entities, including industries. He is co-author of 8 patents, 354 research peer-reviewed papers (15,500 citations, h=66, Scopus), and supervised 28 PhD thesis (+11 running) and 13 Post-Docs. Manuel A. Coimbra is Editor in Chief of Elsevier journal Carbohydrate Polymers (IF2023= 10.7), President of the Scientific Panel of Food Additives and Food Chain Contaminants of ASAE, the Portuguese Food Safety Agency.

Contact: mac@ua.pt

KEYNOTE SPEAKERS

LENKA KOUŘIMSKÁ

Professor, Senior lecturer at the Department of Microbiology, Nutrition and Dietetics, and a vice-dean for international relations of the Faculty of Agrobiology, Food and Natural Resources at the Czech University of Life Sciences Prague, Czechia.

She obtained her master and PhD diplomas from food chemistry and analysis at the University of Chemistry and Technology Prague. Her research activities are focussed on food chemistry and analysis, nutritional and sensory quality of food with a focus on the nutritional value of edible insects, sensory analysis of food, food commodity science, food quality and safety, lipid oxidation, and natural antioxidants. She is the author or co-author of 78 publications with IF (citation index according to the WOS is 1177, h-index 20).

She is an editorial board member of NFS Journal and Journal of Food Research. She a member of International Measurement Confederation, the Czech Chemical Society, and the Czech Society for Nutrition. Within the European large research infrastructure METROFOOD-RI she is the coordinator of the Czech national node.

URSZULA GAWLIK

Full Professor at the Department of Biochemistry and Food Chemistry at the University of Life Sciences in Lublin, Poland.

She was awarded the title of Professor the discipline of Food Technology and Nutrition in 2018. Her scientific expertise focuses on bioactive phenolic compounds derived from edible plants, their nutritional and nutraceutical potential, and their interactions with other bioactive components and the food matrix. Prof. Gawlik has led or contributed to 20 research projects funded by various entities, including industry. She is a co-author of three patents and 154 research papers, which have garnered 5,321 citations (h-index = 43, Scopus).

BENEDIKT CRAMER

Senior scientist at the Institute of Food Chemistry at the University of Münster, Germany.
He earned a degree in Food Chemistry and obtained his PhD in 2009 under the supervision of Prof. Hans-Ulrich Humpf. Since 2012, he has been the head of the service unit for instrumental analysis and mass spectrometry at the institute. His research focuses on the detection, mitigation, toxicity, and human biomonitoring of food contaminants. He has co-supervised publicly- and industry-funded projects investigating the impact of food processing on the formation of furans, acrylamide, and MCPD/GE, as well as the degradation of mycotoxins such as T-2 toxin and citrinin.

JANE K PARKER

Professor of Flavour Chemistry and Food Research Group lead at the University of Reading, UK.
She gained her PhD in physical organic chemistry from the University of Cambridge and became fascinated by flavour chemistry when she worked at Firmenich in Geneva as a process chemist. She is chair of the RSC food group, member of the EuChemS FCD, and was awarded the Bill Littlejohn Medal for contributions to the art and science of flavour.
She has >20y experience in flavour chemistry, and analysis of flavours, off-notes and precursors, particularly flavour formation pathways (Maillard and lipid derived) and how they interact i) with each other, ii) with other sensory modalities, iii) with the other components of the food matrix. She is currently working on designing flavour into plant-based meat analogues, and incorporating pulses into bread, biscuits, crackers, to sustainably increase nutrients. She established the Flavour Centre at the University of Reading which provides consultancy, training and technical service to industry (>100 food companies).
She is heavily involved with EU initiatives, leading work groups in both the AcryRed and Flavoursome Cost Actions and is currently involved in the Horizon Europe PLANTOMYC project using fermentation to generate biomass and flavour from side streams.

PAOLA DUGO

Full Professor of Food Chemistry and vice-rector for Scientific Research (2023-2029) at the University of Messina, Italy.
Her research focuses on conventional and multidimensional chromatographic techniques for the study of complex natural matrices and food products. She is co-author of more than 300 scientific papers.
Prof. Dugo has been coordinator of the Group of Food Chemistry (2019-2021) and vice-president of the Food Chemistry division (2024-2026) of the Italian Chemical Society.

ELISABETH KOCH

EuChemS Division of Food Chemistry Young Researcher Award

Deputy head of the National Reference Laboratory for Food Contact Materials at the German Federal Institute for Risk Assessment (BfR) in Berlin, Germany.

She obtained her PhD in food chemistry in 2023 at the Chair of Food Chemistry at the University of Wuppertal, Germany, in the group of Prof. Schebb. During her PhD, her research focused on the formation of oxidized fatty acids in plant oils and the influence of oil processing on oxylipin patterns, allowing to suggest new potential markers for oil quality and authenticity.

LIST OF PLENARY PRESENTATIONS

PL 1 **Future food design: at the intersection between upcycling and cell agriculture**
Vincenzo Fogliano

PL 2 **Carcinogens in foods as a result of heating processes**
Michael Murkovic

PL 3 **Strengthening food safety through the physicochemical interactions of hazardous compounds with package materials**
Peter Šimko

PL 4 **Impact of acrylamide and other potentially toxic Maillard reaction products**
Vural Gökmen

PL 5 **Food for extreme environments**
Michaela Musilova

PL 6 **Valorisation of byproducts – How the Norwegian seafood industry create more value and bring healthy food products to the marked**
Robert Wolff

PL 7 **Innovation in food - clean label food industry strategies based on carbohydrates**
Manuel A. Coimbra

LIST OF ORAL PRESENTATIONS

SESSION W: WASTE-LESS FOOD PRODUCTION

KN-W: **Nutritional and sensory value of insects as novel food**
Lenka Kouřimská, Petra Škvorová, Barbora Lampová, Anežka Kopecká, Pavel Kouřimský, Martin Kulma

OP-W01 **Valorisation of oil pumpkin (*Cucurbita pepo* L. var. *styriaca*) pulp through fermentation by *Pediococcus* sp.**
Miona Belović, Ilinka Pećinar, Aleksandra Bajić, Ana Varga, Marijana Đorđević, Bojana Kokić, Biljana Cvetković

OP-W02 **Valorization of olive pomace: Sustainable production of bioactive compounds from Portuguese cultivars**
Suzana Ferreira-Dias, Jorge Gominho, Lea Pogačnik da Silva, Fátima Pere

OP-W03 Valorisation of whey and second cheese whey: elaboration of high added value products
Arona Figueroa Pires, Olga Díaz, Carlos Pereira, Angel Cobos

OP-W04 Valorisation of piquant pepper waste towards food condiment
Andreia F.R. Silva, Rita Bastos, Mariana Cunha, Maria H. Gomes, Pedro A.R. Fernandes, Cláudia Passos, Maria P. Ramos, Norton Komora, Manuel A. Coimbra

OP-W05 Sustainable bioactive recovery: the most efficient quercetin extraction from onion peel
Tatiane C. G. Oliveira, F. Chamorro, M. Carpena, M.A. Prieto, Délio Raimundo, Isabel C.F.R. Ferreira, M. Beatriz P.P. Oliveira, Eliana Pereira, Lillian Barros

OP-W06 Sustainable lipid wastes bioconversion – *Yarrowia lipolytica* in lipase and microbial lipids production
Katarzyna Wierzchowska, Agata Fabiszewska

OP-W07 Sensing arrays for fruit ripeness evaluation
Blanka Tobolková, Mária Kopuncová, Janka Kubincová, Xiang Wang, Xiaoshuan Zhang

OP-W08 Exploring insect-derived proteins as sustainable alternatives: digestibility, allergenicity and inflammatory potential
Lisete M. Silva, Inês E. Silva, Sara da Silva, Rafaela Fantatto, Marisa V. Santos, Ricardo Dias, Susana Soares, Victor Freitas

OP-W09 NMR metabolomics to observe the effects of drying processes and growth stage on *Acheta domesticus* (house cricket) nutritional profile
Mattia Spano, Giuseppina Adiletta, Irene Ferri, Paola Russo, Luisa Mannina

OP-W10 Comprehensive two-dimensional liquid chromatography for the characterization of the phenolic content in extra virgin olive oil and its by-products
Francesco Cacciola, Marina Russo, Katia Arena, Paola Dugo, Luigi Mondello

SESSION IN: INNOVATION IN FOODS

KN-In: Dietary polyphenols in thyroid function: influence on TPO activity, oxidative stress, and related metabolic disorders

Urszula Gawlik

OP-In01 Fermented foods and health: Benefits and risks explored by the PIMENTO initiative
Smilja Pracer, Asli Akpinar, Ricardo Assunção, Cornelia Bär, Simona L. Bavaro, Muzeyyen Berkel Kasikci, Julieta Domínguez-Soberanes, Vittorio Capozzi, Paul D. Cotter, Eun-Hee Doo, Burcu Gündüz Ergün, Mustafa Guzel, Hayriye S. Harsa, Emre Hastaoglu, Christèle Humblot, Bahtir Hyseni, Muge I. Hosoglu, Aline Issa, Barçın Karakaş-Budak, Sibel Karakaya, Harun Kesenkas, Erhan Keyvan, Ibrahim E. Künili[23], Mary-Liis Kütt, Marta Laranjo, Sandrine Louis, Fani T. Mantzouridou, Antonia Matalas, Baltasar Mayo, Sandra Mojsova, Arghya Mukherjee, Anastasios Nikolaou, Fatih Ortakci, Diana Paveljšek, Giancarlo Perrone, Eugenia Pertziger, Dushica Santa, Taner Sar, Isabelle Savary-Auzeloux, Clarissa Schwab,

Małgorzata Starowicz, Marko Stojanović, Michail Syrpas, Jyoti P. Tamang, Oktay Yerlikaya, Birsen Yilmaz, Jeadran Malagon-Rojas, Seppo Salminen, Juana Frias, Christophe Chassard, Guy Vergères, Effie Tsakalidou, Photis Papademas, Marie Christine Champomier Vergès, Antonio Del Casale, Vittorio Capozzi, Zuzana Ciesarová, Kathryn Burton-Pimentel, Biljana Trajkovska

OP-In02 Fungal solid-state fermentation as a tool for nutritional enrichment of legume-based products

Tatiana Klempová, Dávid Lörinc, Kristína Kukurová, Jozef Murín, Zuzana Ciesarová, Milan Čertík

OP-In03 Fermentation-induced nutritional and physicochemical changes in microalgae

Shahana Aboobacker, Hakki Bilgin, Rita Kazernavičiūtė, Aušra Šipailienė, Ramunė Rutkaitė, Vaida Kitrytė-Syrpa, Michail Syrpas

OP-In04 Structural and functional insights into ulvan from *Ulva lactuca* L.: multi-methodological characterization and *in vitro* fermentability

Beatrice Zonfrillo, Maria Bellumori, Carmen M.S. Ambrosio, Eleonora Truzzi, Davide Bertelli, Paola Faraoni, Francesco Ranaldi, Serena Orlandini, Josep Rubert, Nadia Mulinacci

OP-In05 Endocannabinoids and endocannabinoid-like compounds in fermented foods

Ecem Berk Aydın, Cemile Yılmaz, Vural Gökmen

OP-In06 Substances and plant extracts affecting the balance between scavenging and generating radicals in relation to food quality, as potential food additives

Tibor Maliar, Marcela Blažková, Marek Kunštek, Mária Maliarová

OP-In07 Recent developments in the CUPRAC sensing/quantification of food antioxidants, reactive species / scavengers, oxidase enzymes substrates and inhibitor pesticides

Reşat Apak, Ayşem Arda, Sema Demirci-Çekiç, Yusuf Dilgin, Esin Çelik, Mustafa Bener, Burcu Bekdeşer, Ziya Can, Şener Sağlam, Selen Ayaz

OP-In08 A journey on the bioavailability of anthocyanin-rich edible flowers bioactives: the case of cornflower, cosmos and wildpansy

Hélder Oliveira, Margarida Teixeira, Wen Tao, Ana Faria, Catarina Rodrigues, João Araújo, Isabel M.P.L.V.O. Ferreira, Nuno Mateus, Victor de Freitas

OP-In09 Shaping the future of Food Metabolomics: innovative strategies and interesting applications for the olive and avocado sectors

Alegría Carrasco-Pancorbo, María Gemma Beiro-Valenzuela, Irene Serrano-García, Romina P Monasterio, Romina Pedreschi, Lucía Olmo-García

OP-In10 Achieving a dramatic blue color stability in anthocyanins bearing acylated sugars in position 3',5'. A thermodynamic and kinetic study

Joana Oliveira, Victor Freitas, Peiqing Yang, Nuno Basilio, Fernando Pina

OP-In11 Role of methylglyoxal in color formation: Investigation of novel intermediates and resulting model melanoidins

Tatjana Rueger, Leon V. Bork, Sascha Rohn, Clemens Kanzler

OP-In12 Strategies to increase psychobiotic activity through dietary fibre modulation
Soraia P. Silva, Abigail Gonzalez, Dalila Roupar, Andreia F. Salvador, Rita Bastos, Mariana Mota, Maria H. Luís, Sónia S. Ferreira, Maria J. Alegria, Clarisse Nobre, Manuel A. Coimbra, Elisabete Coelho

OP-In13 Effects of infrared treatment on phenolic compounds and antioxidant activity of chia
Meltem Laçin, Arzu Başman

OP-In14 Molecularly imprinted polymer-modified electrochemical sensor for low molecular weight compounds
Vilma Ratautaite, Ernestas Brazys, Enayat Mohsenzadeh , Greta Zvirzdine, Raimonda Boguzaite, Deivis Plausinaitis, Urte Prentice, Arunas Ramanavicius

OP-In15 Inhibition of immunogenic gluten peptide release by treatment of gluten with green tea phenols
Aytul Hamzalioglu, Merve Aksoy Dirim, Vural Gokmen

OP-In16 Methylation of lysine in food
Marlene Walczak, Sophia Schreinert, Michael Hellwig

OP-In17 Application of lactoferrin for coating of β-carotene–inulin particles
Inga Gabriūnaitė, Rūta Gruškienė, Tatjana Kavleiskaja, Jolanta Sereikaitė

OP-In18 Enhancing the shelf-life of highly perishable fruits using chitosan based active films and edible coatings
Margarida Moldão, Tiago Vieira, Luisa Brito, Vitor Alves

OP-In19 Fish gelatin nanofibers enriched with bee bread extract
Dılhun Keriman Arserim-Uçar

OP-In20 Fabrication of polysaccharides based edible films impregnated with aqueous zein nanoemulsion for fruit preservation
Jawad Ashraf

OP-In21 Designing biodegradable films using materials from agro-industrial by-products
Vitor D. Alves, Verónica Weng, Andreia Simões, Isabel M. Coelhoso, Carla Brazinha

OP-In22 Unveiling the complexity of Maillard reaction: a novel approach to identify and quantify Maillard reaction products in biscuits
João Siopa, Miguel Ribeiro, Fernanda Cosme, Fernando M. Nunes

OP-In23 Interaction of Maillard reaction and lipid oxidation in meaty emulsion prepared with canola oil
Suleyman Yiltirak, Dimitris P. Balagiannis, Jan Koek, Christopher Sabater, Jens Koch, Donny Merkx, Stephen Elmore

OP-In24 Comparative GC-HRMS and LC-HRMS analysis of modern and ancient food-derived lipids to detect shifts in culinary patterns in Roman Britain
Anastasia Gabiger, Rachel Vykukal, Lucy Cramp, Martin Pitts, Helen Whelton, Simon Hammann

OP-In25 Neuroprotective effects of mushroom biomass: Impact of serum-available and gut microbiota metabolites in *Caenorhabditis elegans* models of Alzheimer's disease
Helena Araújo-Rodrigues, Lidia Garzón-García, João B. Relvas, Freni K. Tavaria, Celestino Santos-Buelga, Ana M. González-Paramás, and Manuela E. Pintado

OP-In26 The seafood process water biorefinery -from waste to new values
Ingrid Undeland, Bita Forghani, João Pedro Trigo, Kristoffer Stedt, Niklas Warwas, Ida Hedén, James Hinchcliffe, Jenny Vilg, Susanne Eriksson, Kristina Sundell, Sophie Steinhagen, Henrik Pavia

SESSION S: SAFETY OF FOODS

KN-S: Formation of furans during breakfast cereal manufacturing

Benedikt Cramer

OP-S01 Genetic and crop management strategies to reduce the risk of acrylamide formation in wheat products, and an introduction to the ACRYRED COST Action
Nigel G. Halford, Navneet Kaur, Natasha Brock

OP-S02 Evaluating acrylamide formation in roasted cereals and pseudocereals: a food safety perspective
Marta Mesías, Francesco Cicala, Pablo Gómez, Marco Arlorio, Francisco J Morales

OP-S03 Simultaneous reduction of acrylamide and 5-hydroxymethylfurfural in crackers using a sustainable extract from purple corn (*Zea mays* L.) cob via hot pressurized liquid extraction
Franco Pedreschi, Maykabeth García-Siu, José Ricardo Pérez-Correa, María Salomé Mariotti-Celis

OP-S04 Reducing the potential for acrylamide formation in legume-based foods by solid-state fermentation with filamentous fungi
Kristína Kukurová, Jana Horváthová, Tatiana Klempová, Dávid Lörinc, Jozef Murín, Milan Čertík, Zuzana Ciesarová

OP-S05 Acrylamide reduction in breakfast cereals by industrial process parameters adjustment
Joana F. da C.M.S. Martins, Manuel A. Coimbra, Diana Moreira, Isabel Franco, Cláudia P. Passos

OP-S06 Acrylamide Reduction in Potato Snacks: Impact of Glutathione and Cysteine During Digestion
Burçe Ataç Mogol, Aytül Hamzalıoğlu, Vural Gökmen

OP-S07 Effect of crop management factors on the accumulation of free asparagine in wheat and spelt grains and acrylamide formation in the cookies
Beka Sarić, Marijana Simić, Kristína Kukurová, Danka Milovanović, Valentina Nikolić, Dušanka Milojković-Opsenica, Zuzana Ciesarová, Slađana Žilić

OP-S08 Formation of chlorinated sugar degradation products during baking with sucralose
Michael Hellwig

OP-S09 Saliva biomonitoring as a tool for tracking food safety and contaminant exposure
A. Reis-Mendes, Z. Martins, A. Araújo, H. Ramos, C.B. Borges, A. Melo, M.A. Faria, Isabel M.P.L.V.O. Ferreira

OP-S10 Rapid detection of Escherichia coli using an electronic nose: a fast and reliable MVOC-based approach
Dalma Radványi

OP-S11 Formation of cytotoxic gamma-tocopheryl quinone during frying of French fries in rapeseed oil
František Kreps, Ondrej Hruška, Kristína Masnicová, Zuzana Krepsová

OP-S12 Quinolizidine alkaloids in lupine-based products: occurrence in food and feed and risks to human consumers
Bram Miserez, Sofie Schrijvers, Jet Van de Steene, Mia Eeckhou, Liesbeth Jacxsens

OP-S13 Gastric and gastrointestinal digestion of Infant Formula in the presence of polypropylene nanoplastics
Tafadzwa Kaseke, Mariachiara Paonessa, Vesna Jovanovic, Dragana Mitic, Tanja Cirkovic Velickovic

OP-S14 Safety features and cell envelope proteinase presence inferred from the whole genome sequences of lactobacilli associated with Slovakian Bryndza cheese
Barbara Brežná, Janka Koreňová, Zuzana Rešková, Zuzana Čaplová, Alexandra Burdová, Ema Holbíková, Hana Drahovská, Tomáš Kuchta

OP-S15 Efficacy of fining agents in the removal of ochratoxin A (OTA) and aflatoxins (AFB1 and AFB2) and their impact on the wine quality
Fernanda Cosme, António Inês, Davide Silva, Luís Filipe-Ribeiro, Luís Abrunhosa, Fernando M. Nunes

OP-S16 Mechanistical insights into browning reactions of hydroxycinnamic acids in the Maillard reaction
Leon Valentin Bork, Sascha Rohn, Clemens Kanzler

OP-S17 The fate of apple pulp phenolic compounds during in vitro gastrointestinal digestion: from oral ingestion into intestinal absorption
Ana Fernandes, Iva Fernandes, Ana Rita Monteiro, Clarisse Nobre, Ana Cristina Pinheiro, Nuno Mateus, Victor de Freitas

OP-S18 Reaction of glycoalkaloids during potato processing – Formation of fatty acid esters and oxidation products
Keven Mittau, Christina Meyers, Inga Smit, Marcus Schmidt, Sascha Rohn

SESSION A: ATTRACTIVENESS OF FOODS

KN-A: Flavour development in alternative proteins
Jane K Parker

OP-A01 Food by-products as a bioactive and aromatic source to ferment kombucha beverage
Eva Tejedor-Calvo, Diego Morales

OP-A02 Kinetic modelling of the formation of aroma during kilning of barley malt
Dimitris P. Balagiannis

OP-A03 Stabilizing flavor in low-sodium canned tuna with encapsulated extracts
Beatriz Fernandes, Gabriel Mota Ribeiro, Sara Sousa, Cristina Delerue-Matos, Valentina F. Domingues, Carmo Serrano

OP-A04 Harmonization on Non-Targeted Testing in Food and Food Packaging Analysis
Thomas Gude

OP-A05 Colorimetric smart labeling systems based on pH-responsive pyranoflavylium-containing membranes for real-time monitoring of food freshness
Vânia Gomes, Mariana Cunha, Victor de Freitas, Luís Cruz

OP-A06 Color formation in caramel and liquid sugars – Pathways of carbohydrate-based browning reactions in food
Clemens Kanzler, Tatjana Rüger, Leon V. Bork, Sascha Rohn

OP-A07 Yellowness of selected legume flours as function of nutritional composition, mineral content and total free phenolic content
Jelica Kovačević, Tung Pham, Thomas Bechtold

OP-A08 Changes in temperature and light regime drive seasonal variations in glucosinolate hydrolysis and affect the nutritional value of red cabbage
Vanda Púčiková, Stefanie Ines Kluge, Sascha Rohn, Andreas Dunkel, Katja Witzel, Franziska Sabine Hanschen

OP-A09 Challenges in chromatographic and effect-directed analyses of phytonutrients in food matrices
Irena Vovk, Vesna Glavnik, Maja Bensa, Breda Simonovska, Etil Guzelmeric, Nisa Beril Sen

OP-A10 Pigmented rice: healthy food for healthy diet. Chemical composition, technology, cooking impact and bioaccessibility insights
Marco Arlorio, Vincenzo Disca, Fabiano Travaglia, Jean Daniel Coïsson, Matteo Bordiga, Yassine Jaouhari, Monica Locatelli

OP-A11 Amadori rearrangement products and volatile formation through high moisture extrusion processing
Chloe Mayo, Dimitris Balagiannis, Valentina Stojceska, David A. Baines, Jane K. Parker, George R. Fern

OP-A12 New reaction pathways, formation of aroma-active methyl ketones during lipid oxidation
Sandra Grebenteuch, Clemens Kanzler, Sascha Rohn

OP-A13 Effects of pasteurisation, processing atmosphere, storage and production year on the aroma stability of orange juice with pulp
Mária Kopuncová, Jana Sádecká, Blanka Tobolková, Martin Polovka, Ján Durec, Xiaoshuan Zhang

OP-A14 Can selenium-induced off-flavors be relevant in beer?
Zeiler Sophie, Schligtenhorst Evelyn Johanna, Horneck Jan Ferdinand, Hellwig Michael

SESSION F: FOOD PRODUCTION AND ITS SUSTAINABILITY

KN-F: Metabolomic profile of food and natural products through ambient mass spectrometry techniques
Paola Dugo

OP-F01 Sustainability driven innovation for the zero-waste biorefining of sour cherry pomace into the high nutritional value ingredients
Laura Jūrienė, Vita Morkūnienė, Petras Rimantas Venskutonis

OP-F02 Investigating the influence of starter cultures on the peptide profile of yogurt using an untargeted LC-MS/MS approach
Eva Beck, Lena Riedinger, Sevim Dalabasmaz, Monika Pischetsrieder

OP-F03 Incorporation of fermented and non-fermented edible mushroom by-products in penne pasta: a sustainable approach to nutritional enhancement
Ana Saldanha, Mikel Añibarro-Ortega, Diogo Salvati, Laura Roman, Maria Inês Dias, Carla Pereira

OP-F04 Tracking soybean origin and assessing environmental impact using elemental profiling and chemometrics
Maria Aparicio Muriana, Yunhe Hong, Cynthia A. Chilaka, Brian Quinn, Alfredo M. Montes Niño, Nicholas Birse, Christopher T. Elliott

OP-F05 Food byproducts as eco-innovative solutions for natural dyeing and mordanting for the 21st textile dyeing industry, inspired by ancient practices
Natércia Teixeira, Paula Nabais, Mara Santo, Nuno Mateus, Victor de Freitas

OP-F06 Combination of bioactive compounds, stable isotopes and multivariate data analysis for controlling tea quality and authenticity and developing its labels
Tran-Thi Nhu-Trang, Nguyen Cong-Hau, Quoc-Duy Nguyen, Philippe Behra

OP-F07 Tracing the geographic origin of tomatoes through soil geochemical fingerprinting
Raffaela Ofano, Carmine Amalfitano, Luigi Ruggiero, Diana Agrelli, Paola Adamo

OP-F08 Sustainability of energy efficiency of the modern beverage industry – opportunities, challenges and their effective use
Ján Durec

FLASH PRESENTATIONS

KN-FP: Occurrence and formation of oxidized fatty acids in edible oils and their use as novel parameters to evaluate oil quality and authenticity
Elisabeth Koch

FP01 Utilizing non-targeted LC-IMS-MS metabolomics to explore the basal chemical profile of olive cultivars with varying tolerance to *Verticillium dahlia*
Irene Serrano-García, Lucía Olmo-García, Ioannis C. Martakos, Lorenzo León, Raúl de la Rosa, Marilena E. Dasenaki, Nikolaos S. Thomaidis, Alegría Carrasco-Pancorbo

FP02 Metabolomics of gold sesame oils produced by different drying methods during storage
Busra Dokmetas, Ayse Burcu Aktas

FP03 Spawn to spoon: Quality and traceability of Mediterranean anchovies (*Engraulis encrasicolus*) through multi-element profile and machine learning
Nidhi Dalal, Antonio Giandonato Caporale, María José Sáiz, Diana Agrelli, Paola Adamo

FP04 Phenolic-rich extract from chestnut by-product as a natural preservative in fish burgers
Ítala Marx, Feliciano Priego-Capote, Joana T. Martins, Fernanda L. Ludtke, Jorge M. Vieira, João Carlos Gonçalves, António A. Vicente

FP05 Risk assessment of chlorpyrifos residues via consumption of tomato and cucumber. case study of Armenia
Meline Beglaryan, Davit Pipoyan, Alberto Mantovani, Sara Monteiro Pires

FP06 Kukoamines A and B in potato and pepper and their impact on κ opioid receptor signaling
Jule Fiori, Imen Ceteci, Harald Hübner, Peter Gmeiner, Monika Pischetsrieder

FP07 Synthesis and identification of 3-oxazolines in cocoa
Heather Spooner, Dimitris Balagiannis, Andreas Czepa , Barbara Suess, Martine Trotin, Paul O'Nion, Jane Parker

FP08 Lipophilization of chlorogenic acid by biodegradable biocatalysts immobilized on spent coffee grounds
Karina Jasińska, Bartłomiej Zieniuk, Rita Brzezińska, Agata Fabiszewska

FP09 Effect of ultrasonication-assisted extraction on antioxidant capacity, phenolic, and flavonoid content of white and black garlic before and after lyophilization
Derya Ozalp Unal

FP10 Halophytic plants as natural sources of bioactive compounds for enhancing oxidative stability of edible vegetable oils
Madalena Antunes, Carla Tecelão, Vítor Alves, Suzana Ferreira-Dias

FP11 *Ex-situ* cultivation of Trametes versicolor from Montesinho Natural Park under monitored conditions
Ana Saldanha, Mikel Añibarro-Ortega, Gonçalo S.A. Martins, Higor Rosse, Estefânia Gonçalves, José Pinela, Maria Inês Dias, Carla Pereira

FP12 Formation of Maillard reaction products in sprouted-fermented whole cereals as a result of thermal treatment
Süleyman Yıltırak, Vural Gökmen, Tolgahan Kocadağlı, Ecem Evrim Çelik, Evrim Özkaynak Kanmaz

FP13 From structure to function: How microwave-assisted hydrothermal treatment modifies gluten-free flours
Ainhoa Vicente, Raul R. Mauro, Marina Villanueva, Pedro A. Caballero, Bruce Hamaker, Felicidad Ronda

FP14 Lupin-enriched bakery products: a strategy for lowering glycemic index and enhancing nutritional value
Tatiana Holkovičová, Lucia Minarovičová, Michaela Lauková, Zlatica Kohajdová

FP15 Biogenic amines detection in foods using a luminescent sensor platform
Cláudio M. R. Almeida, Daniela Tenreiro, Tiago Rato, Telma Costa, Luisa Durães

FP16 Electrochemical sensors based on molecularly imprinted polymers and nanomaterials for rapid detection of milk adulterants
Adeel Afzal

LIST OF POSTER PRESENTATIONS

SESSION W: WASTE-LESS FOOD PRODUCTION

PP-W01 Comprehensive valorisation of Tommy Atkins mango (*Mangifera indica* L.) pulp and by-products for sustainable agroindustrial applications
Francine Albernaz Lobo, M. José Jara-Palacios, Carla M. Stinco, Ana M. Benítez-González, Dolores Hernanz

PP-W02 Distilled solid residue from *Rosmarinus officinalis* L. essential oil extraction as a source of bioactive compounds
Bianca R. Albuquerque, Virginie Xavier, Tiane Finimundy, Filipa Mandim, Tânia C.S.P Pires, Sandrina Heleno[1], Irene Mediavilla, Luis Esteban, Lillian Barros

PP-W03 Turning poultry by-products into value: functional proteins from enzymatic hydrolysis
Helena Araújo-Rodrigues, Sandra Borges, Tânia C. F. Ribas, Maria Leonor Castro, Débora Campos, Maria João Mota, Manuela Pintado

PP-W04 Unlocking mandarin potential: Postharvest treatment effects on phenolic content
Dora Bošnjak, Irina Tanuwidjaja, Marko Vuković, Goran Fruk, Luna Maslov Bandić

PP-W05 Evaluation of black cumin (*Nigella sativa* L.) cake as a sustainable plant-based protein source and investigation of extraction methods
Gülşah Çalışkan Koç, Özge Süfer

PP-W06 Development and characterization of pH-sensitive biopolymer-based smart films for food freshness monitoring
Saliha Esin Çelik, Saida Huseynova, Betül Özdemir Şenyer, Reşat Apak

PP-W07 Photooxidation of biotin
Anna Gabel, Nina Eisfeld, Kristina Fleischer, Michael Hellwig

PP-W08 AutoPro: An automated bioprocess for the cultivation of the microalgae *Galdieria sulphuraria* for improved utilization of aquacultural side streams
Corina Kleps, Stephanie Schönfelder, Sandra Grebenteuch, Daniel Pleissner, Michael Ogurek

PP-W09 Clustering analysis of European countries based on food waste, carbon footprint, and sustainable food chemistry practices
Didem Guleryuz, Erdemalp Ozden

PP-W10 Recycled plastics in focus: Analytical strategies for assessing food contact safety
Elise Hecht, Andrea Hochegger, Erich Leitner

PP-W11 Comprehensive analyses of brewery spent grains chemical composition
Andrejs Banis, Tatjana Kince, Zanda Kruma, Darius Sargautis

PP-W12 Optimized recovery of valuable bioactive fractions from CO_2-delipidated hop residues using pressurized ethanol extraction
Nóra Emilia Nagybákay, Michail Syrpas, Andrius Jaskūnas, Aušra Šipailienė, Petras Rimantas Venskutonis, Vaida Kitrytė-Syrpa

PP-W13 Flavor profile of rapeseed and sunflower fiber matrix upon adsorption of tart cherry flavour compounds
Dubravko Pichler, Vesela Chalova-Zhekova, Ivana Ivić, Josip Šimunović, Anita Pichler, Mirela Kopjar

PP-W14 Valorisation of cabbage core: Composition and potential use in plant-based products
Anda Dubrovska, Evita Straumite, Ruta Galoburda, Ilze Gramatina, Zanda Kruma

PP-W15 The potential of *Quercus suber* flour for sustainable food applications

Maria Luz Maia, Cristina V. Rodrigues, Pedro Babo, Manuela Pintado

PP-W16 Upcycling olive pomace to improve the nutritional profile of breaded foods

Ítala Marx, Carlos Ledesma-Escobar, Ana Castillo-Luna, Mónica Calderón-Santiago, Mario Marostica, Feliciano Priego-Capote

PP-W17 Giving juice intermediates an opportunity: From bioatives characterization to innovative food developments

Raquel Nunes da Silva, Bárbara Maurício, Jorge Vieira, Irina Ribeiro Alves, Maria João Alegria, Rui Rodrigues, Ana Fernandes, Iva Fernandes, António Vicente, Nuno Mateus, Victor de Freitas

PP-W18 Unveiling the acetogenin profile of avocado: LC-IMS-MS/MS Analysis of bacon, fuerte, and hass tissues (peel, pulp and seed)

María Gemma Beiro-Valenzuela, Lucía Olmo-García, Sara Rodríguez-Rodríguez, Aiub Mohamed-Barara, Romina P Monasterio, Irene Serrano-García, Elena Hurtado-Fernández, Romina Pedreschi, Alegría Carrasco-Pancorbo

PP-W19 Nutritional valorization of fermented melon by-products: novel sustainable ingredients?

Mariana Santos Domingues, Mafalda Alexandra Silva, José M. Pestana, Helena S. Costa, Tânia Gonçalves Alburquerque

PP-W20 Potential of currant pomace for stabilisation of oil-in-water-emulsions

Larissa Vivienne Sankowski, Kai Nolte, Rocío Morales-Medina, Stephan Drusch, Monika Brückner-Gühmann

PP-W21 Reduction of food waste through innovative lighting technologies

Christian Krutzler, Andreas Weiss, Christian Fragner, Stefanie Kern, Gabriel Pint, Niklas Pontesegger, Barbara Siegmund

PP-W22 Incorporating cocoa bean shells in bakery products: nutritional enhancement and prebiotic potential

Margherita Stampini, Vincenzo Disca, Francesca Carrà, Fabiano Travaglia, Matteo Bordiga, Jean-Daniel Coïsson, Monica Locatelli, Marco Arlorio

PP-W23 Comparison of bioactive potential in 100% *Coffea canephora* and its spent coffee grounds

Terézia Švecová, Alica Bobková, Alžbeta Demianová, Andrea Mesárošová, Lukáš Jurčaga, Ivana Timoracká, Marek Bobko, Judita Lidiková, Ľubomír Belej

PP-W24 Recovery and fractionation of bioactives of industrial hemp leaves: Green vs traditional methods

Orinta Aleknavičiūtė, Laura Jūrienė, Renata Baranauskienė, Petras Rimantas Venskutonis

PP-W25 Revalorization of buckwheat hulls: Effects of green solvent extraction on the phenolic profiles

Murdiati Murdiati, Ainhoa Vicente, Marina Villanueva, Felicidad Ronda

PP-W26 Raspberry pomace as functional food ingredient: in vitro gastrointestinal digestion, anthocyanins profile and bioactivities

Ziva Vipotnik, Majda Golob

PP-W27 The potential of Haskap berry pomace: characterization of phenolic compounds, antioxidative and antimicrobial activity

Ziva Vipotnik, Majda Golob

SESSION IN: INNOVATION IN FOODS

PP-In01 Screening of antioxidants of *Paeonia officinalis* and *Paeonia anomala* leaves and roots using high pressure extraction techniques

Sana Abbas, Petras Rimantas Venskutonis

PP-In02 Combining wheat sprouting with fermentation as a biocehmical modification strategy to decrease immunogenic gluten peptides

Merve Aksoy Dirim, Aytül Hamzalıoğlu, Ecem Evrim Çelik Yılmaz, Evrim Özkaynak Kanmaz, Vural Gökmen

PP-In03 Bioactive and functional properties of sweet potato flours: effect of variety and drying method

Nelson Pereira, Ana C. Ramos, Marco Alves, Vítor D. Alves, Margarida Moldão, Marta Abreu

PP-In04 Effects of infrared treatment on some constituents of safflower (*Carthamus tinctorius* L.) seed

Elif Nur Dilbirliği, Meltem Laçin, Arzu Başman

PP-In05 Revised EFSA Guidance for novel food applications: spotlight on characterization

Elisa Beneventi, Reinhard Ackerl, Océane Albert, Domenico Azzollini, Wolfgang Gelbmann, Maria Glymenaki, Marcello Laganaro, Irene Nuin Garciarena, Maura Magani, Leonard Matijevic, Vania Mendes, Estefania Noriega Fernandez, Gabriela Precup, Ruth Roldan Torres, Annamaria Rossi, Emanuela Turla, Ermolaos Ververis, Georges Kass, Andrea Germini

PP-In06 Enhancing *Chlorella vulgaris* fermentation: Investigating effective pre-treatment techniques

Hakki Bilgin, Vaida Kitryte-Syrpa, Michail Syrpas

PP-In07 Biofunctionalization of corn to enhance market competitiveness within the frame of Spanish GO-BIODIF project

Gracia P. Blanch, Pedro Revilla, Rosa A. Malvar, Elena Peñas, Cristina Martínez-Villaluenga, Begoña de Ancos, Juana Frias

PP-In08 Optimization of an extraction and analytical method of water and fat-soluble vitamins in mango juices

GP Blanch, A. Nicoara, A. Domene, ML Ruiz del Castillo, B. de Ancos, C. Sánchez-Moreno

PP-In09 Phytochemical profiling of red vine leaves commercial samples: variability of the phenolic fraction

Chiara Carini, Vincenzo Disca, Fabiano Travaglia, Jean Daniel Coïsson, Matteo Bordiga, Hélder Oliveira, Monica Locatelli

PP-In10 Phlorotannin-rich extracts from brown macroalgae for novel food applications

M. Carpena, P. Barciela, F. Chamorro, Cláudia S. G. P. Pereira, Aurora Silva, João C. M. Barreira, M. Beatriz P. P. Oliveira, M.A. Prieto

PP-In11 Natural extracts with high polysaccharides content: effect on wheat dough properties and consumer acceptance of model bakery product

Matej Čech, Tatiana Bojňanská, Anna Kolesárová

PP-In12 Innovation in food production: lab-grown meat, cultivated seafood, and advanced food technologies

Yasemin Celebi

PP-In13 Investigations on *Locusta migratoria*, *Acheta domesticus*, and *Tenebrio molitor* proteins quality

Raffaella Colombo, Marta Barberis, Vanessa Pellicorio, Adele Papetti

PP-In14 Optimized extraction and characterization of spirulina (*Arthrospira platensis*) proteins for innovative food applications

Elisa Costa, Miguel Ribeiro, Luís Filipe-Ribeiro, Fernanda Cosme, Fernando M. Nunes

PP-In15 Comparison of chemical composition and bioactive properties of different *Chlorella vulgaris* hydrolysates

Sara A. Cunha, Manuela Machado, Manuela Pintado

PP-In16 Incorporation of insect hydrolysate in canned tuna: effects on appearance and stability, and assessment of bioavailability

Sara A. Cunha, Manuela Machado, Manuela Pintado

PP-In17 Vegan cheeses – product development and physical- chemistry characteristics

Joana Azevedo, Joana Pinto, Joana Oliveira, Duarte Torres, Daniela Correia, Paula Guedes de Pinho, Victor de Freitas, Susana Soares

PP-In18 The jellying ability of carrageenan in meat products and their analogues

Bernardo A. C. Ferreira, Marta Rendeiro, Ricardo Silva, Kayane Oliveira, Pedro A. R. Fernandes, José A. Lopes da Silva, Maria A. Azevedo, Cláudia Nunes, Manuel A. Coimbra

PP-In19 Changes in the amino acid and biogenic amine content of oyster mushrooms caused by different pretreatment and fermentation

Albert Gashi, Meltem Boylu, György Kenesei, Zsuzsanna Mednyánszky, Livia Simon-Sarkadi

PP-In20 Evaluation of the protein bioaccessibility and bioavailability from a new plant-based protein source: *Jatropha curcas* L.

Mona Grünwald, Tuba Esatbeyoglu

PP-In21 Chitosan nanoparticles used for protecting labile substances in gelation system

Ondrej Hruška, Kristína Masnicová, František Kreps, Erika Hrašková

PP-In22 Liquid drawing technology for creating a beverage with 3D design

Ippei Inoue

PP-In23 Dietary fibre with functional properties ameliorates the thwarting effects of copper nanoparticles on the caecal microbial enzymatic activity and SCFA production

Jerzy Juśkiewicz, Katarzyna Ognik, Anna Stępniowska, Ewelina Cholewińska, Katarzyna Jaworska, Przemysław Sołek, Dorota Napiórkowska, Bartosz Fotschki

PP-In24 Effect of pretreatment on microwave drying of celery roots and process optimization

Naciye Kutlu

PP-In25 Can mushrooms' polysaccharides decrease cholesterol absorption?

Helena Laronha, Filipe Coreta-Gomes, Manuel A. Coimbra, Elisabete Coelho

PP-In26 Enrichment of legumes by filamentous fungi using solid state fermentation process

Dávid Lörinc, Tatiana Klempová, Kristína Kukurová, Jozef Murín, Zuzana Ciesarová, Milan Čertík

PP-In27 Saskatoon berry as an easy-to-grow blueberry substitute

Kristína Masnicová, Ondrej Hruška, František Kreps, Natália Smolárová

PP-In28 AI-Based peak determination for pesticide analysis

Jan Peter Mayser, Vadim Kraft, Waldemar Weber

PP-In29 Impact of chestnut flour processing (Boiled, Roasted, and Dried) on the chemical and sensory properties of fresh pasta

A. B. Guedes, B. Melgar, A. Gonçalves, L. Pinto, J. Moreira, T. C. Finimundy, L. Barros

PP-In30 Valorization of hemp flour in wheat-based products: rheological, structural, and optical properties

Andreea – Lavinia Mocanu, Cătălina – Beatrice Poteraș, Susman Iulia, Gabriela Criveanu-Stamatie, Corina Stroe, Elena Ungureanu, Mustățea Gabriel

PP-In31 Rapid quantification of EPA and DHA in fish oil-based food supplements using Mid- and Near-Infrared Spectroscopy combined with Partial Least Squares Regression

Chi Mai Nguyenová, Jan Poustka

PP-In32 Bioaccessibility and prebiotic effects of phenolic compounds from Diospyros kaki extract

Giulia Moretto, Raffaella Colombo, Raquel Rodríguez-Solana, Gema Pereira-Caro, Adele Papetti

PP-In33 Acorn flour as a new food ingredient: nutritional composition and shelf life

Francesca Vurro, Alexandra-Mihaela Ailoaiei, Davide De Angelis, Giacomo Squeo, Antonella Pasqualone

PP-In34 Nutritional potential of *Lactarius deliciosus* mycelium for sustainable fungi-based food innovation

Carla Pereira, Maria Gabriela Leichtweis, Catarina Ribeiro, Andreia Afonso, Maria InêsDias

PP-In35 Isolation and identification of potential starter cultures to obtain bioactive fermented oats

Maylis Renard, Elena Peñas, Cristina Martínez-Villaluenga, Juana Frias, José María Landete, José Antonio Curiel

PP-In36 Oligosaccharide-based investigation of adulteration in fruit juices and fruit juice concentrates

Kai Scholten, Angelina Schneider, Daniel Wefers, Sascha Rohn, Clemens Kanzler

PP-In37 Impact of cricket powder supplementation on gut inflammatory markers and cholesterol levels in a mouse model of diet-induced obesity

Otto Selenius, Terhi Kolari, Gabriel Vinderola, Seppo Salminen

PP-In38 Encapsulated flavours: A strategy to reduce sodium in canned tuna

Carmo Serrano, Beatriz Fernandes, Gabriel Mota Ribeiro, Daniela Araújo, Joana Castro, Luís F. Baião, Helga Augusto, Ana Cação, Helena Oliveira, Leonor Nunes

PP-In39 Nutritional potential of brown algae extracts: a study on *Bifurcaria bifurcata*, *Fucus spiralis*, and *Ascophyllum nodosum*

Aurora Silva, Cristina Soares, Franklin Chamorro, Maria Carpena, Rafael Nogueira-Marques, M. Fátima Barroso, M.A Prieto

PP-In40 Seaweed-derived functional edible coatings to reduce oil uptake in fried fish fillets

Gabriela Sousa, Carla Tecelão, Suzana Ferreira-Dias, Vítor Alves

PP-In41 Angiotensin-converting enzyme inhibitory activity of selected phenolic acids, flavonoids and their O-glucosides, and low molecular phenolic metabolites in relation to their oxidation potentials

Danuta Zielińska, Małgorzata Starowicz, Małgorzata Wronkowska, Henryk Zieliński

PP-In42 Multifaceted biological activity of rutin, quercetin, and its glucosides

Danuta Zielińska, Małgorzata Starowicz, Małgorzata Wronkowska, Henryk Zieliński

PP-In43 Biodiesel production from edible insect oils

Özge Süfer, Gülşah Çalışkan Koç

PP-In44 Optimization of pressurized liquid extraction for efficient recovery of valuable polar antioxidant-rich fractions from *Gnaphalium uliginosum* L.

Marius Užupis, Michail Syrpas, Vaida Kitrytė-Syrpa

PP-In45 Molecular and structural characterization of starch in Breadfruit flours from pulp and peel

Caleb S. Calix-Rivera, Grazielle Náthia-Neves, Raúl Ricardo Mauro, Marina Villanueva, Felicidad Ronda

PP-In46 Valorisation of blackberry seed flour in gluten-free biscuit development: nutritional, technological, and sensory evaluation

Ángela G. Solaesa, Marina Villanueva, Felicidad Ronda, Rodrigo Melgosa, M. Teresa Sanz, Sagrario Beltrán

SESSION S: SAFETY OF FOODS

PP-S01 Food safety hazards: a comparison of EU data and Slovenian consumers' concerns

Maja Bensa, Mojca Jevšnik Podlesnik, Irena Vovk

PP-S02 Bacterial consortia of ewes´ whey in the production of bryndza cheese in Slovakia

Zuzana Rešková, Zuzana Čaplová, Janka Koreňová, Barbara Brežná, Nikola Klištincová

PP-S03 Monitoring of thermal process contaminants in soy-based milk alternatives during storage

Selin Çakmak, İrem Uçaner, Burçe Ataç Mogol

PP-S04 Effect of air-frier conditions on bioactive properties and formation of harmful Maillard products in potato chips

Elif Apaydın, Mustafa Remzi Otağ, Ayşegül ÇEBİ

PP-S05 Sugar composition affects kinds and levels of alpha-dicarbonyl compounds formed in food

Karel Cejpek, Anna Průšová, Zuzana Procházková

PP-S06 Per- and polyfluoroalkyl substances (PFAS) migration from straws distributed in Korea: An exposure assessment

Siweon Choi, Kwonyong Eom, Minyoung Lee, Dain Bae, Younju Choi

PP-S07 Determination of acrylamide content using the LC-MS/MS method in thermally processed food products from the market of Montenegro

Mitar Delević, Brižita Đorđević, Nevena Ivanović, Biljana Antonijević, Bojan Marković

PP-S08 Effect of extrusion process parameters on acrylamide formation in pea protein-enriched corn snacks

Neslihan Göncüoğlu Taş, Dimitris P. Balagiannis, Sameer Khalil Ghawi, Vural Gökmen, Jane K. Parker

PP-S09 Mitigating acrylamide formation using food waste materials – A sustainable solution

Mouandhe Imamou Hassani

PP-S10 Moisture-activated oxygen scavenger based on Acacia catechu for active food packaging: A plant-based alternative

Prachi Jain, Kirtiraj K Gaikwad

PP-S11 From hive to hazard: Overview of honey-related RASFF notifications

Mina Janković, Ljilja Torović

PP-S12 From hive to risk: Overview of honey-related EU monitoring and risk assessment data

Ljilja Torović, Mina Janković

PP-S13 A combined sample preparation and multi-technique strategy employing GC- and LC-MS/MS for the determination of 60 plasticizers and other selected additives in Germany´s first total diet study "BfR MEAL"

Elisabeth Koch, Andriy Kuklya, Klaudia Michna, Saskia Lehmann, Oliver Kappenstein, Irmela Sarvan, Andreas Luch, Alexander Roloff, Torsten Bruhn

PP-S14 The application of cyclodextrins for the elimination of aflatoxin M1 from aqueous solution and milk

Lukáš Kolarič, Peter Šimko

PP-S15 Comparison of infrared and conventional baking and study of their effect on acrylamide content and quality characteristics of rye crispbread

Maria Kopsacheili, Kali Kotsiou, Maria Papageorgiou, Adamantini Paraskevopoulou

PP-S16 Hemp seed breads – profiles, contents and thermal stability of cannabinoids like Δ9-THC

Niklas Lindekamp, Nadja Triesch, Michael Weiss, Tim Rautenberg, Alexander Voß, Sascha Rohn, Stefan Weigel

PP-S17 Influence of thermal processing on cannabinoids contents and profiles in hemp seed oil

Niklas Lindekamp, Nadja Triesch, Sascha Rohn, Stefan Weigel

PP-S18 Expanding the asparaginase toolbox: New sources, promising properties and industrial potential

Karolína Loužecká, Max Štětina, Jan Beránek, Tomáš Podzimek, Eva Benešová

PP-S19 Microplastics and nanoplastics contamination in food and beverages: a global review

Carolina Mota, Zita E. Martins, Helena Ramos, Isabel M.P.L.V.O. Ferreira, Márcia Carvalho, Ana Margarida Araújo

PP-S20 Innovative radiofrequency application for effective pest control in infested chestnuts

B. Melgar, C. Ribeiro, Â. Fernandes, T. Finimundy, T.C.S.P. Pires, J. Moreira, E. Alexandre, C. Freire, T. Vila Franca, N.C.P. Fernandes, A. Gonçalves, L. Barros

PP-S21 Acrylamide formation in roasted almonds: impact of roasting conditions

Marta Mesías, Francisca Holgado, Francisco J Morales

PP-S22 Effect of free asparagine content on acrylamide formation and texture in crispbreads made from wheat flour

Sofia Keramari, Kali Kotsiou, Maria Kopsacheili, Nigel G. Halford, Maria Papageorgiou, Adamantini Paraskevopoulou

PP-S23 Mitigation of 5-hydroxymethylfurfural formation in muffins by an optimized polyphenolic antioxidant extract from tara pods (*Caesalpinia spinosa*) obtained via high hydrostatic pressure

Franco Pedreschi, Jessami Marín, Andrea Bunger

PP-S24 Analytical approaches to follow process-induced compounds, AGEs and key adducts formed during in vitro digestion of a pea-based cake

Federica Secco, Even Le Roux, Véronique Bosc, Barbara Rega

PP-S25 New European regulation for bisphenols in food contact materials posing analytical challenges

Lara Skef, Erich Leitner

PP-S26 Importance of FHB resistant wheat genotypes in reduction of acrylamide

Valentina Spanic, Jurica Duvnjak, Katarina Sunic Budimir

PP-S27 Analysis of the occurrence of selected persistent organic pollutants (POPs) and perfluoroalkyl substances (PFASs) in Polish traditional cheeses

Magdalena Surma, Anna Sadowska-Rociek, Władysław Migdał, Magda Filipczak-Fiutak, Jacek Domagała, Tomasz Sawicki

PP-S28 Influence of traditional versus industrial processing on the trans-fatty acids content of foods

Beatrice Poteras, Fulvia Manolache, Cristina Todasca

PP-S29 Further decoding of degradation pathways of Nε-carboxymethyllysine (CML) in *Escherichia coli*

Patroklos Vougioukas, Erica Aveta, Judith Mehler, Nicola Gericke, Vincent Hoffmann, Jürgen Lassak, Michael Hellwig

PP-S30 Development of nanoformulations from lavender waste for the sustainable control of *Botrytis cinerea*

María P. Fattobene, Renata Bence, Camila T. Vélez, Natalia S. Podio, Daniel Wunderlin, Natividad Herrera Cano.

PP-S31 From manure to crops: assessing enrofloxacin contamination in agricultural systems using chicory as case study

Camilla Di Marcantonio, Camila T. Vélez, Daniel A. Wunderlin, Natalia S. Podio

SESSION A: ATTRACTIVENESS OF FOODS

PP-A01 METROFOOD-IT – The Italian research infrastructure for metrology and open access data in support to the agrifood

Paola Adamo, Maria Careri, Cesare Manetti, Remo Pareschi, Angelo Riccaboni, Andrea Mario Rossi, Sabina Tangaro, Claudia Zoani

PP-A02 Advanced green microextraction techniques for eco-friendly monitoring of pesticide residues in grapes

Mereke Alimzhanova, Yerkanat Syrgabek

PP-A03 Extraction of functional components from *Lycium ruthenicum* Murray and *Lycium barbarum* Lam. fruits using deep eutectic solvents and antimicrobial effect

Yusuf Can Gerçek, Naciye Kutlu, Sinan Bayram, Saffet Çelik, Fatma Nur Baştürk, Bahar Özmener, Nesrin Ecem Bayram

PP-A04 Biochemical properties and antibacterial activity of Armenian honeys

Viktoriia Chirkova, Marcela Bucekova, Jana Godocikova, Juraj Majtan

PP-A05 AQUASERV: Research services for sustainable aquaculture, fisheries and blue economy

Nidhi Dalal, Antonio G. Caporale, Diana Agrelli, Paola Adamo

PP-A06 Effects of innovative non-thermal techniques on individual polyphenols in Sicilian table olives

Jasmin Djahandideh, Edwin Januschewski, Andreas Juadjur, Kemal Aganovic, Tuba Esatbeyoglu

PP-A07 Valorization of the nutraceutical potential of sumac (*Rhus coriaria* L.)

Laura Dugo, Elisa Pannucci, Katia Arena, Paola Dugo, Luca Santi

PP-A08 Sweetness perception in biscuits: The effects of Maillard and caramelisation reactions

Naz Erdem, Neslihan Göncüoğlu Taş, Tolgahan Kocadağlı, Vural Gökmen

PP-A09 Chemometric analysis of fatty acid profiles of 30 Portuguese corn samples

Lais Freitas, Maria Eugénia Tornadijoa, Pedro Mendes Moreira, Isabel Dinis, André Pereira, Ana Sofia Bagulho, Nuno Pinheiro, Fernanda Simões, Ângela Lopes, Diogo Mendonça, Letícia M. Estevinho, Luís G. Dias

PP-A10 Fermentation-derived bioactives from fruit juices: a natural dietary strategy against metabolic disorders

Ana R. Monteiro, Ana Faria, Maria João Almeida, Shámila Ismael, João Araújo, Nuno Mateus, Victor Freitas, Iva Fernandes

PP-A11 Cultivation and processing of buckwheat under the aspect of climate protection

Martin Almendinger, Lara Mathew, Sandra Grebenteuch, Alexander Voss, Maxie Grüter

PP-A12 Characterization of artisanal and industrial Maroilles cheeses quality by targeted and untargeted techniques

Romdhane Karoui

PP-A13 Production of Maillard reaction flavouring from sprouted wholewheat flour for use in low acrylamide biscuits

Tolgahan Kocadağlı, Dilara Başbozkurt, Neslihan Taş, Aytül Hamzalıoğlu, Vural Gökmen

PP-A14 Quantitative analysis of isomeric tocols in oilsuUsing RPLC-MS/MS

Jesse Namo Ombugadu, Katarzyna Pawlak, Kamil Wojciechowski

PP-A15 Quantitative analysis of saponins in beverages via LC-MS/MS

Jesse Namo Ombugadu, Katarzyna Pawlak, Ewa Kobylska, Kamil Wojciechowski

PP-A16 Influence of heat treatment and ethanol washing on sensory characteristics of pea protein concentrates

Diana Owsienko, Greta van Huyssteen, Leyla Dahl, Evelina Höglund

PP-A17 Harnessing *Brassica oleracea* biodiversity for health-promoting plant-based foods

Vanda Púčiková, Franziska S. Hanschen, Andreas Dunkel, Andreas Börner, Katja Witzel

PP-A18 Maturation study of *Sorbus aucuparia* fruit

Natália L. Seixas, José Fresno Baro, Miguel Sousa Dias, Nuno Sousa Dias, Letícia M. Estevinho, Luís G. Dias

PP-A19 Flavour chemistry as a valuable tool for the evaluation of new apple varieties

Niklas Pontesegger, Thomas Rühmer, Barbara Siegmund

PP-A20 The flavour of coffee substitutes – a comparative investigation

Müge Dogan, Niklas Pontesegger, Barbara Siegmund

PP-A21 Health-promoting properties of young barley (*Hordeum vulgare* L.)-based supplements

Anna Sadowska-Rociek, Magdalena Surma, Adam Florkiewicz

PP-A22 Effect of ascorbic acid on the quality of caviar substitute from eggs of the small brown snail (*Cornu aspersum aspersum*)

Krzysztof Surówka, Maciej Ligaszewski, Barbara Anthony, Ireneusz Maciejaszek, Iwona Tesarowicz, Jagoda Majcherczyk, Wiesław Łasocha, Ladislav Staruch.

PP-A23 Effects of infrared radiation at 850 nm and 940 nm on the synthesis of bioactive phytochemicals in radish sprouts

Grzegorz Fiutak, Krzysztof Surówka

PP-A24 Water stress-induced metabolic shifts and bioactivity in broccoli sprouts

Ivana Šola, Daria Gmižić, Karlo Miškec, Jutta Ludwig-Müller

PP-A25 Influence of red and blue-dominant light spectra on the biosynthesis of secondary metabolites in *Mentha*

Saskia Tsiaparas, Annika Walpert, Kai Kehle, Maike Passon, Andreas Schieber, Matthias Wüst

PP-A26 Effect of coffee roasting degree on bioactive compounds and acrylamide based on processing methods in specialty coffee

Matúš Várady, Jan Tauchen, Adéla Fraňková, Pavel Klouček, Miriam Vlčáková, Anna Reitznerová, Slavomír Marcinčák, Peter Popelk a

PP-A27 Kernel type variability in maize: Insights into mineral element content

Jelena Vukadinović, Violeta Anđelković, Vojka Babić, Snežana Mladenović Drinić, Jelena Srdić, Nikola Grčić, Natalija Kravić

SESSION F: FOOD PRODUCTION AND ITS SUSTAINABILITY

PP-F01 Botanical origin of pollen mixtures and honey: comparison of two ITS2 primer sets for DNA-metabarcoding

Mónica Honrado, Andreia Quaresma, Joana Santos, M. Alice Pinto, Joana S. Amaral

PP-F02 3D printing of bread dough with simultaneous microwave processing: effect on water loss

Diana Vicente-Jurado, Tania Doménech, Purificación García-Segovia, Marta Igual, José-Manuel Catalá-Civera, Javier Martínez-Monzó

PP-F03 Properties of pectin extracted under different conditions from infrared dried orange peels

Arzu Başman, Melis Akdeniz

PP-F04 A green biorefinery approach for *Butia catarinensis* supply chain

Eduardo Macedo de Melo, Juan David Marmolejo Tascón, Sandra Regina Salvador Ferreira, Jane Mara Block

PP-F05 Antioxidant activity of *Butia catarinensis* kernel extracts

Eduardo Macedo de Melo, Juan David Marmolejo Tascón, Sandra Regina Salvador Ferreira, Jane Mara Block

PP-F06 Next-generation non-alcoholic beer fermented with potential probiotic yeasts

Ján Brunner, Tatiana Klempová, Peter Vaštík

PP-F07 In-depth LC-IMS-MS profiling of avocados from different Iberian regions: utilizing ion mobility as a crucial descriptor in non-targeted metabolomics

Irene Serrano-García, María Gemma Beiro-Valenzuela, Romina Pedreschi, José Jorge González-Fernández, José Ignacio Hormaza, Lucía Olmo-García, Alegría Carrasco-Pancorbo

PP-F08 Advances in sustainable and functional mycelium-based foods

Maria Inês Dias, Maria Gabriela Leichtweis, Catarina Ribeiro, Andreia Afonso, Carla Pereira

PP-F09 3D printing extrusion flow optimisation with simultaneous microwave processing

Tania Doménech, Diana Vicente-Jurado, Purificación García-Segovia, Marta Igual, José-Manuel Catalá-Civera, Javier Martínez-Monzó

PP-F10 Ohmic heating-assisted extraction of bioactive compounds from goji berry

Harun Kantar, Yusuf Can Gerçek, Nesrin Ecem Bayram

PP-F11 Aerogels in food: Innovation for sustainability and functionality

Tuğba Elbir Abca

PP-F12 Impact of dehydration on the nutritional and bioactive properties of *Anisophyllea quangensis* Engl. ex Henriq.

Luísa Dovala, Maria Manuel Romeiras, Vitor Alves, Margarida Moldão

PP-F13 Adherence to the Mediterranean diet in older adults with metabolic syndrome: PERTE_AGRO pilot study

Rosario Pastor, Ángela García-Solaesa, Carolina García-Barrosom, Paula Jiménez, Elena Álvarez-Olmedo, Marina Villanueva, Felicidad Ronda, Pedro A. Caballero

PP-F14 Mediterranean diet and pistachio flour biscuit intervention in older adults with metabolic syndrome: a pilot study design

Rosario Pastor, Carolina García-Barroso, Ángela García-Solaesa, Paula Jiménez, Elena Álvarez-Olmedo, Marina Villanueva, Felicidad Ronda, Pedro A. Caballero

PP-F15 Scavenging of methylglyoxal by Maillard reaction products: Antiglycation effects of norfuraneol and coffee melanoidins and impact on their antioxidant properties

Anna Průšová, Karel Cejpek, Zuzana Procházková

PP-F16 Free asparagine concentration in wheat and rye grain depending on different agronomic approaches

Matěj Satranský, Petr Dvořák, Beverly Hradecká, Eva Benešová, Martin Král, Hana Pírová, Josef Vršťala, Karolína Loužecká, Ivana Capouchová, Jana Hajšlová

PP-F17 Malting process to improve legume pulses nutritional properties: an NMR metabolomics characterization

Mattia Spano, Alessio Cimini, Annamaria Giusti, Lorenzo Maria Donini , Mauro Moresi, Luisa Mannina

PP-F18 Rapid contamination assessment through GC-IMS for probiotic production in a lab-scale environment

Marta Lo Re, Chiara Carini, Margherita Stampini, Tamara Attard, Patrizia Malfa, Marco Arlorio, Vincenzo Disca

PP-F19 Authentication of Argentinean NFC citrus juices using nuclear and complementary techniques

Daniel Wunderlin, María Verónica Baroni, Romina Di Paola, Pablo Yunes, Gabriel Lutti

PP-F20 The effect of controlled viral infection on the antioxidant potential of basil leaves

Urszula Złotek, Urszula Gawlik, Anna Złotek, Marta Budziszewska, Patryk Frąckowiak, Aleksandra Obrępalska-Stęplowska

PP-F21 Sweet chestnut (*Castanea sativa* Mill.) catkins and leaves extracts: assessment of phenolic content and antibacterial activity against human pathogenic bacteria

Jelena V. Živković, Slavica Sunarić, Nemanja Stanković, Tatjana Mihajilov-Krstev, Zoran Zeković

PP-F22 Sweet chestnut (*Castanea sativa* Mill.) spiny burs and bark extracts: assessment of phenolic content and antibacterial activity against human pathogenic bacteria

Jelena V. Živković, Slavica Sunarić, Nemanja Stanković, Tatjana Mihajilov-Krstev, Zoran Zeković

PP-F23 Impact of bioactive agent encapsulation on chlorophyll a, chlorophyll b, and total carotenoid content in carrots

Lana Živković, Marko Vinceković, Adrijana Novak

PP-F24 Japanese knotweed – threat or opportunity?

Eugen Kiss, Stanislav Baxa, Pavol Tóth, Elena Panghyová

PP-F25 Food, energy and phytoproducts compete for agricultural biomass

Pavol Tóth, Stanislav Baxa, Lucia Baľák Lukáňová, Marek Kunštek

PP-F26 3D printing of protein-based ink: Multivariate analysis of printing conditions on physicochemical properties

Yeison Barrios-Rodríguez, Marta Igual, Javier Martínez-Monzó, Purificación García-Segovia

PP-F27 Antibacterial activity of honeys from Slovakia

Jana Minarovičová, Kristína Kukurová, Zuzana Ciesarová

ABSTRACTS OF PLENARY LECTURES

PL 1

Future food design: at the intersection between upcycling and cell agriculture

Vincenzo Fogliano
Food Quality and Design group, Wageningen University & Research, Wageningen, the Netherlands

Rapidly increasing global population and progressing environmental issues require urgent changes in modern food systems. One of the approaches is introducing more sustainably produced food sources into human diet. However, such novel sources are often novel to the consumers as in the case of cultivated cells. Therefore, their inclusion into diet is not straightforward due to the tendency of consumers to have low willingness to try and especially to shift the consumption pattern. The solution lies in using novel food sources as food ingredients in traditional food products that would make such sources more acceptable.

Upcycling by enzymatic treatment and fermentation has great potential to achieve a zero waste food chain while cell agriculture can produce biomasses with intriguing quality characteristics. The postharvest transformation of these innovative biomasses into food ingredients is an inevitable and crucial step to make upcycled and cells-based food products palatable and acceptable as food by consumers.

In this lecture the main strategies for designing healthy and sustainable food products will be discussed starting from examples taken from the main food production chains

PL 2

Carcinogens in foods as a result of heating processes

Michael Murkovic
Institute of Biochemistry, Graz University of Technology, Graz, Austria

In foods heating processes induce a series of chemical reactions that include the very complex Maillard reaction, oxidation of lipids, and many others. Normally, these complex reactions result in a huge number of different reaction products, meaning that the expected concentrations are very low and are normally a challenge for the analytical chemist. A typical example is the group of heterocyclic aromatic amines that are formed from reactions of amino acids with carbonyl compounds and (in many cases) creatin. The heterocyclic amines are the most potent known carcinogens and the concentrations in heated meat are in the range of several ng/g. Depending on the heat load these can reach a few hundred mgs.

PL 3

Strengthening food safety through the physicochemical interactions of hazardous compounds with package materials

Peter Šimko
Institute of Food Science and Nutrition, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia

In addition to others, food safety is considerably affected by the presence of hazardous compounds in foods due to their carcinogenic effects on living organisms. However, these compounds can be effectively eliminated by various procedures to deepen the protection of consumer health. One of the most effective elimination procedures is based on physicochemical interactions of hazardous compounds with package materials. This lecture will retrieve and summarise information related to the theory and application of physicochemical interactions between hazardous compounds and the package matrix for effective elimination of hazardous compounds from foods.

PL 4

Impact of acrylamide and other potentially toxic Maillard reaction products

Vural Gökmen

Food Engineering Department at Hacettepe University, Turkey

Thermal processes such as baking, roasting, and frying involve simultaneous heat and mass transfer phenomena. Heat is transferred from the surrounding air or oil into the interior of the food, while moisture and some volatile compounds escape from the food towards the exterior or surrounding air due to evaporation. This results in high-temperature and low-moisture conditions during these processes, which lead to the formation of Maillard reaction products. A diverse range of new molecules, some of which have been associated with beneficial health effects, are generated. Conversely, undesirable compounds, such as acrylamide, may also be formed, exhibiting carcinogenic and, in certain instances, mutagenic properties. The precursors present in foods, including amino acids, sugars, vitamins, and fatty acids, are involved in these chemical reactions, leading to the formation of thermal process contaminants. This presentation is about the formation, mechanism and further reactions of Maillard reaction products, primarily acrylamide, which are formed in foods during heat treatment and have potentially toxic effects.

PL 5

Food for extreme environments

Michaela Musilova
President of XtremeFrontiers, Slovakia

The long-term survival of humans in extreme environments requires thorough preparations and high-quality food products. The food needs to be nutritious, easily transportable (both light and compact) and flavorsome. When performing long duration expeditions and simulated space missions, humans need nutrition that fulfils their needs, all while being enjoyable enough to motivate them to eat regularly. These extreme environments, whether they are places in challenging conditions on Earth or in space, also make it difficult to store food. Nutritional products for humans on these expeditions thus also need to be able to be shelf-stable without losing their nutritional value. Dr. Michaela Musilova will share her experiences with food while leading over 30 simulated missions to the Moon and Mars, and while leading various expeditions to some of the most challenging environments on Earth.

PL 6

Valorisation of byproducts – How the Norwegian seafood industry create more value and bring healthy food products to the marked

Robert Wolff
Foundation for Industrial and Technical Research (SINTEF), Norway

Norway is the largest seafood exporter in the world. The seafood industry represents one of Norway's largest export industries, with a total export value exceeding 15 billion EUR in 2024. Every day, all year round, approximately 36 million meals are prepared with origin from the Norwegian seafood industry. Norway exports farmed and wild fish to more than 150 countries.

Marine residual raw material (blood, cut offs, skin, viscera, heads, back bones etc.), constitutes an important value-creating resource generated from the Norwegian seafood industry. Today, most of the residual material are utilised. Nevertheless, there is still a potential to increase rate of utilisation. Cod (*Gadus morhua*) and other species within the cod family, is the main species harvested in Norway, but it is also the less exploited. Both the players in the seafood sector and the R&D environment, have an increasing focus on finding sustainable solutions to increase utilisation. Every year SINTEF conduct a survey which gives and overview of total quantities of residual raw material generated, where it arises and how it is utilised. This has become a powerful decision support tool for what is known as the marine ingredients industry in Norway. The aim is to provide an overview of the availability of, and which product flows arise from, marine residual raw materials.

In 2024 a total of approximately 1 mill ton of rest raw material. From this, just above 860 000 ton were exploited fully. There has been a tremendous increase over the last decade. Among products based on biomass from residual raw materials from the seafood industry are pet-food, animal feed, protein rich products and fish oil. To further increase the value creation and fully exploit the potential which lays in the biomass, a lot of R&D are conducted, specially related to products that are prepared for nutritional health marked and pharma. Among products omega-3 products should be mentioned.

This presentation will give an overview of how the Norwegian marine ingredient industry are innovating and how the industry even can increase the utilisation of unexploited biomass, to create more value.

PL 7

Innovation in food - clean label food industry strategies based on carbohydrates

Manuel A. Coimbra
Department of Chemistry, University of Aveiro, Portugal.

The advances in methodologies for carbohydrate analysis allowed to revisit their structures, rendering available a better knowledge of food raw materials and derived products. In a close collaboration between academia and industry, new food ingredients, formulations, and technologies to produce healthy, tasty, affordable, and appealing processed foods are under development taking advantage of carbohydrate properties.

Examples of the challenge and solutions achieved so far for clean label strategies include the use of inulin-rich tuberous root and derived fructooligosaccharides that can replace sucrose added in processed jams for use in dairy products [1], the increment of soluble dietary fibre and oligosaccharides in apple and pear juices, the revisiting of the antioxidant activity of polysaccharides [2] and their interaction with phenolic compounds [3], and the brewers' spent yeast mannoprotein and glucan structural characteristics [4] and related applications [5]. The relevance of transglycosylation reactions in honey [6] and coffee brew carbohydrates [7] will be also discussed taking into account their relevance for the development of functional foods.

Innovation in food can also benefit by the enrolment of students in food industry practical cases. The organization of national and European food innovation competitions in the aim of ECOTROPHELIA (https://eu.ecotrophelia.org/), a European Organization that attributes awards to European higher education students for their innovation in food, creates an environment able to promote entrepreneurship and competitiveness envisioning the future of European food industry.

References

1 Fernandes et al. Valuation of yacon agri-food by-products as sweetening agents. Applied Sciences, 2024, 14: 894.

2 Fernandes & Coimbra. The antioxidant activity of polysaccharides: a structure-function relationship overview. Carbohydrate Polymers, 2023, 314: 120965.

3 Fernandes et al. The hydrophobic polysaccharides of apple pomace, Carbohydrate Polymers, 2019, 223: 115132.

4 Bastos et al. Structural role of yeast cell wall glycogen upon brewing revealed by enzymatic approaches and advanced NMR. Carbohydrate Polymers, 2024, 324: 121475.

5 Bastos et al. Brewers' Yeast Polysaccharides – a review of their exquisite structural features and biomedical applications. Carbohydrate Polymers, 2022, 277: 118826.

6 Silva et al. Contribution of non-enzymatic transglycosylation reactions to the honey oligosaccharides origin and diversity. Pure and Applied Chemistry, 2019, 91: 1231–1242.

7 Moreira et al. Transglycosylation reactions, a main mechanism of phenolics incorporation in coffee melanoidins: inhibition by Maillard reaction", Food Chemistry, 2019, 227: 422–431.

Acknowledgments*: Thanks are due to FCT for the financial support of research unit UID/50006 – Associate Laboratory for Green Chemistry – Clean Technologies and Processes.*

ABSTRACTS OF KEYNOTE AND ORAL PRESENTATIONS

SESSION OP-W: WASTE-LESS FOOD PRODUCTION

KN-W

Nutritional and sensory value of insects as novel food

Lenka Kouřimská[1], Petra Škvorová[1], Barbora Lampová[1], Anežka Kopecká[1], Pavel Kouřimský[1], Martin Kulma[2]

[1]*Department of Microbiology, Nutrition and Dietetics, Czech University of Life Sciences Prague, Praha – Suchdol, Czech Republic;*

[2]*Department of Zoology and Fisheries, Czech University of Life Sciences Prague, Praha – Suchdol, Czech Republic*

Edible insects represent an alternative protein source for human nutrition and animal feed, which is attractive due to their low greenhouse gas emissions, excellent feed conversion, minimal land requirements, and ability to convert low-value organic by-products into high-value protein raw materials. The aim of the work was to evaluate the possibilities of using edible insects in the agri-food sector with a focus on the sensory and nutritional quality of edible insects. Possibilities of influencing the quantitative and qualitative content of nutrients in insects were also discussed.

Insect species approved in the EU as novel food or feed were monitored. The following parameters were monitored: dry matter, ash, fat, protein, amino acid and fatty acid profiles, as well as some non-protein nitrogenous compounds (chitin, purines, taurine), lipophilic vitamins and sensory acceptability of visible and hidden forms of insects.

Nutritional value of insects is high and depends on several factors. The type and developmental stage of insects, rearing conditions and feed have a significant effect on the nutritional composition of insects. Replacing soybean with feed based on rapeseed cake and oil positively affected the fatty acid profile of insects in terms of reducing the content of saturated fatty acids. Significant differences in the fat and protein content of insects were recorded depending on the rearing temperature. The acceptability of insects by assessors is influenced by the type of insect and its form (meal or whole insects).

Edible insects represent a promising alternative to traditional protein sources. Although edible insects offer numerous environmental and nutritional benefits, their wider acceptance still depends on overcoming cultural barriers and further research focused on safety, optimization of farming practices, and the sensory properties of insect products.

OP-W01

Valorisation of oil pumpkin (*Cucurbita pepo* L. var. *styriaca*) pulp through fermentation by *Pediococcus* sp.

Miona Belović[1], Ilinka Pećinar[2], Aleksandra Bajić[1], Ana Varga[1], Marijana Đorđević[1], Bojana Kokić[1], Biljana Cvetković[1]

[1]*University of Novi Sad, Institute of Food Technology in Novi Sad, Novi Sad, Serbia*

[2]*University of Belgrade, Faculty of Agriculture, Belgrade, Serbia*

During the processing of oil pumpkin (*Cucurbita pepo* L. var. *styriaca*), the fruit is discarded as agricultural waste. Lactic acid fermentation is a traditional technology widely used to preserve vegetables. *Pediococcus* sp. is a genus of gram-positive lactic acid bacteria responsible for the spontaneous fermentation of cabbage. The presented study aimed to analyse the change of physicochemical properties of oil pumpkin pulp caused by thermal pre-treatments and subsequent fermentation by *Pediococcus* sp. and compare it to butternut squash (*Cucurbita moschata* Duchesne) pulp.

The pulp was prepared with the addition of water due to the hard texture of vegetables. Steam blanching was used as a pre-treatment. Both native and blanched samples were sterilized and inoculated with *Pediococcus* sp. After each processing step, samples were taken for rheological, particle size, colour and carotenoids determination. All samples were analysed using Raman spectroscopy to elucidate chemical changes.

Thixotropic loop area, storage and loss moduli were influenced by the pumpkin species, with lower values of both moduli recorded for oil pumpkin (G′ = 20060 Pa; G″ = 2146.5 Pa for native sample) than for butternut squash (G′ = 85715 Pa; G″ = 10765 Pa), that can be partly attributed to the lower concentration of particles in oil pumpkin pulp. Blanching had a detrimental effect on the carotenoids in oil pumpkin pulp. Fermentation increased the content of carotenoids in native oil pumpkin (from 1.78 to 2.19 mg/kg) and butternut squash (from 20.90 to 30.03 mg/kg), probably due to the increase in their availability. It can be concluded that fermentation combined with minimal thermal treatment can be used to increase the content of available carotenoids in *Cucurbita* sp. pulp.

Acknowledgments: *This publication is based upon work from COST Action CA20128 (Promoting Innovation of ferMENTed fOods; https://fermentedfoods.eu/), supported by COST (European Cooperation in Science and Technology; www.cost.eu).*

OP-W02

Valorization of olive pomace: Sustainable production of bioactive compounds from Portuguese cultivars

Suzana Ferreira-Dias[1,2], Jorge Gominho[3], Lea Pogačnik da Silva[4], Fátima Peres[1,5]
[1]*Instituto Superior de Agronomia, Universidade de Lisboa, LEAF — Linking Landscape, Environment, Agriculture and Food—Research Center, Lisbon, Portugal;*
[2]*Laboratório de Estudos Técnicos, Instituto Superior de Agronomia, Universidade de Lisboa, Lisbon, Portugal;*
[3]*Centro de Estudos Florestais, Laboratório Associado TERRA, Instituto Superior de Agronomia, Universidade de Lisboa;*
[4]*Biotechnical Faculty, Department of Food Science and Technology, University of Ljubljana, Slovenia;*
[5]*Instituto Politécnico de Castelo Branco, Escola Superior Agrária, 6001-909 Castelo Branco, Portugal*

The use of local agro-industrial residues to produce high added-value products is crucial for achieving economically sustainable industrial processes. Virgin olive oil, extracted from the olive fruit (*Olea europaea* L.) through mechanical processes, generates significant amounts of olive pomace. This by-product, rich in lignocellulosic materials, also contains residual oil (3–4.5%, wet basis) and bioactive phenolic compounds. Olive pomace oil is solvent-extracted and refined for edible purposes. However, the variability in olive pomace composition from different cultivars and locations is not well-documented. This study aims to valorize olive pomaces (OPs) from Portuguese cultivars grown in various locations to obtain added-value compounds, specifically: (i) xylo-oligosaccharides with prebiotic activity; (ii) glucose; and (iii) phenolic compounds for food and pharmaceutical applications. An integrated green and sustainable process, involving thermal, non-thermal, and enzymatic treatments, was employed. Initially, oil was extracted using *n*-hexane. The extracted OPs (EOPs) underwent autohydrolysis to yield a liquid stream rich in hemicellulose-derived compounds (mainly xylans) and a solid fraction rich in cellulose and lignin. The highest sugar yields were achieved at Severity factors of 4.7 (190℃/120 min) or 4.9 (198℃/90 min). Subsequently, the solid residue was submitted to saccharification using commercial blends of cellulases and beta-glucosidases, producing glucose for fermentation or other industrial uses. EOPs were also treated with ultrasound followed by green-solvent (ethanol and/or water) extraction to recover phenolics. Phenolic content, along with antioxidant, anti-inflammatory, and antimicrobial activities, varied with the cultivar. These results highlight the potential of utilizing olive pomace from various cultivars as a valuable resource for producing bioactive compounds, contributing to more sustainable and economically viable industrial processes.

Acknowledgements: *This work was funded by Fundação "La Caixa" and FCT, Fundação para a Ciência e a Tecnologia, I.P., Portugal, project PD24-00014, and by the research center LEAF (UIDP/04129/2020; UIDB/04129/2020) and Forest Research Centre (UIDB/00239/2020) funded by FCT.*

OP-W03

Valorisation of whey and second cheese whey: elaboration of high added value products

Arona Figueroa Pires[1,2,3], Olga Díaz[1], Carlos Pereira[2,3], Angel Cobos[1]
[1]*Department of Analytical Chemistry, Nutrition and Bromatology, Faculty of Sciences of Lugo, Food Technology Area, Universidade de Santiago de Compostela, 27002 Lugo, Spain*
[2]*Polytechnic Institute of Coimbra, College of Agriculture, Bencanta, 3045-601 Coimbra, Portugal*
[3]*Research Centre for Natural Resources, Environment and Society (CERNAS), Bencanta, 3045-601 Coimbra, Portugal*

Whey and second cheese whey are byproducts of the dairy industry from the production of cheese and cottage cheese. Both have a very significant environmental impact, but because they have high nutritional, functional and biological value, they can be used for the production of dehydrated products, such as whey powder, protein concentrates and isolates. However, small and medium-sized dairy companies are limited by the high costs of these technologies represent, especially for traditional sheep and goat cheese producers. The development of more efficient and economical processes to reduce environmental pollution and the creation of new products can increase the possibility of using these by-products by these companies. Creating new foods or value-added products through the use of these by-products, allows small and medium-sized industries to use them efficiently [1]. Thus, the application of membrane technology (ultrafiltration) is proposed to obtain liquid protein concentrates, avoiding the drying stage, which can be used directly in the manufacture of innovative foods (yogurt ice creams containing different starter cultures, symbiotic kefirs and cottage cheeses containing probiotics and protective cultures) [2,3,4]. To study the characteristics of the new products obtained, microbiological, sensory and physical-chemical analyses were carried out. Furthermore, the obtained liquid concentrates were dried to investigate their application in the food industry (production of edible films and coatings). These edible coatings were applied with the addition of oregano and sage essential oils for the preservation of cheeses, replacing commercial films and coatings [5].

***References*:**

[1]-Pires et al. *Foods* 2021, 10, 1067. https://doi.org/10.3390/foods10051067
[2]- Pires et al. *Foods* 2023, 11, 4091. https://doi.org/10.3390/foods11244091
[3]-Pires et al. *Membranes* 2023, 13, 473. https://doi.org/10.3390/ membranes13050473
[4]-Pires et al. *Foods* 2024, 13, 1214. https://doi.org/10.3390/foods13081214
[5]- Pires et al. *Foods* 2024, 13, 674. https://doi.org/10.3390/foods13050674

OP-W04

Valorisation of piquant pepper waste towards food condiment

Andreia F.R. Silva[1], Rita Bastos[1], Mariana Cunha[2], Maria H. Gomes[1], Pedro A.R. Fernandes[2], Cláudia Passos[2], Maria P. Ramos[3], Norton Komora[3], Manuel A. Coimbra[2]

[1]*Colab4Food – Laboratório Colaborativo Para a Inovação da Indústria Agroalimentar, INIAV, Vairão, Portugal;*
[2]*LAQV-REQUIMTE -Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, Aveiro, Portugal;*
[3]*Casa Mendes Gonçalves, Golegã, Portugal*

The hot pepper sauce industry has been constantly pressured to improve the management of the disposal of pungent by-products to minimize economic and environmental impacts[1,2]. To address this challenge, VIIAFOOD project aims to repurpose *Capsicum pepper* waste into valuable food ingredients, supporting the principles of a circular economy. Peppers' by-products comprise fibrous tissues, peels, seeds, and additives, but are a good source of capsaicinoids and pigments. This study aims to evaluate the optimal material conditions and extraction techniques to obtain a food-pungent oleoresin from jalapeño by-products. Ethanol reflux for five hours (standard methodology) and ultrasound-assisted extraction (UAE) at different times were the two techniques used to extract oleoresin from both wet and oven-dried jalapeño waste. The oleoresins were evaluated regarding capsaicinoids, total phenolic compounds and antioxidant activity, and the extracted residue left was characterized by carbohydrates and protein amount.

The results showed wet jalapeño by-product (WJ) results in higher oleoresin yields than dried jalapeño by-product (DJ). 10 minutes of UAE of WJ extracted 85% of the capsaicinoid obtained under reflux extraction, and longer UAE durations further increased capsaicinoid yields. Using DJ, reflux extraction achieved the highest yield in capsaicinoids (88%), while UAE resulted in capsaicinoids yields varying from 64 to 71%, without improvements beyond 10 minutes. WJ and DJ oleoresins were classified as 'hot', containing approximately ~200 k Scoville units. WJ's oleoresins presented more total phenolic compounds and antioxidant activity than DJ's oleoresins, highlighting the importance of water in the by-product of extracting bioactive compounds. Additionally, the extraction residue is rich in carbohydrates (40%) and protein (11%), potentially for use as a food ingredient. Jalapeño oleoresins were applied in spicy mayonnaises, snacks and fresh cheeses. Overall, this study highlights the potential of piquant pepper waste as a valuable source of food ingredients, fostering sustainability and innovation in food processing.

Acknowledgements: *We would like to thank to Casa Mendes Gonçalves for samples providing and support, as well to GlycoFoodChem research group for their support throughout this study. Pedro Fernandes, Cláudia Passos and Manuel A. Coimbra acknowledge to the projects of LAQV/REQUIMTE (LA/P/0008/2020 DOI 10.54499/LA/P/0008/2020, UIDB/50006/2020 DOI 10.54499/UIDB/50006/2020, UIDP/50006/2020 DOI 10.54499/UIDP/50006/2020) and CICECO-Aveiro Institute of Materials, UIDB/50011/2020 (DOI 10.54499/UIDB/50011/2020), UIDP/50011/2020 (DOI 10.54499/UIDP/50011/2020) & LA/P/0006/2020 (DOI 10.54499/LA/P/0006/2020), funded by FCT/MCTES through national funds.* ***Funding:*** *This work was financially supported by VIIAFood Project 5.1.9 - Production of piquant and coloring extracts from Capsicum peppers through green extraction methods (C644929456-00000040) from PRR (Programa de Recuperação e Resiliência).*

References:

1. N. Gontard et al., *Crit. Rev. Environ. Sci. Technol*, **2018**, *48*, 614-654.
2. C. J. Sandoval-Castro et al., *J Food Sci Technol*, **2017**, *54*, 1999–2010.

OP-W05

Sustainable bioactive recovery: the most efficient quercetin extraction from onion peel

Tatiane C. G. Oliveira[1,2], F. Chamorro[3], M. Carpena[3], M.A. Prieto[3], Délio Raimundo[4], Isabel C.F.R. Ferreira[1], M. Beatriz P.P. Oliveira[2], Eliana Pereira[1*], Lillian Barros[1]

[1]*CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;*
[2]*REQUIMTE/LAQV, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, R. Jorge de Viterbo Ferreira, 228, 4050-313 Porto, Portugal;*
[3]*Universidade de Vigo, Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain;*
[4]*Campotec S.A., Estrada Nacional 9, Zona Industrial de Casalinhos de Alfaiata 2560-393 Silveira Torres Vedras – Portugal*

Onion peel (*Allium cepa* L.) is an agro-industrial by-product with a large volume of waste, which has a high content of phenolic compounds, especially quercetin. This flavonoid is widely studied due to its biological properties, namely antioxidant, antimicrobial, and anti-inflammatory action. This compound's efficient and sustainable extraction is essential to enhance its application in the food and/or pharmaceutical industry. The study was designed following a response surface methodology (RSM) approach to optimize three extraction techniques: pressurized liquid extraction (PLE), microwave-assisted extraction (MAE), and heat-assisted extraction (HAE). Different independent variables were considered: for PLE, *time* (*t*, 1–25 min), *temperature (T, 50–200°C)* and *ethanol percentage of the solvent* (*S*, 0–100%), for MAE, (*t*, 5–25 min, *T, 50–180°C, S*, 0–100%), and HAE, *(t, 5–60 min, T, 30–90°C, S, 0–100%)*. The extracts obtained were analyzed by HPLC-ESI-QqQ-MS/MS following the previous methodology to identify and quantify total quercetin (TQ) compounds. The selected response parameters were yield and TQ concentration. MAE was the most effective technique for TQ extraction, followed by PLE and HAE. The optimum conditions for TQ extraction were short time, high temperature, and high concentration of ethanol in the solvent, with the maximum values for TQ being 158.31 mg/g of extract for MAE, 66.50 mg/g E for PLE, and 51.60 mg/g E for HAE at respective optimum conditions.

This study highlights the efficiency of MAE and contributes to the development of greener, more effective strategies for the valorization of onion peel as a natural source of quercetin, promoting its application in food and pharmaceutical formulations.

Acknowledgements: *This work was financially supported by national funds through FCT/MCTES (PIDDAC): CIMO, UIDB/00690/2020 (DOI: 10.54499/UIDB/00690/2020) and UIDP/00690/2020 (DOI: 10.54499/UIDP/00690/2020); and SusTEC, LA/P/0007/2020 (DOI: 10.54499/LA/P/0007/2020); national funding by F.C.T. for Tatiane C.G. Oliveira PhD grant (2021.06046.BD) and for Eliana Pereira (2021.03908.CEECIND) and Lillian Barros contracts. This work is supported by the EU-FORA Fellowship Program (EUBA-EFSA-2023-ENREL-01-GA13) that supports the work of F. Chamorro.*

OP-W06

Sustainable lipid wastes bioconversion – *Yarrowia lipolytica* in lipase and microbial lipids production

Katarzyna Wierzchowska, Agata Fabiszewska
Department of Chemistry, Institute of Food Sciences, Warsaw University of Life Sciences, Warsaw, Poland

Lipid waste from the food industry poses significant environmental challenges due to its complex composition and disposal difficulties. *Yarrowia lipolytica* is an oleaginous yeast known for its ability to metabolize hydrophobic substrates, making it a promising candidate for lipid waste valorization. This study explores the potential of *Y. lipolytica* to convert liquid and solid lipid waste into valuable microbial lipids and extracellular lipases. The study aimed to evaluate the growth, lipid accumulation, and lipase production of different *Y. lipolytica* strains cultured in media containing lipid waste from the meat industry (solid lipid fraction from meat broths, post-frying rapeseed oil from chicken frying, waste fat from pork head cooking, and waste lard from pork frying). The influence of waste type, carbon source concentration, yeast strain, and inoculum size on microbial responses was assessed. Experiments were conducted using the Latin Square 5×5 design. The yeast was cultured in media with different liquid and solid hydrophobic waste from the agri-food industry. Biomass yield, lipid accumulation efficiency, lipase activity, emulsification index, and waste utilization were analyzed over 96 hours of culture under controlled conditions. Post-frying rapeseed oil promoted the highest biomass yield, while solid lipid fractions enhanced lipid accumulation and lipase activity. The highest lipid biosynthesis efficiency (34.66%) was observed at an 8% carbon source concentration with a 2.5% inoculum size. The maximum emulsification index (62%) was recorded in cultures with post-frying oil, indicating biosurfactant production. Lipase activity peaked at 48 hours and was significantly influenced by the type of waste substrate and yeast strain. The results demonstrate the feasibility of utilizing *Y. lipolytica* for the bioconversion of lipid waste into valuable bioproducts. The findings highlight the yeast's potential for industrial applications, including biodiesel production, food supplements, and bioremediation.

OP-W07

Sensing arrays for fruit ripeness evaluation

Blanka Tobolková[1], Mária Kopuncová[1], Janka Kubincová[1], Xiang Wang[2], Xiaoshuan Zhang[2]
[1]Department of Chemistry and Food Analysis, National Agricultural and Food Centre – Food Research Institute, Bratislava, Slovakia;
[2]College of Engineering, China Agricultural University, Beijing, PR China

Traditionally, physico-chemical indicators, rigid sensors and complex instruments have been used to monitor, detect or predict the quality of post-harvest and post-ripening fruit. However, this approach involves time-consuming procedures, destructive techniques and a low level of monitoring accuracy. On the other hand, flexible sensor technology is a viable alternative to rigid sensors for monitoring of post-harvest fruit quality and long-term environmental signals. An essential process in the supply chain is the sorting of fruit for ripeness and size. Incorrect sorting can easily result in spoiled and degrades fruit entering the market. This study explores the converging applications of flexible technology, integrated flexible sensing manipulator, in Fruit quality control. The manipulator grips the fruit, detects its hardness and determines the degree of ripeness. The data set obtained from sensing hardness was trained using a machine learning classification model. The study shows that flexible sensors offer promising platforms for real-time fruit quality monitoring and evaluation due to their exceptional stretchability and biocompatibility. In addition, the use of multi-scale, flexible sensors enable the collection of information in confined spaces. The accuracy of monitoring can be effectively improved by combining these sensors with machine learning algorithms, wireless sensing technology and intelligent devices such as manipulators.

Acknowledgement: *This work was supported by the Slovak Research and Development Agency under the contract No. SK-CN-23-0013.*

OP-W08

Exploring insect-derived proteins as sustainable alternatives: digestibility, allergenicity and inflammatory potential

Lisete M. Silva[1], Inês E. Silva[1], Sara da Silva[1], Rafaela Fantatto[2], Marisa V. Santos[3], Ricardo Dias[4], Susana Soares[1], Victor Freitas[1]
[1]*Faculty of Sciences of University of Porto, Porto, Portugal;*
[2]*EntoGreen, Santarém, Portugal;*
[3]*Thunder Foods, Santarém, Portugal;*
[4]*LAQV-REQUIMTE, Porto, Portugal*

Insect-derived proteins are emerging as a sustainable alternative to animal proteins, offering high protein content, a complete amino acid profile, and versatile food applications, while reducing greenhouse gas emissions, land use and water consumption. Although a few studies suggest their digestibility may match or exceed that of traditional proteins, it varies by species and processing methods. Thus, assessing their digestibility, allergenicity and inflammatory potential is crucial for evaluating their suitability as food ingredients. In this work, dehydrated *Hermetia illucens* (Black Soldier Fly, BSF) and *Tenebrio molitor* (TM) larvae, as well as the defatted insect meals, and protein extracts (PE) obtained after a protein extraction optimization and characterization, were subjected to in vitro gastrointestinal digestions, following the INFOGEST protocol. The samples were desalted and analyzed by nano-LC-MS/MS. The allergenicity potential of the resulting peptides were predicted in silico using the AllerCatPro 2.0 web server. The pro-inflammatory response of BSF and TM meals and their corresponding PE was assessed using a transwell-based human intestinal epithelial cell model consisting of differentiated Caco-2 and HT-29-MTX co-cultures. For BSF samples, 1076 peptides (0.6–3.6 kDa) were identified, with 0.2 % in the PE, and 0.9 % in the larvae and meal showing strong allergenicity potential. For TM, 1329 peptides (0.6–3.9 kDa) were identified, with 0.9 % in the PE, 3.9 % in the meal and 2.6% in the larvae predicted as allergenic. Despite these results, further tests are needed to confirm the allergenicity potential of these insect-based ingredients. None of the insect samples induced a significant pro-inflammatory response under the tested conditions – monitored through IL-8 release -, supporting their potential as sustainable food ingredients.

Acknowledgments: *This work received funding from the Recovery and Resilience Plan (PRR), under the scope of Mobilizing Agenda for Business Innovation; Ref. C644917393- 00000032: "InsectERA – A ERA da indústria dos insetos".*

OP-W09

NMR metabolomics to observe the effects of drying processes and growth stage on *Acheta domesticus* (house cricket) nutritional profile

Mattia Spano[1], Giuseppina Adiletta[2], Irene Ferri[3], Paola Russo[2], Luisa Mannina[1]
[1]*Department of Chemistry and Technology of Drugs, Sapienza University of Rome, Italy;*
[2]*Department of Chemical Engineering Materials Environment, Sapienza University of Rome, Italy;*
[3]*Department of Veterinary Medicine and Animal Sciences (DIVAS), University of Milan, Italy*

In recent years, an even growing need of alternative and sustainable food sources is occurring. In this context, edible insects, traditionally used in different areas of the world, have been introduced in Europe as Novel Foods in 2019. However, several aspects regarding these matrices have to be explored in-depth, namely nutritional and safety properties, as well as the effects of technological treatments on these profiles.

In this study, *Acheta domesticus* samples at two different stages of the vital cycle (nymph and adult) were subjected to different drying methodologies namely freeze-drying, oven, and microwave (using several parameters) to analyze the potential changes that occur in the metabolite profile, thus affecting the nutritional properties.

Proximal analysis and NMR metabolomics were applied to define both macronutrients profile and metabolites one.

NMR analysis allowed to detect several classes of metabolites namely sugars, amino acids, organic acids, fatty acids, sterols, and other compounds whose qualitative and quantitative features were strongly affected by both vital cycle stage and drying processes.

The obtained results underlined how also in the case of edible insects, production and processing practices are important to be studied since, as for “typical” foodstuffs, they strongly define chemical and nutritional properties of these innovative matrices. In the aim of improving the knowledge regarding edible insect nutritional properties and safety, this information represents an important starting point.

Acknowledgements: *Gruppo Italiano Discussione Risonanze Magnetiche (GIDRM) Society is thanked for having financed the participation to the conference with "Stefano Caldarelli" scholarship.*

OP-W10

Comprehensive two-dimensional liquid chromatography for the characterization of the phenolic content in extra virgin olive oil and its by-products

Francesco Cacciola[1], Marina Russo[1], Katia Arena[1], Paola Dugo,[1,2] Luigi Mondello[1,2]
[1]Messina Institute of Technology c/o Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, former Veterinary School, University of Messina, Viale G. Palatucci Snc, Messina 98168, Italy;
[2]Chromaleont s.r.l., c/o Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, former Veterinary School, University of Messina, Viale G. Palatucci Snc, Messina 98168, Italy

The industrial olive oil production generates significant quantities of wastes, such as olive pomace which does contain high concentrations of organic carbon, particularly phenols. Some of these wastes can potentially act as environmental pollutants due to their phytotoxic properties if they are not properly managed.

Due to the ever-increasing attention paid to the valorization and recycling of these by-products due to their richness in bioactive compounds, including phenolic compounds, they could be advantageously used in nutraceutical products with dual benefits from both the environmental and economic point of view.

This study proposes a sensitive and reliable analytical method, based on high-performance liquid chromatography for the qualitative and quantitative characterization of phenols in EVOOs and their wastes. However, because of matrix complexity, comprehensive two-dimensional liquid chromatography, under reversed phase conditions, was also tuned.

Thanks to the complementary of the two stationary phases and the hyphenation to triple quadrupole MS, under multi reaction monitoring, up to 53 phenolic compounds were positively identified in the drupe sample, which turned out to be the most complex among the ones investigated.

The reduction of matrix effects, when using comprehensive two-dimensional liquid chromatography with respect to conventional one-dimensional liquid chromatography, was assessed by comparing the slopes of calibration curves built from standard solutions and spiked samples.

Acknowledgments: *The researches were performed within the framework of the Research Project PRIN PNRR 2022- MISSIONE 4, COMPONENTE 2, INVESTIMENTO 1.1 – BANDO PRIN 2022 PNRR – DECRETO DIRETTORIALE N. 1409 DEL 14-09-2022: REcovery and Enhancement of WAste and processing products of the olive oil industry thRough innovative analytical methods for the Development of newly developed NUTRAceutical and COSMetic prOducts (REWARD-NUTRACOSMO), supported by the Italian Ministry of University and Scientific Research, no. Prot. P20224ZHA5, CUP: J53D23014480001.*

SESSION OP-IN: INNOVATION IN FOODS

KN-In

Dietary polyphenols in thyroid function: Influence on TPO activity, oxidative stress, and related metabolic disorders

Urszula Gawlik

Department of Biochemistry and Food Chemistry at the University of Life Sciences in Lublin, Poland

Oxidative stress and chronic inflammation are crucial in the pathogenesis of thyroid diseases. Thyroid peroxidase (TPO) is essential for thyroid hormone synthesis, and its activity can be influenced by phenolic compounds. Bioactive food components impact redox homeostasis, regulate pro-inflammatory enzymes and affect MAO activity, potentially alleviating metabolic and mood disorders often associated with thyroid dysfunction. These factors are particularly relevant in metabolic syndrome, where thyroid dysfunction can exacerbate the condition. Given the sometimes conflicting dietary recommendations, understanding these mechanisms may help clarify the impact of nutrition on thyroid health and guide more effective nutritional strategies.

OP-In01

Fermented foods and health: Benefits and risks explored by the PIMENTO initiative

Smilja Pracer[1], Asli Akpinar[2], Ricardo Assunção[3], Cornelia Bär[4], Simona L. Bavaro[5], Muzeyyen Berkel Kasikci[2,6], Julieta Domínguez-Soberanes[7], Vittorio Capozzi[8], Paul D. Cotter[9], Eun-Hee Doo[10], Burcu Gündüz Ergün[11], Mustafa Guzel[12], Hayriye S. Harsa[13], Emre Hastaoglu[14], Christèle Humblot[15], Bahtir Hyseni[16], Muge I. Hosoglu[17], Aline Issa[18], Barçın Karakaş-Budak[19], Sibel Karakaya[20], Harun Kesenkas[21], Erhan Keyvan[22], Ibrahim E. Künili[23], Mary-Liis Kütt[24], Marta Laranjo[25], Sandrine Louis[26], Fani T. Mantzouridou[27], Antonia Matalas[28], Baltasar Mayo[29], Sandra Mojsova[30], Arghya Mukherjee[9], Anastasios Nikolaou[31], Fatih Ortakci[32], Diana Paveljšek[33], Giancarlo Perrone[34], Eugenia Pertziger[35,36], Dushica Santa[37], Taner Sar[38], Isabelle Savary-Auzeloux[39], Clarissa Schwab[40], Małgorzata Starowicz[41], Marko Stojanović[42], Michail Syrpas[43], Jyoti P. Tamang[44], Oktay Yerlikaya[21], Birsen Yilmaz[45,46], Jeadran Malagon-Rojas[47], Seppo Salminen[48], Juana Frias[49], Christophe Chassard[39], Guy Vergères[35], Effie Tsakalidou[50], Photis Papademas[51], Marie Christine Champomier Vergès[52], Antonio Del Casale[53], Vittorio Capozzi[54], Zuzana Ciesarová[55], Kathryn Burton-Pimentel[35], Biljana Trajkovska[56]

[1]Institute for Biological Research Sinisa Stankovic, National Institute of Republic of Serbia, University of Belgrade, Belgrade, Serbia;

[2]Department of Food Engineering, Manisa Celal Bayar University Faculty of Engineering and Natural Science, Manisa, Türkiye;

[3]Egas Moniz Center for Interdisciplinary Research (CiiEM), Egas Moniz School of Health and Science, Almada, Portugal;

[4]Competence Division Method Development and Analytics, Agroscope, Berne, Switzerland;

[5]National Research Council of Italy – Institute of Sciences of Food Production (ISPA), Turin, Italy;

[6]STLO, INRAE, Institut Agro-Rennes Angers, Rennes, France;

[7]Facultad de Ingeniería, Universidad Panamericana, Aguascalientes, Mexico;

[8]Department of Food Science, University of Foggia, Foggia, Italy;

[9]Department of Food Biosciences, Teagasc Food Research Centre, Fermoy, Ireland;

[10]School of Living and Environmental Engineering, Dongyang Mirae University, Seoul, Republic of Korea;

[11]Biotechnology Research Center, Field Crops Central Research Institute, Ankara, Türkiye;

[12]Department of Food Engineering, Hitit University, Corum, Türkiye;

[13]Department of Food Engineering, Izmir Institute of Technology, Izmir, Türkiye;

[14]Cumhuriyet University, Sivas, Türkiye;

[15]French National Research Institute for Sustainable Development (IRD), Montpellier, France;

[16]Faculty of Food Technology, University Isa Boletini in Mitrovica, Mitrovica, Serbia;

[17]Gebze Technical University, Kocaeli, Türkiye;

[18]Faculty of Nursing and Health Sciences, Notre Dame University-Louaize, Zouk Mosbeh, Lebanon;

[19]Department of Food Engineering, Akdeniz University Faculty of Engineering, Antalya, Türkiye;

[20]Department of Food Engineering, Faculty of Engineering, Ege University, Izmir, Türkiye;

[21]Department of Dairy Technology, Faculty of Agriculture, Ege University, Izmir, Türkiye;

[22]Department of Food Hygiene and Technology, Faculty of Veterinary Medicine, Burdur Mehmet Akif Ersoy University, Burdur, Türkiye;

[23]Department of Fishing and Fish Processing Technology, Faculty of Marine Sciences and Technology, Canakkale Onsekiz Mart University, Canakkale, Türkiye;

[24]ÄIO, Tallinn, Estonia;

[25]MED Mediterranean Institute for Agriculture, Environment and Development-CHANGE-Global Change and Sustainability Institute and Departamento de Medicina Veterinária-Escola de Ciências e Tecnologia (ECT), Universidade de Évora, Évora, Portugal;
[26]Department of Physiology and Biochemistry of Nutrition, Max Rubner Institut, Karlsruhe, Germany;
[27]Laboratory of Food Chemistry and Technology, School of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece;
[28]Department of Nutrition and Dietetics, Harokopio University, Athens, Greece;
[29]Departamento de Microbiología y Bioquímica, Instituto de Productos Lácteos de Asturias (IPLA), Consejo Superior de Investigaciones Científicas (CSIC), Villaviciosa, Spain;
[30]Department of Food Safety and Veterinary Public Health, Food Institute, Faculty of Veterinary Medicine, Skopje, Ss. Cyril and Methodius University, Skopje, North Macedonia;
[31]Department of Molecular Biology and Genetics, Democritus University of Thrace, Alexandroupolis, Greece;
[32]Food Engineering Department, Istanbul Technical University, Istanbul, Türkiye;
[33]Institute of Dairy Science and Probiotics, Department of Animal Science, Biotechnical Faculty, University of Ljubljana, Domžale, Slovenia;
[34]Consiglio Nazionale delle Ricerche, Istituto di Scienze delle Produzioni Alimentari, Bari, Italy;
[35]Research Division Microbial Food Systems, Agroscope, Berne, Switzerland;
[36]Department of Epidemiology and Health Systems, Center for Primary Care and Public Health (Unisanté), University of Lausanne, Lausanne, Switzerland;
[37]Faculty of Agricultural Sciences and Food, Ss. Cyril and Methodius University in Skopje, Skopje, North Macedonia;
[38]Swedish Centre for Resource Recovery, University of Borås, Borås, Sweden;
[39]Human Nutrition Unit, INRAE, Université Clermont-Auvergne, Clermont Ferrand, France;
[40]Department of Biological and Chemical Engineering, Aarhus University, Aarhus, Denmark;
[41]Department of Chemistry and Biodynamics of Food, Institute of Animal Reproduction and Food Research of the Polish Academy of Sciences, Olsztyn, Poland;
[42]Faculty of Medicine, University of Belgrade, Belgrade, Serbia;
[43]Department of Food Science and Technology, Kaunas University of Technology, Kaunas, Lithuania;
[44]Department of Microbiology, School of Life Sciences, Sikkim University, Gangtok, India;
[45]Department of Biological Sciences, Tata Institute of Fundamental Research, Hyderabad, India;
[46]Department of Nutrition and Dietetics, Faculty of Health Sciences, Çukurova University, Adana, Türkiye;
[47]Instituto Nacional de Salud de Colombia, Bogotá, Colombia;
[48]Functional foods Forum, Faculty of Medicine, University of Turku, Turku, Finland;
[49]Department of Technological Processes and Biotechnology, Institute of Food Science, Technology and Nutrition (ICTAN-CSIC), Madrid, Spain;
[50]Laboratory of Dairy Research, Department of Food Science and Human Nutrition;
[51]Agricultural University of Athens, Athens 118 55, Greece, Cyprus University of Technology, Cyprus;
[52]INRAE, Micalis Institute, France;
[53]MICROBION, Open Innovation Department, Italy;
[54]Institute of Sciences of Food Production, National Research Council (ISPA-CNR), Italy;
[55]National Agricultural and Food Centre, Food Research Institute in Bratislava, Priemyselná 4, 824 75 Bratislava, Slovak Republic;
[56]University St. Kliment Ohridski, Faculty of Biotechnical Sciences, Bitola, North Macedonia

Fermented foods are an integral part of the European diet and offer significant nutritional, cultural and sustainability benefits. These foods, whose health benefits are increasingly recognized, contain live microorganisms, bioactive compounds and essential nutrients. As biodiversity declines globally, diversity in the diet is associated with better health outcomes, highlighting the need to maintain and improve food sources rich in beneficial microorganisms. Furthermore, the transition to a more sustainable diet is in line with consumer demand for natural, healthier and affordable products — an area where fermented foods can play a crucial role.

Despite the growing scientific interest, a comprehensive assessment of the health benefits and risks of fermented foods is lacking. The COST Action CA20128 "Promoting Innovation of Fermented Foods" (PIMENTO) addresses this gap by systematically reviewing the available evidence on the effects of fermented foods in key health areas such as cardiovascular, gastrointestinal, neurological, immune and skeletal systems. The initiative also examines the production of bioactive compounds, bioavailability, food safety, regulatory aspects and the health potential of novel and ethnic fermented foods.

Following the guidelines of the European Food Safety Authority (EFSA) for the assessment of health claims, PIMENTO takes an innovative approach combining systematic human studies with food characterization and mechanistic insights. The results will be summarized in a strategic roadmap that will identify research gaps and guide future studies in food fermentation and nutritional science. Beyond fermented foods, the methodologies developed by PIMENTO could serve as a model for assessing the health effects of different food categories, contributing to a more evidence-based approach in nutrition research.

Acknowledgments: *The authors thank the administrative team of PIMENTO for their support, particularly Nadège Picard and Elena Gerbaud (INRAE).*

OP-In02

Fungal solid-state fermentation as a tool for nutritional enrichment of legume-based products

Tatiana Klempová[1], Dávid Lörinc[1], Kristína Kukurová[2], Jozef Murín[3], Zuzana Ciesarová[2], Milan Čertík[1]

[1]*Institute of Biotechnology, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia;*

[2]*Food Research Institute, National Agricultural and Food Centre, Bratislava, Slovakia;*

[3]*Celpo, a.s., Očová, Slovakia*

Lower filamentous fungi belonging to group Zygomycetes are well known as producers of polyunsaturated fatty acids such as gamma-linolenic acid, arachidonic acid, eicosapentaenoic acid etc., sterols (ergosterol, desmosterol etc.), carotenoid pigments, coenzyme Q and enzymes (e.g. amylases, proteases). One of the promising technologies for production of these metabolites is based on a fungal solid-state fermentation (SSF). SSF is technique employing microorganisms grown on solid substrate with absence of free water. Since these conditions represent the natural habitat of fungal strains, the production of important nutrients represents promising way of natural enrichment of solid matrixes that are ready-to-use in food industry.

Legumes are an important food source for millions of people. They are highly valued as protein-rich foods. The popularity of legumes as a substitute component in place of cereals has been increasing recently. The protein content is much higher than that of cereals and they are rich in lysine and sulphur-containing amino acids such as methionine, which are low in most plant foods. However, their nutritional value is low compared to animal proteins. Since the lower filamentous fungi contain amino acids, application legumes as substrates for fungal SSF can also lead to an increased content of essential amino acids in final products.

Our work focuses on the use of different fungal strains (*Mortierella alpina*, *Actinomucor elegans*, *Umbelopsis isabellina*) in the SSF process, where different types of legumes serve as solid matrix. Each of the obtained products was enriched with the polyunsaturated fatty acids, coenzyme Q10, carotenoids and free essential amino acids. Furthermore, the antioxidant potential of prepared products was increased.

Thus, the application of fungal solid-state fermentation represents very intriguing method to increase the nutritional value of legumes.

Acknowledgement: *This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-23-0169 and APVV-22-0235.*

OP-In03

Fermentation-induced nutritional and physicochemical changes in microalgae

Shahana Aboobacker[1], Hakki Bilgin[1], Rita Kazernavičiūtė[1], Aušra Šipailienė[1], Ramunė Rutkaitė[2], Vaida Kitrytė-Syrpa[1], Michail Syrpas[1]

[1]*Department of Food Science & Technology, Kaunas University of Technology, Kaunas, Lithuania;*

[2]*Department of Polymer Chemistry and Technology, Kaunas University of Technology, Kaunas, Lithuania*

Arthrospira platensis is a protein-rich cyanobacterium with extensive applications in the food and nutraceutical industries. Fermentation is a well-established technique that enhances food materials' digestibility and nutritional profile; however, its effects on microalgal biomass and protein-rich fractions remain underexplored. Given the potential of algal fermentation in developing novel formulations and nutraceutical products, further research is needed to address existing challenges and unlock new opportunities.

This work presents research on the physicochemical changes occurring during the fermentation of spirulina and phycobiliprotein-rich extract. Both microalgal powder and isolated protein-rich extracts were subjected to fermentation with lactic acid bacteria under different conditions, with and without glucose supplementation. Samples were collected at 0, 24, and 48 hours and multiple physicochemical parameters were evaluated. Microbial growth was substantial across all strains, reaching counts up to 10.1 log CFU/mL, accompanied by a significant pH reduction. The most pronounced drop in pH (3.84 ± 0.03) was observed after 24 hours in samples fermented with *Lactiplantibacillus plantarum*. Liquid chromatography confirmed that this decrease correlated with lactic acid production.

Additionally, fermentation affected the pigment composition, leading to the degradation of phycocyanin and allophycocyanin due to pH sensitivity and proteolytic activity. HPLC MS/MS revealed the release of free essential and non-essential amino acids and B-complex vitamins. Notably, pyridoxine (vitamin B_6) was released only after 24 hours of fermentation.

Furthermore, the fermentates demonstrated antimicrobial activity. Conversely, LC-MS/MS analysis identified the formation of biogenic amines, primarily tyramine and histamine, though their levels remained within safe limits. These findings suggest that spirulina and spirulina protein may serve as viable fermentation substrates, significantly altering their physicochemical properties. However, further research is required to assess the bioactivity and safety of the fermented extracts before potential applications in food and nutraceutical products.

OP-In04

Structural and functional insights into ulvan from *Ulva lactuca* L.: multi-methodological characterization and *in vitro* fermentability

Beatrice Zonfrillo[1], Maria Bellumori[1], Carmen M.S. Ambrosio[2], Eleonora Truzzi[3], Davide Bertelli[3], Paola Faraoni[4], Francesco Ranaldi[4], Serena Orlandini[5], Josep Rubert[26], Nadia Mulinacci[1]
[1]*Department of Neuroscience, Psychology, Drug Research and Child Health (NEUROFARBA), University of Florence, Sesto Fiorentino, Italy;*
[2]*Division of Human Nutrition and Health, Wageningen University & Research, Wageningen, the Netherlands;*
[3]*Department of Life Science, University of Modena-Reggio Emilia, Modena, Italy;*
[4]*Department of Experimental and Clinical Medicine, University of Florence, Florence, Italy;*
[5]*Department of Chemistry "Ugo Schiff" (DICUS), University of Florence, Sesto Fiorentino, Italy;*
[6]*Food Quality and Design group, Wageningen University & Research, Wageningen, the Netherlands*

Ulva lactuca is a widespread macroalga that has attracted attention due to its role in green tides, phenomena linked to coastal eutrophication. Approved in the European Union as both food and food supplement, *Ulva* is rich in ulvan, a sulfated polysaccharide which represents a promising product for biomass valorization.

This study investigates *U. lactuca* harvested in the Orbetello lagoon, where it grows naturally and requires costly disposal. The research aimed to provide insights for transforming this underexploited biomass into a source of bioactive compounds focusing on ulvan, by optimizing extraction, characterizing its chemical structure, and assessing its *in vitro* fermentability and prebiotic potential. Additionally, enzymatic hydrolysis was optimized to produce oligosaccharides suitable for biological applications.

Extraction conditions were optimized using Response Surface Methodology (RSM). Oligosaccharides were produced by ulvan lyase PLSV_3875. Ulvan was characterized by 2D-NMR, HPAEC-PAD (monosaccharide composition), and GPC-RID (molecular weight). *In vitro* digestion (INFOGEST 2.0) and subsequent batch colonic fermentation were conducted, with samples collected over time for targeted and untargeted LC-MS/MS analyses.

RSM optimal conditions (pH 2.0, 105 min, L/S ratio 60:1 mL/g) yielded 9.27% ulvan with 27.8% rhamnose, 20% sulfate, and average Mw of 88 kDa. Ulvan fermentation by gut microbiota resulted in SCFA production (averaging 2.43 mg/L at 48 h) and modulation of tryptophan metabolism, generating health-promoting catabolites such as indole 3-propionic acid and indole 3-acetic acid. RM-ASCA statistical analysis of untargeted data highlighted ulvan-specific features. Optimized enzymatic hydrolysis (25 mM KCl, 100 mM phosphate buffer, pH 7.5, 3 mg/mL ulvan) and kinetic characterization yielded oligosaccharides suitable for biological applications.

The developed protocols for ulvan extraction and hydrolysis provide the basis for future research on *Ulva* biomass valorization. Ulvan shows promising fermentability and prebiotic potential, supporting its use as a dietary supplement or functional food ingredient.

OP-In05

Endocannabinoids and endocannabinoid-like compounds in fermented foods

Ecem Berk Aydın, Cemile Yılmaz, Vural Gökmen

Food Quality and Safety (FoQuS) Research Group, Department of Food Engineering, Hacettepe University, Ankara, Türkiye

Endocannabinoids and endocannabinoid-like compounds are a class of lipids derived from various fatty acids. These compounds include *N*-acylethanolamines, *N*-acylamino acids, *N*-acyl neurotransmitters, monoacylglycerols, and primary fatty acid amides. The endocannabinoid system is particularly vital in regulating appetite and energy balance through central and peripheral pathways in humans. In addition to humans, these compounds are also found in plants and microorganisms, making their presence in foods inevitable. Although there is significant research on the presence and potential health implications of endocannabinoid and endocannabinoid-like compounds, knowledge of their changes in foods during processing remains insufficient. Moreover, no comprehensive research has been conducted on endocannabinoid and endocannabinoid-like compounds found in cheeses and sausages produced by different processes. Therefore, this study aimed to determine their profiles and quantities in different animal-origin fermented foods. For this purpose, Turkish-type sausages (dry fermented and heat-treated sausages) and cheese (aged or ripened and fresh cheeses) samples were analysed to evaluate the effect of fermentation, heat-treatment and ripening processes on these compounds. Furthermore, fermentation of laboratory-scale sausage was performed. Consequently, 2-arachidonoylglycerol and *N*-arachidonoyl ethanolamine were found in sausages, while cheese samples contained only 2-arachidonoylglycerol. Among cheese samples, Danish Blue and aged Kashar (a type of pasta-filata cheese) were notably rich in *N*-acylamino acids. It was determined that the ripening process plays a significant role in shaping the profile of lipid signalling compounds when comparing fresh and ripened cheeses. Additionally, it was concluded that monoacylglycerols were present in higher concentrations in sausages than in cheeses, likely due to the higher fat content and lipolysis occurring in sausages. In sausage fermentation, the concentrations of these compounds, particularly the *N*-acylamino acids, increased as fermentation progressed. Overall, this study provides valuable insights into how processing methods, such as ripening, affect the profile of endocannabinoids in foods and offers potential explanations for their formation mechanisms.

OP-In06

Substances and plant extracts affecting the balance between scavenging and generating radicals in relation to food quality, as potential food additives

Tibor Maliar[1], Marcela Blažková[2,3], Marek Kunštek[2,3], Mária Maliarová[1]

[1]*University of St. Cyril and Methodius, Faculty of Natural Sciences, Institute of Chemistry and Environmental Sciences, Trnava, Slovakia;*

[2]*University of St. Cyril and Methodius, Faculty of Natural Sciences, Institute of Biology and Biotechnology, Trnava, Slovakia;*

[3]*National Agricultural and Food Centre, Lužianky, Slovakia*

The balance between antioxidant and pro-oxidant forms is important too for the stability and safety of food. Despite the fact that methods for determining both of the aforementioned forms are established and widely known, the scientific community is currently addressing the possibility of their simultaneous determination. A breakthrough in this area is microplate techniques, which use a common dilution mode for both different effects, thereby eliminating errors in determination. Methods that quantify the ability to scavenge or quench radicals include: DPPH, ABTS, Galvynoxil, and others. Paradoxically, methods for determining antioxidant activity that color the reduction of the oxidation state of transition metals are understood as methods for antioxidant activity, but at the same time, they generate reduced forms of transition metals (e.g., FRAP, CUPRAC, and others). These in Fenton´s reactions, in the presence of hydrogen peroxide, generate additional radicals. The number of ROS and RNS in food primarily leads to the degradation of double bonds in the lipid components of food, the elimination of antioxidants, and protein degradation. Primary screening of substances and plant extract samples indicated that substances with an SP2-hybridized oxygen atom (such as flavonoids) show a predominant reducing effect on transition metal ions, due to their ability to better form coordination compounds, which in the presence of hydrogen peroxide, lead to the formation of further radical forms, food instability, and its sensory deterioration. On the other hand, substances and plant extracts rich in derivatives with aromatic hydroxyl groups or conjugated dienes show a predominant scavenging and neutralizing effect on radicals. For these reasons, substances and plant extracts with a high PABI index value are suitable as food additives. These include, for example, polyphenolic acids, catechins, stilbenes, or hydroxy-substituted conjugated dienes, and plant extracts such as horse chestnut fruit (*Aesculus hippocastanum*, L.) or grapevine fruit (*Vitis vinifera*, L.).

OP-In07

Recent developments in the CUPRAC sensing/quantification of food antioxidants, reactive species / scavengers, oxidase enzymes substrates and inhibitor pesticides

Reşat Apak[1], Ayşem Arda[1], Sema Demirci-Çekiç[1], Yusuf Dilgin[2]. Esin Çelik[1], Mustafa Bener[3], Burcu Bekdeşer[1], Ziya Can[1], Şener Sağlam[1], Selen Ayaz[2]
[1]*Chemistry Department, Istanbul University-Cerrahpasa, Istanbul, Türkiye;*
[2]*Chemistry Department, Canakkale Onsekiz Mart University, Canakkale, Türkiye;*
[3]*Chemistry Department, Istanbul University, Istanbul, Türkiye*

Unbalanced reactive oxygen/nitrogen species (RONS) are involved in various physiological disorders bringing antioxidant research to the forefront. The original CUPRAC (cupric ion reducing antioxidant capacity) method, widely applied in food and biochemistry research centres, was developed in our laboratories as an electron-transfer assay for food antioxidants, but later evolved into an integrated series of measurements for RONS, enzymes/substrates, pesticides.
The aim was to integrate the original and modified CUPRAC methods to nanotechnology, enzyme/nanozyme catalysis for measuring analytes relevant to food, environmental and biochemistry.
Direct/indirect CUPRAC measurements were performed spectrophotometrically while enzyme-functionalized nanoparticles and nanozymes were characterized with SEM, TEM, EDX, XRD, and XPS.
The CUPRAC reagent−functionalized gold nanoparticles sensor was stabilized with heparin, catalyzing the detection of slow-reacting antioxidants. CUPRAC could measure oxidase enzyme substrates through H_2O_2 produced from magnetite nanoparticles-immobilized enzyme-substrate reaction. Mn-based peroxidase-mimetic nanoparticles were let to cause DNA damage monitored spectrophotometrically by CUPRAC and 3,3',5,5'-tetramethylbenzidine methods, measuring both DNA hazard and antioxidant defense. Lactate oxidase and pyruvate oxidase were immobilized on silanized nano-Fe_3O_4, yielding enhanced CUPRAC sensitivity *via* double-fold H_2O_2 release in mixtures. Paraoxon ethyl (P-pesticide) could be selectively detected *via* acetylcholine esterase inhibition using the CUPRAC response to thiocholine.
The versatility of the CUPRAC method has been demonstrated for the direct/indirect determination of antioxidants, reactive species, enzymes/substrates, and pesticides, and its sensitivity/selectivity could be greatly enhanced by integrating nanotechnology.

OP-In08

A journey on the bioavailability of anthocyanin-rich edible flowers bioactives: the case of Cornflower, Cosmos and Wildpansy

Hélder Oliveira[1], Margarida Teixeira[1], Wen Tao[1], Ana Faria[2], Catarina Rodrigues[2], João Araújo[2], Isabel. M.P.L.V.O. Ferreira[3], Nuno Mateus[1], Victor de Freitas[1]

[1]*REQUIMTE/LAQV, Chemistry and Biochemistry Department, Faculty of Sciences, University of Porto, Portugal;*
[2]*CHRC, NOVA Medical School, Faculdade de Ciências Médicas, NMS, FCM, Universidade NOVA de Lisboa, Lisboa, Portugal;*
[3]*LAQV/REQUIMTE, Laboratory of Bromatology and Hydrology, Department of Chemical Sciences, Faculty of Pharmacy, University of Porto, Portugal*

Edible flowers (EF) are regaining interest for both consumers and researchers due to the need for healthy dietary alternatives. Besides, anthocyanins have become a key group of natural compounds during the last years due to their health benefits and applications in different areas. Indeed, these compounds have been showing potential roles against different pathologies. Among EF, the species containing high amounts of anthocyanins, represent, therefore, an extremely interesting alternative food source of such bioactives.

The aim of this study was to evaluate key aspects of the bioavailability, including nutritional and chemical characterization, stability under different cooking conditions, fate upon ingestion at the gastrointestinal (GI) cavities, absorption, and metabolization of the bioactives of three different EF rich in anthocyanins: *Cornflower*, *Cosmos* and *Wildpansy*.

Several techniques were utilized such as AOAC official methods, UHPLC-PDA-ESI-MS, different conditions of pH, temperature, and time. INFOGEST 2.0 digestion protocol, and Transwell® models with NCI-N87 and caco-2/HT29-MTX. The influence of different food matrix components was evaluated. Finally, the metabolization studies were performed with three bacterial species typically present in the intestine: *E. coli*, *S. flexneri*, *L. paracasei*.

The tested EF showed high nutritional content and amount of anthocyanins, with structurally different features impacting their overall stability at the different tested conditions. The same was observed for the INFOGEST studies. Regarding absorption, the results showed that the bioactives can be effectively absorbed. The presence of food matrix components affects both absorption and digestion in specific ways. EF bioactives were able to improve the number of healthy bacteria (*E. coli* and *L. paracasei*) while reducing the number of pathogens (*S. flexneri*). Upon this incubation, anthocyanins were converted into metabolites, mainly phenolic acids and aldehydes.

Acknowledgements: *The authors acknowledge the funding by Fundação para a Ciência e Tecnologia under the scope of the projects "FLORA.MED" (2023.11612.PEX) and "AnthoE.Flos" (2022.01014.PTDC).*

OP-In09

Shaping the future of Food Metabolomics: innovative strategies and interesting applications for the olive and avocado sectors

Alegría Carrasco-Pancorbo[1], María Gemma Beiro-Valenzuela[1], Irene Serrano-García[1], Romina P Monasterio[1], Romina Pedreschi[2], Lucía Olmo-García[1]
[1]*Department of Analytical Chemistry, Faculty of Sciences, University of Granada, Granada, Spain;*
[2]*Facultad de Ciencias Agronómicas y de los Alimentos, Escuela de Agronomía, Pontificia Universidad Católica de Valparaíso, Quillota, Chile*

The emergence of Food Metabolomics has opened up new frontiers and possibilities for scientists to explore food composition in greater detail. By qualitatively and quantitatively analyzing the food metabolome, researchers can uncover valuable insights into food content, quality, authenticity, safety, and health benefits. Once considered technically challenging, advancements in analytical techniques and chemometric tools have made it possible. New methodologies are also being developed to monitor compounds from multiple chemical classes in a single run, expanding coverage while reducing analysis time and costs.
This contribution focuses on applications related to the determination of metabolites of interest in olive-derived matrices and avocado tissues. Both targeted and non-targeted approaches combined with advanced chromatographic techniques coupled with mass spectrometry (in some cases ion mobility spectrometry), have been applied to assess endogenous metabolites in olive and avocado samples.
Food Metabolomics applications can be broadly classified into six main areas, though it is challenging to encompass all potential applications within these categories: (a) characterization studies, (b) food safety, quality and authentication (e.g., verifying botanical or geographical origin), (c) agro-technological and industrial research (examining the impact of different agro-technological practices on food composition), (d) evaluation of the results of breeding programmes at metabolic level and selection of specific varieties; (e) valorization of different by-products, and (f) health and nutrition studies.
This work will highlight selected applications from the two areas we have focused on in recent years, covering the main categories outlined above. It will showcase a range of analytical methodologies and Metabolomics approaches, address major analytical challenges, explore future trends, and identify needs within the olive and avocado sectors, concluding with key takeaways.

OP-In10

Achieving a dramatic blue color stability in anthocyanins bearing acylated sugars in position 3′,5′. A thermodynamic and kinetic study

Joana Oliveira[1], Victor Freitas[1], Peiqing Yang[2,3], Nuno Basilio[2], Fernando Pina[2]

[1]LAQV – REQUIMTE, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre, 687, 4169-007 Porto, Portugal;

[2]LAQV – REQUIMTE, Departamento de Química, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal;

[3]College of Food Science and Nutritional Engineering, China Agricultural University, China

The kinetics, thermodynamics, and degradation of acylated anthocyanins versus pH, including the basic ones, are described. At the equilibrium, it was verified that the number of acylated units increases the color hue of the quinoidal base and respective anionic forms and extends their pH domain to higher pH values. In the case of the flavylium cation its pH domain is also extended. This is particularly important to achieve the blue color in flowers possessing vacuoles with neutral to slightly basic pHs, whose blue color is given by the anionic quinoidal base, as in the tri-acylated heavenly blue anthocyanin extracted from *Ipomoea tricolor.*[1]

The position of the acylated sugars is also crucial. Recent results have shown that those in position 3′,5′ [2] or in position 7[3]are more efficient than in position 3 and 5. In fact, for the tri-acylated anthocyanin extracted from *Clitoria ternatea*, the degradation is negligible in basic to neutral media and less than 10% in basic medium after 15 days.

Funding: *This work received financial support from the PT national funds (FCT/MECI, Fundação para a Ciência e Tecnologia and Ministério da Educação, Ciência e Inovação) through the project UID/50006 – Laboratório Associado para a Química Verde – Tecnologias e Processos Limpos. J.O. would like to thank FCT for her research contract (2022.00042.CEECIND/CP1724/CT0017).*

References:

(1) Mendoza, J.; Basilio, N.; Pina, F.; Kondo, T.; Yoshida, K. Rationalizing the Color in Heavenly Blue Anthocyanin: A Complete Kinetic and Thermodynamic Study. *J. Phys. Chem. B* **2018,** *122*, 4982–4992.

(2) Joana Oliveira, Nuno Basílio, Fernando Pina, *et al.* work in progress.

(3) Kumi Yoshida, Nuno Basílio, Fernando Pina, *et. al.* work in progress.

OP-In11

Role of methylglyoxal in color formation: Investigation of novel intermediates and resulting model melanoidins

Tatjana Rueger, Leon V. Bork, Sascha Rohn, Clemens Kanzler
Department of Food Chemistry and Analysis, Technische Universität Berlin, Berlin, Germany

In the complex cascade of the Maillard reaction, methylglyoxal is an essential precursor for both flavor compounds, like pyrazines or pyrroles [1], and colorants [2]. Due to its two electrophilic carbonyl groups and its C-H-acidic methyl group, methylglyoxal is highly reactive. It is postulated to be involved in the formation of melanoidins, the high-molecular-weight, nitrogen-containing end-products of the Maillard reaction, via aldol reactions [2]. Although aldol reactions are considered the key formation mechanism of such melanoidins, the structural elucidation of distinct precursors remains to be determined. This is necessary to evaluate their physiological and technofunctional properties more comprehensively. This study aimed to characterize model melanoidins formed from methylglyoxal.

In binary model mixtures, methylglyoxal was incubated with alanine, proline, glutamic acid, or phenylalanine at 100 °C and pH 5 for up to 300 min. Novel Maillard reaction intermediates were isolated (preparative HPLC) and structurally elucidated (HRMS and NMR). Isolating model melanoidins from the colored reaction mixtures was achieved by dialysis (cutoff >12 kDa). These were characterized regarding their browning (absorbance at 420 nm), repetitive structural patterns (HRMS), and antioxidant properties (TEAC assay).

The contribution of high-molecular-weight products to the browning in aqueous solution strongly depends on the amino compound, ranging from 5% (methylglyoxal/proline) to 44% (methylglyoxal/alanine). These differences occur despite a comparable melanoidin yield of 2–4 wt% of dry mass. TEAC assay showed that the melanoidin fraction of methylglyoxal/alanine contributes approximately 5% to the antioxidant activity of the entire mixture, corresponding with its weight proportion. Additionally, the most quantitatively relevant intermediates were isolated to reveal the structures and formation mechanisms of novel pyrrole and pyridine derivatives. HRMS data of the reaction mixture showed that these condensation products serve as constituents in complex melanoidin structures.

References

[1] Adams, *J. Agric. Food Chem*. **2008**, 56, 2147–2153.
[2] Kanzler, *J. Agric. Food Chem*. **2021**, 69, 11960–11970.

OP-In12

Strategies to increase psychobiotic activity through dietary fibre modulation

Soraia P. Silva[1], Abigail Gonzalez[2], Dalila Roupar[2], Andreia F. Salvador[2,3], Rita Bastos[4], Mariana Mota[1], Maria H. Luís[1], Sónia S. Ferreira[1], Maria J. Alegria[5], Clarisse Nobre[2], Manuel A. Coimbra[1], Elisabete Coelho[1]
[1]*LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, Aveiro, Portugal;*
[2]*CEB–Centre of Biological Engineering, University of Minho, Braga, Portugal;*
[3]*LABBELS –Associate Laboratory, Braga, Portugal;*
[4]*Colab4Food – Collaborative Laboratory, INIAV – Vairão, Vila do Conde, Portugal;*
[5]*SUMOL COMPAL Marcas S.A, R. Dr. António João Eusébio, n.º24, 2790-179, Carnaxide, Portugal*

Soluble polysaccharides and oligosaccharides are prebiotic compounds that promote the growth of beneficial gut bacteria and contribute to improved health. Industrial juice production results in juices with moderate amounts of soluble dietary fibre because most polysaccharides that constitute the dietary fibre are retained in pulp (41–37%), mostly insoluble fibre rich in cellulose and pectic polysaccharides. Incorporation of glucanases and pectinases into the juice production process can therefore enrich the juice with soluble fibre and possible prebiotic effects. Apple cloudy juice was composed of 4% of fibre (dry basis), mainly pectic polysaccharides. Hydrolysis of apple pulp with endo- and exo-cellulase released a high amount of material (63.9%), composed of monosaccharides and cellulose and xyloglucan oligosaccharides. Hydrolysis with pectin lyase, polygalacturonase, and pectin methylesterase released 57.7% material composed of pectic poly- and oligosaccharides. Fermentation with fecal inocula, increased the concentration of short-chain fatty acids (SCFAs), γ-aminobutyric acid (GABA), and 5-hydroxytriptophan. Enzymatic treatment with pectinases improved the intestinal microbiota and the production of neurotransmitters.

In lignified by-product materials, more drastic strategies need to be used to recover polysaccharides and oligosaccharides with prebiotic activity. Pine nut skin, a by-product obtained during pine nut processing, is a source of insoluble dietary fiber. Subcritical-water extraction allowed to obtain an extract rich in pectic polysaccharides and xyloglucans that had an impact on the microbiota composition similar to fructooligosaccharides used as positive control, also increasing the abundance of *Bifidobacterium adolescentis*. The core microbiome upon these polysaccharides' fermentation was composed of multiple butyrate producers, which lead to butyrate increase. A selective microbial utilization towards xyloglucans was observed in detriment of pectic polysaccharides, attaining the highest GABA concentration at 24h. Pine nut skin can be considered a source of soluble oligo- and polysaccharides with prebiotic effect, promoting the growth of psychobiotics which may help reduce depression, anxiety, and modulate mood.

Acknowledgments: *This work was funded by VIIAFOOD-1.2.2. FFV Fruit Fractioning and Valorization from PRR (Programa de Recuperação e Resiliência). Authors acknowledge the FCT financial support through LAQV/REQUIMTE (10.54499/UIDB/50006/2020, 10.54499/UIDP/50006/2020, and 10.54499/LA/P/0008/2020), and through UIDB/04469/2020 unit and LA/P/0029/2020 within the PT2020 Partnership Agreement, thank FCT/MCTES for PhD grants (SFRH/BD/136471/2018, SFRH/BD/06268/2021 and SFRH/DB/139884/2018), and E. Coelho research contracts (DL 57/2016/CP1482/CT0038, 2023.08855.CEECIND).*

OP-In13

Effects of infrared treatment on phenolic compounds and antioxidant activity of chia

Meltem Laçin, Arzu Başman

Faculty of Engineering, Food Engineering Department, Hacettepe University, Beytepe, Ankara, Türkiye

In recent years, there has been a growing trend in the consumption of chia seeds. Chia seeds are potential source of antioxidants due to their phenolic and flavonoid compounds. The rich composition of chia makes it a unique seed and has an effect on reducing the risk for coronary heart disease, Diabetes Mellitus type 2, and several types of cancer.

Infrared treatment has gained popularity in food industry due to its advantages over conventional heating, such as improved energy efficiency, high heat transfer coefficient, and shorter processing time. Utilization of infrared treatment in roasting, cooking, drying, extraction, and enzyme inactivation provide some advantages.

To the best of our knowledge, in literature, there is no study about the effects of infrared treatment on antioxidant activity, phenolic and flavonoid content of chia seed. Therefore, in this study, chia seeds were infrared treated at different powers (700,900,1100W) and times (25,50 min). Effects of infrared treatment on total phenolic and total flavonoid content, antioxidant activity (DPPH, CUPRAC) and phenolic profile of chia samples were investigated. Slight changes were observed in the color values of chia seeds. Infrared treatment caused an increase in total flavonoid content at 700W and 900W. Total phenolic content and antioxidant activity gradually increased as the infrared power and time increased. Chlorogenic acid, ferulic acid (except 1100W-50min), rutin and quercetin (only at 700W-50min, 900W-25min) increased, while caffeic and p-coumaric acid decreased by infrared treatment.

Infrared treatment of chia seeds may enhance the extractability of bound polyphenols and flavonoids due to thermal breakdown of cellular components, thereby increasing extractability. Infrared treatment shows great potential for utilization of chia in value-added food products for increasing the consumability of chia seeds with improved nutritional quality, taste and aroma.

Acknowledgments: *The authors wish to thank Hacettepe University, Scientific Research Projects Coordination Unit for financial support (Project No: FHD-2021-19644). Meltem Laçin would like to thank TÜBİTAK (2224-A) for the financial support it provided for her participation in the conference.*

OP-In14

Molecularly imprinted polymer-modified electrochemical sensor for low molecular weight compounds

Vilma Ratautaite [1, 2], Ernestas Brazys [2], Enayat Mohsenzadeh [1], Greta Zvirzdine [1], Raimonda Boguzaite [1], Deivis Plausinaitis [2], Urte Prentice [1, 2], Arunas Ramanavicius [1, 2]

[1]*Department of Nanotechnology, State Research Institute Center for Physical Sciences and Technology (FTMC), Saulėtekio Ave. 3, LT-10257 Vilnius, Lithuania;*

[2]*Department of Physical Chemistry, Institute of Chemistry, Faculty of Chemistry and Geosciences, Vilnius University (VU), Naugarduko Str. 24, LT-03225 Vilnius, Lithuania*

Interest in electrochemical sensors arises from features such as their adaptability, the possibility of miniaturisation, and, most importantly, their ability to be used for rapid analysis.
Sensitivity and selectivity are the most important parameters characterising an electrochemical sensor, and modifying the electrode surface can tune these parameters.
The electrode modification applying molecular imprinting technology (MIT) can significantly impact the final properties of the electrochemical sensor properties. The MIT application for polymer polymerisation produces the molecular imprinted polymer (MIP). The essential property of MIP is the formation of specific and complementary cavities for the analyte.
A wide range of polymers can be used to prepare MIP, including electrically conductive polymers (such as polypyrrole, polyaniline, poly(*o*-phenylenediamine, etc.).
The key step in the MIP preparation process is template molecule extraction. In this step, specific and complementary cavities for the analyte are formed.
This presentation discusses electrochemical sensors modified with MIPs, focusing on compounds such as tryptophan [1], melamine [2], caffeine [3], theophylline [4], glyphosate [5], etc.

Acknowledgement: *Projektas finansuojamas Ekonomikos gaivinimo ir atsparumo didinimo plano "Naujos kartos Lietuva" lėšomis.*

***References*:**

[1] V. Ratautaite, E. Brazys, A. Ramanaviciene, A. Ramanavicius, Journal of Electroanalytical Chemistry 917 (2022) 116389, https://doi.org/10.1016/j.jelechem.2022.116389.
[2] E. Brazys, V. Ratautaite, B. Brasiunas, A. Ramanaviciene, L. Rodríguez, A. Pinto, D. Milea, U. Prentice, A. Ramanavicius, Microchemical Journal 199 (2024) 109890, https://doi.org/10.1016/j.microc.2024.109890.
[3] V. Ratautaite, D. Plausinaitis, I. Baleviciute, L. Mikoliunaite, A. Ramanaviciene, A. Ramanavicius, Sensors and Actuators B-Chemical 212 (2015) 63–71, https://doi.org/10.1016/j.snb.2015.01.109.
[4] V. Ratautaite, S.D. Janssens, K. Haenen, M. Nesládek, A. Ramanaviciene, I. Baleviciute, A. Ramanavicius, Electrochimica Acta 130(0) (2014) 361-367, https://doi.org/10.1016/j.electacta.2014.03.035.
[5] D. Balciunas, D. Plausinaitis, V. Ratautaite, A. Ramanaviciene, A. Ramanavicius, Talanta 241 (2022) 123252, https://doi.org/10.1016/j.talanta.2022.123252.

OP-In15

Inhibition of immunogenic gluten peptide release by treatment of gluten with green tea phenols

Aytul Hamzalioglu, Merve Aksoy Dirim, Vural Gökmen
Food Quality and Safety (FoQuS) Research Group, Department of Food Engineering, Hacettepe University, 06800 Beytepe, Ankara, Turkey

Celiac disease is an autoimmune disorder triggered by gluten consumption, a protein found in wheat, barley, and rye. Gluten's high proline content makes it resistant to digestive enzymes, which results in the formation of longer peptide fragments known as "immunogenic gluten peptides," responsible for immunological responses. Proline residues, on the other hand, might potentially serve as binding sites for the phenolic compounds. Through these interactions, binding of polyphenols may be a viable method to hamper gluten digestion and the release of immunogenic fragments. This study aimed to modify gluten by protein-phenol interactions and to monitor *in vitro* immunogenic gluten peptide release.
In this study, treatment of gluten was carried out by free green tea phenols (GTPs) as well as oxidized form of GTPs by polyphenol oxidase (PPO). Gluten was treated by free GTPs at 50°C and pH 8, while treatment with oxidized GTPs was done at 25°C. Following modification, interactions were characterized by analyzing changes in structural characteristics of gluten by FTIR, UV spectrometry and thermal stability analysis. Native and modified gluten samples were subjected to *in vitro* digestion protocol and analyzed for their 33-mer (most immunogenic gluten peptide) content.
Structural analysis revealed that gluten could be effectively modified by both free and oxidized GTPs. This modification could suppress the release of 33-mer at varying levels, ranging from 36.9% to 78.4%. PPO-oxidized GTPs were found to be promising for effectively modifying gluten, resulting in a 78.4% inhibition in the release of 33-mer peptides. Gluten treated with GTPs was then used to prepare biscuits and subjected to sensory and texture analysis. Both analyses showed that the biscuits prepared of gluten treated by oxidized GTPs were similar to control biscuits. These findings suggest that the production of less immunogenic gluten ingredients could be achieved by the interaction of gluten with PPO-oxidized GTPs.

OP-In16

Methylation of lysine in food

Marlene Walczak, Sophia Schreinert, Michael Hellwig
Technical University Dresden, Dresden, Germany

The enzyme-mediated modification of amino acid side chains in proteins, also known as post-translational modification, is used in organisms to optimise the function of proteins. Enzymatic methylation is of great importance for cell communication and the body's own synthesis of carnitine. Therefore, the ε-amino group of lysine is methylated up to three times by methyltransferases leading to the derivatives mono- (MML), di- (DML) and trimethyllysine (TML). The latter has already been quantified in various foods. Based on these data and the German National Food Consumption Study, approx. 8 mg of TML is ingested daily with food.
We expect the presence of MML and DML in addition to TML in foods due to the common formation mechanism.
A stable-isotope labelled standard was synthesized for simultaneous quantification of MML, DML, and TML, and a HILIC-MS/MS method was developed. Various foods were analysed for the occurrence of methylated lysine derivatives and the content of free and protein-bound derivatives was determined.
All three derivatives were quantified in concentrations up to 67 mg MML/kg, 34 mg DML/kg and 74 mg TML/kg. As all derivatives are consumed on a daily basis, the question arises whether they pass through the gastrointestinal tract completely. To answer this question, a simulated *in vitro* digestion was carried out according to the INFOGEST protocol. The results indicate that the derivatives survive human digestion unchanged and are available for resorption. Using a Caco-2 cell system, we were also able to demonstrate that the free derivatives are transported across the epithelium.
We therefore assume that the methylated lysine derivatives supplied alimentarily are absorbed into the bloodstream.

OP-In17

Application of lactoferrin for coating of β-carotene–inulin particles

Inga Gabriūnaitė[1,2], Rūta Gruškienė[1], Tatjana Kavleiskaja[2], Jolanta Sereikaitė[1]
[1]Department of Chemistry and Bioengineering, Faculty of Fundamental Sciences, Vilnius Gediminas Technical University, Saulėtekio av. 11, 10223 Vilnius, Lithuania,
[2]Institute of Chemistry, Faculty of Chemistry and Geosciences, Vilnius University, Naugarduko str. 24, 03225 Vilnius, Lithuania

Lactoferrin (LF) is a glycoprotein found in most mammals in different secretory fluids, but mostly in milk. LF belongs to transferrin family as it has iron binding properties and transfers iron to cells. Additionally, LF has antibacterial, anti-inflammatory properties. Thus, it plays important role in human body. It could be used in food technology to improve the quality of different foods. Here we propose the application of LF for coating of β-carotene-inulin (CAR-IN) particles.
CAR is a provitamin A, well established antioxidant, mostly found in red-orange-colored fruits and vegetables. To improve stability and solubility in water, CAR was complexed with inulin, as it is lipophilic. Inulin is a prebiotic and is not digestible in gastrointestinal tract. Given its sweet taste, inulin could be used as a healthy sweetener without contributing to diabetes.
The aim of this study is to improve the quality and stability of the CAR-IN particles by the application of coating using LF. First, CAR was complexed with inulin by slow addition of CAR solution in acetone to hot inulin solution in water, followed by evaporation of the acetone. Afterwards, LF was added dropwise to the CAR-IN solution, followed by adjustment of the pH to either 4 or 8. Finally the solution was shaken for 18–20 h. Then, dynamic light scattering measurements were performed, the antioxidant capacity and the stability were determined.
In conclusion, CAR-IN-LF particles were synthesized. The obtained data suggest that new particles could be used for the improvement of food quality.
Acknowledgements: *This research was funded by Research Council of Lithuania project No. S-PD-24-55*

OP-In18

Enhancing the shelf-life of highly perishable fruits using chitosan based active films and edible coatings

Margarida Moldão[1], Tiago Vieira[2], Luisa Brito[1], Vitor Alves[1]
[1] *Linking Landscape, Environment, Agriculture and Food (LEAF), Associated Laboratory TERRA, Instituto Superior de Agronomia (ISA), Universidade de Lisboa, Tapada da Ajuda, 1340-017 Lisbon, Portugal;*
[2] *Centre for Biotechnology and Fine Chemistry (CBQF), Universidade Católica Portuguesa, Porto, Portugal*

Raspberries (*Rubus idaeus* L. cv. 'Kweli') and figs (*Ficus carica* L. cv. 'Pingo de mel') are highly perishable fruits with substantial nutritional, functional, and sensory value. However, their post-harvest deterioration due to microbial growth, weight loss, and physiological changes limits their commercial viability. This study investigates two sustainable approaches to extend the shelf life of these fruits: (i) the green tea (GTE) and rosemary (RSME) ethanolic extracts incorporated in chitosan-based active film-pads inside compostable packaging for raspberries, and (ii) the application of chitosan/olive oil (C-OO) and sodium alginate/olive oil (A-OO) edible coatings for figs. Raspberries were stored under refrigeration conditions (4±1°C) and analysed over 14 days for fungal decay, weight loss, firmness, colour, pH, total soluble solids, volatile acidity, phenolic content, and antioxidant activity. Results demonstrated a significant reduction in fungal growth and decay, with only 13% and 5% of spoiled fruits after 14 days using green tea and rosemary extracts, respectively, compared to 80% spoilage in control samples. Additionally, RSME samples presented lower weight loss (5.6%) and reduced firmness degradation (3.7%). Figs coated with chitosan/olive oil or alginate/olive oil emulsions were stored under refrigeration conditions (4±1°C) for up to 19 days, followed by 2 days at 25°C. Analytical assessments included fungal infection incidence, respiration rate, weight loss, firmness, surface colour, total soluble solids, and titratable acidity. The coatings effectively delayed spoilage, with coated figs maintaining visual and microbial stability for 14 days, whereas uncoated figs have shown deterioration by the 7th day. The coatings also led to a significant reduction in respiration rate, weight loss, and fungal disease incidence. These findings highlight the potential of bio-based active packaging and edible coatings to improve the shelf life of soft fruits, reducing post-harvest losses, and offering sustainable alternatives to conventional synthetic packaging materials.

Acknowledgements: *FCT/MCTES (UIDP[UIDB]/50006/2020), project CRI-CRI: PRR-C05-i03-I-000244.*

OP-In19

Fish gelatin nanofibers enriched with bee bread extract

Dılhun Keriman Arserim-Uçar

Department of Nutrition and Dietetics, Faculty of Health Sciences, Bingöl University, Bingöl, Türkiye

Electrospun nanofiber has been used for many delivery systems, including drug delivery. Bee bread is a fermented honey bee product composed of pollen, honey, and secretions, from the salivary glands. Bee bread, is rich in bioactive compounds, including phenolic acids and flavonoids. This study aims to develop a mucoadhesive nanofiber film with fish gelatin and supercritical carbon dioxide (CO2) bee bread extract (SBBE). The electrospinning technology is used to encapsulate the SBBE in fish gelatin nanofibers (FGN). The electrospun nanofiber films were characterized using scanning electron microscopy (SEM) and thermogravimetric analysis (TGA). The antioxidant properties of the engineered nanofiber films were evaluated using ABTS (2, 2-azinobis (3-ethylbenzothiazoline-6-sulfonic acid)) radical-scavenging activity. UHPLC-Orbitrap®-HRMS was utilized to quantify the flavonoids and phenolic compounds. The engineered mucoadhesive nanofiber films exhibited antioxidant activity. UHPLC-Orbitrap®-HRMS analysis, identifying 16 phytochemicals in SBBE containing nanofibers. SBBE-encapsulated FGN films contain high amounts of 4-hydroxybenzoic acid, gallic acid (3,4,5-trihydroxy benzoic acid), naringenin, protocatechuic acid (3,4-dihydroxybenzoic acid), caffeic acid, quinic acid and isorhamnetin (quercetin 3'-methyl ether). Combining fish gelatin, SCO_2 bee bread extract, and electrospun nanofiber technology presents a potential strategy for advancing mucoadhesive drug delivery systems.

OP-In20

Fabrication of polysaccharides based edible films impregnated with aqueous zein nanoemulsion for fruit preservation

Jawad Ashraf
School of Food and Biological Engineering, Jiangsu University, China

This study aimed to develop ultrasonically-assisted, alcohol-free, and noncorrosive aqueous zein/turmeric essential oil (TEO)-loaded nanoemulsions (NEs) to stimulate pullulan/carboxymethyl chitosan (P/CMCS)-based edible films for mango fruit preservation. The influence of innovative sonicated zein/TEO-based NEs (ZTNEs) as nanofillers on the physico-mechanical characteristics of the resulting P/CMCS edible films was investigated. A stable and well-dispersed ZTNE was achieved using 20 % zein with 10 min of ultrasound treatment, leading to a reduced droplet size (194.23 ± 0.41 nm) and high ζ-potential (-48.72 ± 0.74 mV). Furthermore, the homogeneity of the ZTNE dispersion, evaluated via confocal laser microscopy (CLSM) analysis, indicated that it can be uniformly incorporated into P/CMCS edible films. In addition, the incorporation of ZTNE into P/CMCS edible films improved barrier properties, mechanical strength, oxidative stability, and antimicrobial properties compared with P/CMCS edible films without ZTNE, possibly due to hydrogen bonding in the film matrix, as confirmed by scanning electron microscopy (SEM) micrographs as well as Fourier transform infrared spectroscopy and X-ray diffraction. Interestingly, the results indicated that P/CMCS/ZTNE/US 10 min and P/CMCS/ ZTNE 4 % films demonstrated substantial antibacterial activity against *Escherichia coli* (11.54 ± 0.72 and 16.62 ± 1.13 mm, respectively) and *Staphylococcus aureus* (12.81 ± 1.03 and 14.13 ± 0.69 mm), respectively. Moreover, P/CMCS/ZTNE/US 10 min and P/CMCS/ZTNE 4 % films were found to be effective in mango preservation over a 12-day storage period at 25 ◦C ± 1 ◦C, as assessed by fruit firmness, weight loss, total soluble solid content, total phenolic content, lipoxygenase activity, and electronic nose analysis. Consequently, these findings indicate that P/CMCS/ZTNE edible films may function as an effective biodegradable packaging solution for fruit preservation within the food industry.

OP-In21

Designing biodegradable films using materials from agro-industrial by-products

Vitor D. Alves[1], Verónica Weng[1,2], Andreia Simões[1,2], Isabel M. Coelhoso[2], Carla Brazinha[2]

[1]LEAF – Linking Landscape, Environment, Agriculture and Food, Associated Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Lisboa, Portugal;

[2]LAQV-REQUIMTE, Department of Chemistry, NOVA School of Science and Technology, FCT NOVA, Universidade Nova de Lisboa, Lisboa, Portugal

Agro-industrial by-products are valuable sources of materials that can be utilized for the production of biodegradable films, aligning with strategies to reduce waste and promote sustainable resource use. Examples include corn fiber, rich in arabinoxylan; tomato pomace, containing cutin; and crustacean and insect exoskeletons, from which chitosan can be obtained through chitin extraction and deacetylation.

This study explores the use of arabinoxylan, as well as chitosan combined with cutin monomers, in the development of polysaccharide-based films with improved water barrier properties. Films from unmodified arabinoxylan, extracted from corn fiber, were produced via solvent casting using glycerol as plasticizer. To reduce arabinoxylan's hydrophilicity, it was acetylated following a route with green solvents, and films from acetylated arabinoxylan were produced with triacetin as plasticizer. The acetylation process significantly enhanced moisture resistance, yielding films with water solubility of around 4%, compared to 87% for unmodified arabinoxylan films, while retaining most of their mechanical properties and UV barrier functionality.

Additionally, composite blend films were developed using commercial chitosan (from crustaceans) and cutin monomers isolated from tomato pomace in a previous study. Solutions of 1.5% wt. chitosan (in 1% wt. acetic acid) were blended with 1% wt. cutin monomers (in glacial acetic acid) in varying proportions, cast, and dried to form films. The composite films obtained with 30% wt. cutin monomers solution exhibited a decrease in water solubility and water vapor permeability, of around 26% and 33%, respectively, compared to pure chitosan films.

This study highlights the potential of agro-industrial by-products for developing biodegradable polysaccharide films with enhanced resistance to water, which may be applied in more sustainable packaging solutions within the circular economy framework.

Acknowledgements: *FCT/MCTES (LA/P/0008/2020, UIDP[UIDB]/50006/2020, grant 2021.08511.BD), Sociedade Ponto Verde, WASTELESS (HORIZON-CL6-2022-FARM2FORK-01, Project number: 101084222).*

OP-In22

Unveiling the complexity of Maillard reaction: a novel approach to identify and quantify Maillard reaction products in biscuits

João Siopa[1], Miguel Ribeiro[1,2], Fernanda Cosme[1,3], Fernando M. Nunes[1,4]
[1]*Chemistry Research Centre-Vila Real (CQ-VR) – Food and Wine Chemistry Lab, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal;*
[2]*Genetics and Biotechnology Department, University of Trás-os-Montes e Alto Douro, Vila Real, Portugal;*
[3]*Biology and Environment Department, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal;*
[4]*Chemistry Department, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal*

The Maillard reaction occurs during the thermal processing of a wide variety of foods, such as coffee, bread, and biscuits, among others; and is considered responsible for the sensory properties of the foods in which this reaction occurs. The Maillard reaction is in fact a combination of a myriad of reactions that starts with the condensation of the amine group of amino acids and/or proteins with the carbonyl group of reducing sugars, at high temperatures, ultimately leading to the formation of brown colored polymers known as melanoidins, in its final stages. The extension of the reaction depends on factors such as the composition of the starting materials, temperature, pH, and water activity. As a result, the reaction pathways vary between different foods, resulting in a wide range of products formed (Maillard reaction products, MRPs). However, the identification of MRPs can be helpful in understanding the formation mechanism and composition of melanoidins in foods.
In this work a method was developed and optimized to identify and quantify MRPs formed during the baking of biscuits. Biscuits samples were hydrolyzed, using Pronase E and by acid hydrolysis, followed by derivatization with ethyl chloroformate. The derivatized samples were then analyzed by high-performance liquid chromatography coupled to tandem mass spectrometry (HPLC-MS/MS).
The developed method was validated for precision and accuracy. We were able to identify several MRPs present in the biscuit samples, which showed promising results. Therefore, this method can be a powerful tool to better understand the complexity of the Maillard reaction and consequently, the composition and formation mechanism of melanoidins in food.
***Acknowledgments**: We would like to thank the financial support from the Portuguese Foundation for Science and Technology (FCT) to CQ-VR (https://doi.org/10.54499/UIDB/00616/2020 and https://doi.org/10.54499/UIDP/00616/2020). The author J.S. also acknowledges the financial support from the FCT/MCTES PhD studentship (https://doi.org/10.54499/2020.04409.BD).*

OP-In23

Interaction of Maillard reaction and lipid oxidation in meaty emulsion prepared with canola oil

Suleyman Yiltirak[1], Dimitris P. Balagiannis[1], Jan Koek[2], Christopher Sabater[3], Jens Koch[3], Donny Merkx[2], Stephen Elmore[1]
[1]*Department of Food and Nutritional Sciences, University of Reading, Whiteknights, Reading, RG6 6AZ, UK;*
[2]*Foods Innovation Centre Unilever, Bronland 14, 6708 WH Wageningen, the Netherlands;*
[3]*Symrise AG, Mühlenfeldstraße 1, 37603 Holzminden, Germany*

Plant-based meat alternatives are becoming increasingly popular, as consumers seek more sustainable and healthier options. Nonetheless, vegetable-based meat replacers are often criticized for lacking the authentic flavor of cooked meat. The Maillard reaction and lipid oxidation are mainly responsible for the characteristic cooked meat flavor. In particular, cysteine and ribose are important precursors of meaty flavor. Emulsion systems prepared using vegetable oil in water could be used to create meaty flavor in plant-based products. To understand the effect of the creation of an emulsion on Maillard reaction and lipid oxidation products, several model systems containing cysteine and ribose were prepared: (i) emulsion (buffer/oil/emulsifier), (ii) oil/buffer, (iii) emulsifier/buffer, (iv) buffer. These model systems were heated in four ways (100 °C/4 h, 110 °C/2 h, 120 °C/1 h, 130 °C/0.5 h); dynamic headspace extraction was used for the volatile compounds formed, followed by analysis using gas chromatography/mass spectrometry. In general, heating at low temperature for a longer time increased the formation of volatile compounds, compared to high temperature for a shorter time. Principal component analysis (PCA) showed that alcohols and ketones were closely correlated with the emulsion system, and aldehydes were associated with the oil/buffer system. Pyrazines and dicarbonyl compounds were more pronounced in the buffer and emulsifier/buffer systems, respectively. Additionally, thiazoles and thiophenecarboxaldehydes were clustered with the emulsifier/buffer system. An interesting finding was that long-chain thiophenes and long-chain furans were positively correlated with the emulsion system. These results suggested that the emulsion structure affected the interaction between the Maillard reaction and lipid oxidation. This study shows how many factors can affect the formation of meaty flavor in plant-based model systems. The importance of the type of oil, the type of emulsifier, the emulsion droplet size and the heating conditions are discussed.

OP-In24

Comparative GC-HRMS and LC-HRMS analysis of modern and ancient food-derived lipids to detect shifts in culinary patterns in Roman Britain

Anastasia Gabiger[1], Rachel Vykukal[1], Lucy Cramp[2], Martin Pitts[3], Helen Whelton[4], Simon Hammann[1,5]
[1]*Food Chemistry, Department of Chemistry and Pharmacy, Friedrich-Alexander-University Erlangen-Nuremberg, Erlangen, Germany;*
[2]*Department of Anthropology and Archaeology, University of Bristol, Bristol, UK;*
[3]*Department of Classics and Ancient History, University of Exeter, Exeter, UK;*
[4]*Organic Geochemistry Unit, School of Chemistry, University of Bristol, Bristol, UK;*
[5]*Institute of Food Chemistry, Department of Food Chemistry and Analytical Chemistry, University of Hohenheim, Hohenheim, Germany*

Lipid residues preserved in archaeological ceramics are an important source of information for insights into human diets of the past. Standard approaches rely on gas chromatography-low resolution mass spectrometry (GC-MS) to analyze fatty acid patterns and diagnostic compounds such as sterols, sometimes complemented by gas chromatography-combustion-isotope ratio mass spectrometry (GC-C-IRMS), which allows to distinguish between marine, terrestrial, plant, ruminant, non-ruminant, and dairy sources. The relatively low sensitivity and focus on GC-amenable compounds, however, puts limits on the lipid classes and species detectable in archaeological residues.
This study explores the potential of combining gas chromatography and liquid chromatography coupled with high-resolution mass spectrometry (GC-HRMS and LC-HRMS) in an untargeted approach to expand the range of lipid classes analyzed in archaeological residues. Roman Britain serves as an ideal case study due to extensive records on chronology, cuisine and food imports. Despite the attested importance, plant-based foods remain underrepresented in archaeological research, due to low lipid contents and lack of biomarkers. To address this, lipids from fourteen foods relevant to Roman occupation – including seven plant-based ones – were extracted and comprehensively analyzed as baseline data. Additionally, cooking experiments in replicated ceramic vessels investigated lipid release, absorption, and degradation to ultimately apply the findings to archaeological samples.
While GC-HRMS enabled detailed analysis of low-molecular-weight compounds such as fatty acids, sterols, and alkanes, LC-HRMS extended this spectrum by improved detection of high-molecular-weight lipids, including diacylglycerols and triacylglycerols. These compounds, although detectable in GC-based analyses, cannot be confidently identified this way due to strong fragmentation. Furthermore, LC-HRMS uniquely detected phospholipids, which are not accessible through GC-based methods.
By directly comparing these two approaches, this study evaluates their respective advantages and limitations for archaeological applications. The results highlight the complementary nature of GC-HRMS and LC-HRMS and contribute to the methodological advancement of archaeological and food research.

OP-In25

Neuroprotective effects of mushroom biomass: Impact of serum-available and gut microbiota metabolites in *Caenorhabditis elegans* models of Alzheimer's disease

Helena Araújo-Rodrigues[1,2,*], Lidia Garzón-García[3], João B. Relvas[2,4], Freni K. Tavaria[1], Celestino Santos-Buelga[3], Ana M. González-Paramás[3], and Manuela E. Pintado[1]

[1]*Centro de Biotecnologia e Química Fina– Laboratório Associado, Escola Superior de Biotecnologia, Universidade Católica Portuguesa, Porto, Portugal;*

[2]*Glial Cell Biology, i3S Instituto de Investigação e Inovação em Saúde, Universidade do Porto, Porto, Portugal;*

[3]*Grupo de Investigación en Polifenoles (GIP-USAL), Campus Miguel de Unamuno, Universidad de Salamanca, 37007 Salamanca, Spain;*

[4]*IBMC Instituto de Biologia Molecular e Celular, Universidade do Porto, Porto, Portugal*

Mushrooms are considered a next-generation food with numerous health-promoting properties, including prebiotic and neuroprotective effects. While most research studies focus on the polysaccharide fractions of mushroom-fruiting bodies[1,2], this study investigates the neuroprotective potential of mushroom biomass (MB) from *Trametes versicolor*, *Hericium erinaceus*, and *Pleurotus ostreatus* considering the possible synergistic effects of different macromolecules found both in the mycelium and fruiting bodies. Gastrointestinal digestion was simulated using the standardized INFOGEST protocol, and the passage throughout the duodenum and jejunum was simulated. Results revealed that glucans were the most abundant group in colon and serum-available fractions (26–44% dry weight-DW). The colon-available fraction also contained proteins and peptides (<75 kDa) as well as fatty acids (oleic and linoleic acids). I*n vitro* fecal fermentation assays confirmed the potential of MB to modulate gut microbiota, promoting short-chain fatty acids production and increasing the relative abundance of key bacteria genera (e.g., *Bifidobacterium* and *Faecalibacterium*). In contrast, the serum-available fraction was richer in low molecular weight peptides (<1.2 kDa), amino acids (Tyr, Val, Phe, and Leu), total phenolic compounds (730–863 mg GAE/ 100 g DW), and demonstrated significant antioxidant capacity by different assays (e.g., FRAP: 177–305 mg ISHE/ 100 g DW). The neuroprotective potential of serum-available fractions and key gut microbiota-derived metabolites were evaluated in transgenic *Caenorhabditis elegans* models of Alzheimer's disease by analyzing chemotactic behavior and paralysis onset. Chemosensory responses in strains exhibiting neuronal tau and amyloid toxicity (BR5270 and CL2355) were improved after treatment with serum-available fractions and gut microbiota metabolites, namely, gamma-aminobutyric acid and butyric acid. Additionally, paralysis onset was delayed in the CL4176 strain, exhibiting amyloid toxicity in muscles. These findings suggest that MB confers *in vivo* protective effects against Tau neurotoxicity and amyloid toxicity in neurons and muscles. Future work is required to elucidate the underlying molecular mechanisms.

OP-In26

The seafood process water biorefinery - from waste to new values

Ingrid Undeland[1], Bita Forghani[1], João Pedro Trigo[1], Kristoffer Stedt[2], Niklas Warwas[3], Ida Hedén[3], James Hinchcliffe[3], Jenny Vilg[4], Susanne Eriksson[5], Kristina Sundell[3], Sophie Steinhagen[2], Henrik Pavia[2]
[1]*Department of Life Sciences-Food and Nutrition Science, Chalmers University of Technology, Gothenburg, Sweden*
[2]*Department of Marine Sciences, Tjärnö Marine Laboratory, University of Gothenburg, Strömstad, Sweden;*
[3]*SWEMARC and Department of Biological and Environmental Sciences, University of Gothenburg, Gothenburg, Sweden;*
[4]*Chalmers Industriteknik/RISE Research Institute of Sweden, Gothenburg, Sweden*
[5]*Department of Biological and Environmental Sciences, Kristineberg Center, University of Gothenburg, Fiskebäckskil, Sweden*

The conversion of whole fish and shellfish into consumer-ready seafood products is in many cases a highly water-intense operation. For example, industrial steaming and peeling of shrimps requires up to 50 m3 of water per ton peeled end-product. Besides providing high freshwater footprint, valuable nutrients are lost into the used process waters which are then subject for costly, and non-food-grade, in-house pre-cleaning to release the waters into local sewage plants. In the past 10 years, the aim of several research projects, e.g., AquaStream, NoVAqua, WaSeaBi and CirkAlg, has been to develop alternative food-grade routes to recover nutrients which are currently lost into seafood process waters. Main water streams addressed have been from shrimp and herring processing. Beyond thorough characterizations, two approaches for their valorization have been applied, independently or in combination. The first one comprises food-grade flocculation followed by dissolved air flotation (DAF) or centrifugation to recover a protein-enriched biomass. The second strategy involves the use of process waters as feed stock for cultivation of other organisms, primarily algae, which provides new sources of protein.

Using polysaccharides and salts as food grade flocculants/coagulants has allowed up to >90% of proteins to be recovered from process waters with DAF or centrifugation. The protein-enriched biomass has been successfully utilized in e.g., feeds for lobster larvae and salmon. When cultivating marine yeast, microalgae, and green seaweed with DAF-outlets or crude process waters, protein levels have in several cases been many-fold increased compared to when using control media. For example, for sea lettuce (*U. fenestrata*); it was 71% higher when cultivated in herring process waters, compared to controls. Our results reveal completely new possibilities to create values from aqueous side streams which today imply a nutrient loss from the food chain, at the same time as they constitute costs for companies.

SESSION OP-S: SAFETY OF FOODS

KN-S

Formation of furans during breakfast cereal manufacturing

Benedikt Cramer

Institute of Food Chemistry at the University of Münster, Germany

Furan and its alkylated derivatives are possibly carcinogenic process contaminants formed during thermal food processing, such as roasting, baking, extrusion cooking, and toasting. They can be generated from a wide range of precursors and detected in various foods, including breakfast cereals. Raw materials, moisture content, and process conditions—such as temperature and mechanical energy—affect the formation of furans. Through laboratory experiments, commercial samples, and on-site sampling at manufacturers, critical processing steps were identified, and process conditions with a high impact on furan formation were identified. A parallel determination of acrylamide formation enabled correlation analyses with furan and alkylfurans.

OP-S01

Genetic and crop management strategies to reduce the risk of acrylamide formation in wheat products, and an introduction to the ACRYRED COST Action

Nigel G. Halford, Navneet Kaur, Natasha Brock
Rothamsted Research, Harpenden, the United Kingdom

Acrylamide is a carcinogenic processing contaminant that forms from free (non-protein) asparagine and reducing sugars during high-temperature cooking and processing of cereal grains and other plant products. Food businesses face the prospect of the European Union setting Maximum Levels for acrylamide in food this year. Compliance would be greatly facilitated by the development of crop varieties with reduced acrylamide-forming potential. We have used CRISPR/Cas9 to knock out the asparagine synthetase-1 and -2 (*TaASN1* and *TaASN2*) genes of bread wheat. Wheat lines with mutations in the A, B and D genome *TaASN2* genes have also been identified in a TILLING population produced by chemical mutagenesis, and the mutations have been stacked to produce a total *TaASN2* knockout. We have also assessed the effect of a natural deletion of B genome *TaASN2* in some varieties. Data from field trials show the CRISPR lines to have significant (up to >90%) reductions in free asparagine concentration and a concomitant decrease in acrylamide formation in heated flour, biscuits and bread, especially after toasting. These genetic approaches to reduce free asparagine accumulation are being undertaken alongside experiments on fertilisation rates, especially of sulphur, and disease control, with the signalling hub through which pathogen infection induces free asparagine accumulation being elucidated in detail. The work is being conducted during a period of rapid change in the regulations governing gene edited crops in the UK, culminating in the Genetic Technology (Precision Breeding) Act, which gained royal assent in March 2023. The acrylamide issue in cereal products is the subject of the ACRYRED COST Action (https://acryred.eu/) and the aims, objectives and activities of ACRYRED will be introduced.

OP-S02

Evaluating acrylamide formation in roasted cereals and pseudocereals: a food safety perspective

Marta Mesías[1]; Francesco Cicala[2]; Pablo Gómez[1]; Marco Arlorio[2]; Francisco J Morales[1]

[1]Institute of Food Science, Technology and Nutrition (ICTAN), Spanish National Research Council (CSIC), José Antonio Novais 6, Madrid, Spain;

[2]University of Piemonte Orientale "Amedeo Avogadro", Department of Pharmaceutical Sciences – Food Chemistry Unit, Largo Donegani 2, Novara, Italy

Over the past few years, incorporating alternative cereals and pseudocereals in cereal-based foods has gained traction as a response to consumer demand for more diverse, innovative products. Cereals such as rice and rye, along with pseudocereals like quinoa, amaranth, and buckwheat, are commonly included in food formulations due to their favorable nutritional composition, bioactive properties, and, except for rye, suitability for gluten-free diets. Despite their benefits, these ingredients can also increase exposure to heat-induced contaminants such as acrylamide, which forms during high-temperature processing. Given these concerns, this study investigated acrylamide formation in rice, rye, quinoa, amaranth, and buckwheat seeds subjected to roasting at different conditions (160–200°C for 10–30 minutes) in two forms (whole and ground seeds), using wheat seeds as a reference. Acrylamide levels in roasted samples were determined by LC-ESI-MS/MS. The results revealed that acrylamide formation was directly influenced by thermal intensity, with the highest levels detected in ground seeds roasted at 200°C for 20 minutes. Compared to wheat seeds (841 µg/kg), rice, quinoa, amaranth, and buckwheat presented lower acrylamide levels (729 µg/kg, 517 µg/kg, 236 µg/kg, and 566 µg/kg, respectively). In contrast, ground rye seeds exhibited significantly higher acrylamide concentrations, reaching 3718 µg/kg—4.4 times higher than wheat. The structural integrity of the seeds played a crucial role in acrylamide formation, with smaller particle sizes promoting its development. Except for amaranth, acrylamide levels in the tested seeds exceeded the European benchmark values (150–300 µg/kg) for conventional wheat- and rye-based products. However, it is important to recognize that real-world bakery formulations include additional ingredients that help reduce acrylamide levels in the final product. These findings emphasize the importance of considering both nutritional benefits and food safety when developing novel cereal-based products.

Acknowledgements: *Project PID2022-137697NB-I00 funded by MCIN/AEI/ 10.13039/501100011033 and by "ERDF A way of making Europe".*

OP-S03

Simultaneous reduction of acrylamide and 5-hydroxymethylfurfural in crackers using a sustainable extract from purple corn (*Zea mays* L.) cob via hot pressurized liquid extraction

Franco Pedreschi[1], Maykabeth García-Siu[1], José Ricardo Pérez-Correa[1], María Salomé Mariotti-Celis[2]
[1]*Faculty of Engineering, Pontificia Universidad Católica de Chile, Chile;*
[2]*Faculty of Medicine, Universidad de Finis Terrae, Chile*

Crackers are widely consumed bakery products that undergo high-temperature processing, which promotes the formation of neo-contaminants such as acrylamide (AA) and 5-Hydroxymethylfurfural (5-HMF) through non-enzymatic browning reactions. While these thermal processes enhance desirable attributes like flavor, aroma, and texture, they also pose health concerns due to the presence of these harmful compounds. Purple corn, a native Peruvian maize, is an abundant source of antioxidants, particularly in its cob—a byproduct often discarded during industrial processing.

This study aimed to develop a sustainable approach to simultaneously mitigate AA and 5-HMF formation in crackers by incorporating an antioxidant-rich extract from purple corn cob (PCC).

The PCC extract was obtained using hot pressurized liquid extraction (HPLE) with hydroalcoholic mixtures under varying ethanol concentrations and temperatures: (i) T1: 90 °C, 0% ethanol; (ii) T2: 90 °C, 32.5% ethanol; and (iii) T3: 150°C, 50% ethanol. The most effective PCC extract—defined by its highest antioxidant properties—contained 55.43 mg GAE/g of polyphenols, 13.42 mg/g of anthocyanins, and an antioxidant capacity of 1120.18 μM Trolox Eq/g. This extract was incorporated into cracker dough at concentrations of 1000, 2000, and 3000 mg extract/kg flour.

Results demonstrated that adding 1000 mg extract/kg flour significantly reduced AA levels by 68% and 5-HMF levels by 92% in crackers baked at 180 °C for 13 minutes. At this concentration, AA levels in the crackers were reduced to approximately 14% of the European Union's benchmark value.

These findings underscore the potential of PCC extract as an innovative and sustainable solution for mitigating harmful compounds in baked goods.

Acknowledgements: *This research was funded by Fondecyt Projects 1190080 and 1240031.*

OP-S04

Reducing the potential for acrylamide formation in legume-based foods by solid-state fermentation with filamentous fungi

Kristína Kukurová[1], Jana Horváthová[1], Tatiana Klempová[2], Dávid Lörinc[2], Jozef Murín[3], Milan Čertík[2], Zuzana Ciesarová[1]

[1]*Food Research Institute, National Agricultural and Food Centre, Bratislava, Slovakia;*

[2]*Institute of Biotechnology, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia;*

[3]*Celpo, a.s., Očová, Slovakia*

Legumes are known for their nutritional value and high-protein content, making them an attractive ingredient in ready-to-eat snacks and biscuits. In addition, for improving their antioxidative properties and digestibility and for enriching these plant matrices with bioactive compounds such as essential fatty acids, phenolics, and flavonoids, solid-state fermentation with filamentous fungi has been applied. However, legumes are characterized by a high concentration of free amino acids, especially asparagine, which readily forms acrylamide during heat treatment. Acrylamide, a probable human carcinogen, is a subject of current and pending stricter legislative regulation. In heat-processed products containing peas and lentil, the acrylamide content often exceeds the benchmark level set by Commission Regulation No 2017/2158 (300 µg/kg), raising concerns about food safety. This study focused on the selection of suitable strains of filamentous fungi to reduce the free asparagine content. A significant decrease was observed using *Mortierella alpina*, which holds promise as a method to valorise legumes while minimizing the formation of undesirable acrylamide in heat-processed legume-based food products.

Acknowledgements. *This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-23-0169. The tested legume samples were complimentary provided by Celpo, a.s., Slovakia, for the purpose of cooperation in the field of research and development.*

OP-S05

Acrylamide reduction in breakfast cereals by industrial process parameters adjustment

Joana F. da C.M.S. Martins[1], Manuel A. Coimbra[1], Diana Moreira[2], Isabel Franco[2], Cláudia P. Passos[1]
[1]*LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal;*
[2]*Cerealis Produtos Alimentares, Rua Manuel Gonçalves Lage 988 Águas Santas, 4425-122 Maia, Portugal*

The Maillard reaction contributes to the sensory appeal of the final product with important molecules that originate flavour and colour. However, this reaction can also originate unwanted compounds, such as acrylamide. Acrylamide is a toxic compound that has been associated with genotoxic and neurotoxic effects and therefore poses a concern for human health.
In this study, multiple acrylamide mitigation strategies in breakfast cereals were explored at the industrial scale, highlighting the importance of enzymes like asparaginase and possible modifications in the industrial processing of the food product.
The production processes for MULTIGRAIN and EXTRUSION products can differ in their inherent characteristics as well as their impact in the acrylamide formation. The phase that contributes the most to the formation of acrylamide in MULTIGRAIN product production is the roaster phase. The acrylamide levels found in this project for this product generally average approximately around 300 µg/kg. On the other hand, the EXTRUSION product is exposed to high temperatures for a short period leading to average levels of acrylamide that in the present study are around 370 µg/kg.
The MULTIGRAIN process allowed for efficient acrylamide reduction using the enzymatic approach in a cost- and time-effective manner, with asparaginase resulted in a 35% reduction in acrylamide levels in the MULTIGRAIN product when comparing the control values with those of the tested samples. The EXTRUSION process allowed for the sustainable reduction of acrylamide by controlling extrusion parameters, especially moisture levels, as acrylamide levels can be correlated with moisture. In EXTRUSION products, increasing the moisture content led to a reduction of 60 to 75%. Both approaches achieved acrylamide levels below the regulatory limit of 300 µg/kg, which must be maintained. The present study highlights ways that can be used at the industrial scale to analysed, reduced, and explored acrylamide in a cost-efficient way.
Acknowledgements: *Thanks are due to University of Aveiro and to the projects of LAQV/REQUIMTE (LA/P/0008/2020 DOI 10.54499/LA/P/0008/2020, UIDB/50006/2020 DOI 10.54499/UIDB/50006/2020, UIDP/50006/2020 DOI 10.54499/UIDP/50006/2020) funded by FCT/MCTES through national funds. FCT is also thanked for the individual Call to Scientific Employment Stimulus (CPP, https://doi.org/10.54499/CEECIND/00813/2017/CP1459/CT0053). The authors would also like to express their gratitude to Cerealis Produtos Alimentares,S.A for their collaboration in data collection and the technical knowledge shared throughout this research. We also thank for the financial support provided.*
Funding: *Cláudia Passos received a dissemination conference grant supported by the COST Action CA21149 "Reducing acrylamide exposure of consumers by a cereals supply-chain approach targeting asparagine (ACRYRED)".*

OP-S06

Acrylamide reduction in potato snacks: Impact of glutathione and cysteine during digestion

Burçe Ataç Mogol, Aytül Hamzalıoğlu, Vural Gökmen

Hacettepe University, Food Quality and Safety Group (FoQuS), Department of Food Engineering, Ankara, Turkey

Thermal processing of certain foods produces acrylamide via the Maillard reaction, a probable human carcinogen. Understanding its fate is crucial for reducing toxicity. Natural compounds like glutathione (GSH) and cysteine can inhibit acrylamide formation and offer potential chemoprotective effects. Exposure to acrylamide can be reduced by reformulating thermally processed foods with GSH or cysteine or by consuming these compounds together with processed foods. Therefore, project aims to understand the fate of acrylamide during digestion of potato snacks.

The potato snacks including GSH (1.0%) or cysteine (0.5%) were baked, and the samples were subjected to in vitro digestion. Control potato snacks were also subjected to in vitro digestion together with free GSH or Cysteine to simulate co-consumption.

The initial acrylamide concentration of control snacks was 1749.6±0.1 µg/kg. Incorporation of 1.0% GSH or 0.5% cysteine into the recipe decreased acrylamide by 84.7% and 87.0%, respectively. The in vitro digestion of control potato snacks showed a 34.6% decrease in acrylamide during the gastric phase and 56.5% after digestion. However, the addition of GSH or cysteine to the formulation did not result in further elimination of acrylamide during digestion. GSH and cysteine can reduce acrylamide during baking but oxidize to GSSG and cystine, respectively, preventing them from forming adducts with acrylamide for its elimination. Acrylamide levels decreased by 66.8% when control snacks were co-digested with 0.5% cysteine and remained the same after. In control snacks co-digested with 1.0% GSH, acrylamide elimination was 48.7% during digestion and increased to 70% after co-digestion, indicating acrylamide released from the potato matrix shortly during the digestion and readily reacted with free thiol compounds. This study showed that GSH and cysteine could be effective to decrease acrylamide both in potato snacks and during digestion.

OP-S07

Effect of crop management factors on the accumulation of free asparagine in wheat and spelt grains and acrylamide formation in the cookies

Beka Sarić[1], Marijana Simić[1], Kristína Kukurová[2], Danka Milovanović[1], Valentina Nikolić[1], Dušanka Milojković-Opsenica[3], Zuzana Ciesarová[2], Slađana Žilić[1]

[1]*Maize Research Institute, Department of Research, Belgrade, Serbia;*

[2]*National Agricultural and Food Centre, Food Research Institute, Bratislava, Slovakia;*

[3]*Faculty of Chemistry, University of Belgrade, Belgrade, Serbia*

The nutritional safety of wheat and spelt-based food products is at risk due to the presence of acrylamide. The reduction of free asparagine, a crucial precursor in acrylamide formation, can potentially be achieved in wheat and spelt grains through specific crop management practices. However, these strategies have not yet been fully optimized. To determine the effect of sulfur fertilizer on the content of free asparagine in grains, two genotypes of wheat and two of spelt were grown in 2024 under three conditions: no fertilization, the addition of 100kgN/ha (positive control), and N:S=100:10kg/ha. Whole-grain flours of these genotypes, with a defined chemical composition, were used to prepare cookies baked at 180°C for 10 minutes. Acrylamide was analyzed in them, as well as their textural and sensory properties.

Our study found that sulfur fertilizer did not have a significant effect on the reduction of free asparagine content in the grains. Sulfur reduced the content by 4 and 6% in spelt grains but increased it by 10% in wheat grains compared to the positive control. Although a strong positive correlation was observed between free asparagine content in the grains and acrylamide levels in the cookies, the results indicate that the chemical composition of the flour and its ability to bind water during the dough kneading process played a significant role in acrylamide formation. This was also reflected on the textural characteristics of the cookies.

Acknowledgement: *This work was supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia and the Slovak Research and Development Agency under project of bilateral cooperation SK-SRB-23-0059. The presentation is funded by CA 21149 ACRYRED supported by COST (European Cooperation in Science and Technology; www.cost.eu).*

OP-S08

Formation of chlorinated sugar degradation products during baking with sucralose

Michael Hellwig

Technische Universität Dresden, Dresden, Germany

Sucralose, a chlorinated derivative of sucrose with 500 to 750 times the sweetness of sucrose, is widely used in various food products. Previous research has suggested that thermal degradation of sucralose may lead to the release of chlorinated compounds, raising questions about its safety in baking and cooking applications.

The study aimed to investigate the thermal stability of sucralose compared to sucrose, focusing on its degradation products and their potential interactions with other biomolecules. Specifically, the research sought to analyze the formation of chlorinated compounds during heating and assess their presence in baked goods.

Sucralose and sucrose samples were subjected to dry heating at temperatures ranging from 80 to 120 °C. Aqueous extracts of these samples were analyzed for the concentration of hydroxymethylfurfural (HMF), pH value, and UV absorption changes (280 nm and 420 nm). Mixtures of casein with sucralose or sucrose were prepared, freeze-dried, and heated under baking conditions (up to 160 °C for 1 hour) to evaluate the interaction of sucralose with proteins. Baked goods, including cookies and muffins, were prepared with and without sucralose and analyzed for chlorinated dicarbonyl compounds using HPLC-MS/MS.

Isolated sucralose began to degrade at 100 °C, displaying discoloration, pH reduction, and the formation of HMF and chlorinated dicarbonyl compounds. In comparison, sucrose remained stable up to 120 °C. Casein/sucralose mixtures showed significant degradation of lysine and tryptophan, with the formation of 3-chlorotyrosine. Cookies baked with sucralose showed increased HMF concentrations and the presence of chlorinated dicarbonyl compounds not found in sucrose-based cookies.

The study demonstrated that sucralose undergoes significant thermal degradation, for the first time showing the formation of chlorinated dicarbonyl compounds and other chlorinated sugar degradation products as previously unknown contaminants. Therefore, the use of sucralose in baking cannot be recommended.

OP-S09

Saliva biomonitoring as a tool for tracking food safety and contaminant exposure

A. Reis-Mendes[1], Z. Martins[1], A. Araújo[1], H. Ramos[1], C.B. Borges[1], A. Melo[2,3], M.A. Faria[1], I.M.P.L.V.O. Ferreira[1]

[1]*LAQV/REQUIMTE, Departamento de Ciências Químicas, Laboratório de Bromatologia e Hidrologia, Faculdade de Farmácia, Universidade do Porto, 4050-313 Porto, Portugal;*

[2]*National Institute of Health Doutor Ricardo Jorge, Department of Environmental Health, 4000-055 Porto, Portugal;*

[3]*LAQV/REQUIMTE, Universidade do Porto, Portugal*

Saliva biomonitoring, when linked to food science offers a non-invasive and innovative approach for assessing food safety and dietary exposure. This connection can improve public health policies and consumer awareness about contaminants exposure through diet.

The goal was to implement a systematic framework for organizing and synthesizing existing knowledge on saliva analysis, its potential applications in biomonitoring a wide variety of hazardous compounds that humans are daily exposed, which include pollutants, toxins, food processing contaminants, among others and identify key gaps in the research concerning the use of saliva as a reliable biospecimen for advancing food safety.

Advanced tools for literature mining were used to systematically extract and organize data. The search was performed in two databases (PubMed/Scopus) between 2000 and 2024 and involved 700 contaminants, including heavy metals, polycyclic aromatic hydrocarbons (PAHs), bisphenols, phthalates, dioxins and dioxin-like PCBs, pesticide residues, disinfection by-products, heterocyclic aromatic amines, mycotoxins, microplastics, perfluoroalkyl and polyfluoroalkyl substances (PFAS and PFOS), nitrites/nitrates and advanced glycation end products (AGEs). Inclusion criteria: biomonitoring of these compounds in saliva of healthy individuals.

A total of 113 articles described the biomonitoring of compounds with different polarities, including nitrites/nitrates (37.2%), polyamines (4.4%), AGEs (2.7%), pesticide residues (6.2%), heavy metals (36.3%), parabens/phthalates (0.9%), bisphenols (7.1%), PCBs (2.7%), microplastics (1.8%), and PAHs (0.9%). Saliva biomonitoring increased in recent years, due to advanced sample pre-treatment/extraction methodologies. However, there are no reports of mycotoxins, heterocyclic aromatic amines, PFAS, or PFOS being biomonitored in saliva. The lack of standardized saliva collection procedures poses challenges in comparing results and assessing exposure levels. While saliva shows promise for monitoring dietary intake, such as biomarkers for heated food consumption, research is limited and these studies involved small numbers of saliva samples.

Acknowledgements: *Project SALIVA+ (DOI 10.54499/2022.08978.PTDC), funded by FCT/MCTES through national funds.*

OP-S10

Rapid detection of *Escherichia coli* using an electronic nose: a fast and reliable MVOC-based approach

Dalma Radványi
Department of Hospitality, Budapest University of Economics and Business, Budapest, Hungary

Microbial volatile organic compounds (MVOCs) could be used as biomarkers to find bacteria and molds in the food industry, agriculture, hospitality, and other industrial systems. In this study, we investigated the volatile emissions of *Escherichia coli* (*E. coli*). The bacteria were cultured on a modified meat peptone agar with varying amounts of microbial suspension (100 μL, 250 μL, and 500 μL). The effect of the amount of microorganisms on the volatile compound production was analyzed. The concentration of the microbial suspension was 10^6 measured by an automatic coliform detector.

The emitted volatiles were analyzed using a Heracles electronic nose (e-nose) device. The e-nose device can execute rapid and accurate analytical measurements because it is designed for real-time detection of complex gas mixtures within a very short time. We built a new, rapid method for determining MVOCs.

As a result of the study, we characterized the aroma profile of *E. coli* on modified meat peptone agar. According to our findings, the amount of emitted compounds and the amount of *E. coli* on the medium are associated. We also determined some compounds as biomarkers, which may be specific compounds and potential indicators of *E. coli* presence.

The results show that the e-nose is an excellent device for detecting coliform bacteria.

The method can be further developed to detect other bacteria and molds. This could be a useful method not only in food safety but also in medical diagnostics and environmental monitoring, including indoor air analysis in hospitality and tourism. By analytical monitoring of the indoor air in guest accommodation units and restaurants, harmful microorganisms would be detected in a short time so that the microbiological risks could be properly handled. This rapid analytical solution could ensure the health and safety of visitors in the not too distant future.

OP-S11

Formation of cytotoxic gamma-tocopheryl quinone during frying of French fries in rapeseed oil

František Kreps, Ondrej Hruška, Kristína Masnicová, Zuzana Krepsová

Department of Food Technology, Faculty of Chemical and Food Technology, Slovak University of Technology in Bratislava, Radlinského 9, Bratislava SK-812 37, Slovakia

Rapeseed oil is a rich source of gamma-tocopherol (240–420 mg/kg), which oxidizes during frying into cytotoxic gamma-tocopheryl quinone. It can adsorb onto the surface of French fries, posing a health risk to consumers. Studies have shown its cytotoxicity and ability to induce apoptosis in both healthy and cancer cells. Prolonged exposure may cause DNA damage, leading to mutations and carcinogenesis.
The study focuses on the impact of gamma-tocopherol oxidation in rapeseed oil during frying and the adsorption of cytotoxic gamma-tocopheryl quinones onto the surface of French fries.
An ETA 2109 induction cooker (1000 W, CZ) was used to heat rapeseed oil (Vénusz, Hungary) at 180 ± 2 °C, monitored with thermometer. The experiment lasted 2 hours, replacing 100 g of French fries (table potatoes, SK) every 10 minutes. The analysis of tocopherols and tocopheryl quinone was performed under normal-phase conditions (hexane:isopropanol; 98.2:0.8) at different wavelengths and a flow rate of 1 mL/min using HPLC-DAD (1260 Infinity II, Agilent, SK).
Pan frying with French fries caused a 70% decrease in alpha-tocopherol and a 45% decrease in gamma-tocopherol after 2 hours of heating compared to fresh oil. Following the frying process, 55 mg/kg of gamma-tocopheryl quinone was detected in the oil. It formed 1.2 times faster than alpha-tocopheryl quinone. During pan frying, 18 mg/kg of alpha-tocopheryl quinone and 27 mg/kg of gamma-tocopheryl quinone were adsorbed onto the surface of French fries. The surface of French fries adsorbed 1.5 times more gamma-tocopheryl quinones than alpha-tocopheryl quinones.
The increase in the content of alpha-tocopheryl quinone and cytotoxic gamma-tocopheryl quinone on the surface of fried chips is a signal for re-evaluating the suitability of using oils rich in gamma tocopherol for frying.

Acknowledgements*: Research was supported by the Slovak Scientific Grant Agency VEGA based on contracts no. 1/0141/23*

OP-S12

Quinolizidine alkaloids in lupine-based products: occurrence in food and feed and risks to human consumers

Bram Miserez[1], Sofie Schrijvers[2] Jet Van de Steene[3], Mia Eeckhou[2], Liesbeth Jacxsens[2]
[1]*Ciboris npo, Zwijnaarde, Belgium;*
[2]*Department of Food Technology, Saftey and Health, Ghent University, Ghent, Belgium;*
[3]*Primoris Belgium, Zwijnaarde, Belgium*

Lupins, a protein-rich legume, are becoming more popular in food and in animal feed. They contain quinolizidine alkaloids (QAs), a toxic, nitrogen-rich class of secondary metabolites.
The aim of our study is to assess the occurrence of QAs in food and assess risks for human consumption, the influence of processing on the QA level and the possibility of QAs entering food products through animal products of animals fed with lupins.
A method for the analysis of seven QAs was developed, validated and applied to over 300 food samples. Unit processes, including toasting, dehulling, sterilization, baking, frying and boiling in water, were simulated on lab-scale and differences in QA content were evaluated. 104 feed samples were analyzed and to assess carry over, 10 muscle samples and 10 liver samples from calves fed with lupin containing feed (40 samples) were analyzed.
Highest levels of QAs were found in 'Lupins (dry) and similar', 'Lupin-based protein powder', 'Lupin-based egg alternatives' and 'Lupin-based coffee surrogates'. MOE values of 0.02 and 0.83 were obtained for the P95 of consumers of 'Lupins (dry) and similar' and 'Canned or jarred legumes' categories, respectively, indicating a potential health risk following acute exposure.
Production steps leaching out QAs, from the food products (i.e. sterilization in jars, cooking of pasta) and not by heating steps, as they are stable even when baking or frying. Content in muscle and liver from calves fed lupin containing feed (average total QA content 42 mg/kg) was low, with average total QA content after enzymatic hydrolysis of 73 and 106 µg/kg, respectively.
Regular consumers of dry lupins and canned or jarred lupins are the only consumers with a risk of adverse health effects by the consumption of QAs. QAs can be eliminated by leaching in water. Transfer to animal products is low.

OP-S13

Gastric and gastrointestinal digestion of Infant Formula in the presence of polypropylene nanoplastics

Tafadzwa Kaseke[1], Mariachiara Paonessa[2], Vesna Jovanovic[1], Dragana Mitic[3], Tanja Cirkovic Velickovic[1,4]
[1]*University of Belgrade- Faculty of Chemistry, Center of Excellence for Molecular Food Sciences and Department of Biochemistry, Studentski trg 16,11000 Belgrade, Serbia;*
[2]*University "Magna Graecia" of Catanzaro, Department of Health Science, Viale Europa, 88100 Catanzaro, Italy;*
[3]*Innovation Center of the Faculty of Chemistry, Studentski trg 16,11000 Belgrade, Serbia;*
[4]*Serbian Academy of Sciences and Arts, Knez Mihajlova 35, Belgrade, Serbia*

Polypropylene nanoplastics (nPP) have been identified as potential contaminants in infant formula, primarily due to their presence in polypropylene feeding bottles, which expose infants to nPP. Health impacts of nanoplastics exposure are not well understood. Furthermore, the effect of nPP on the digestion of proteins, which are crucial for the growth and development of infants remain unknown. Therefore, the current study investigated the *in vitro* digestion of infant formula proteins (1 mg/mL) with or without agglomerated nPP (10, 50 and 100 μg/mL) in simulated gastric and intestinal fluids using the infant model of digestion. Firstly, the particle size distribution of nPP and their mixture with infant formula in the simulated digestive fluids was determined. Then, the simulated *in vitro* gastric and intestinal digestion of the infant formula proteins was done at 37 °C and monitored during physiologically relevant period. The profiles of the digested proteins were analyzed using the sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). Our results suggest agglomeration on nPPs and infant formula proteins. Furthermore, caseins were digested more rapidly than whey proteins in all samples, regardless of the presence of agglomerated nPP. Meanwhile, in the presence of agglomerated nPP, the rate of digestion of allergic proteins such as β-lactoglobulin could be decreased during gastric digestion of the infant formula. During intestinal digestion of the infant formula, nearly all types of proteins were digested for all the investigated times of digestion and no differences were observed with varying concentrations of nPP. Our results suggest that nPP interacts with infant formula proteins and formed large size aggregates. Gastric and intestinal digestion of proteins is not affected significantly by the presence of nPP.

Acknowledgments: *This study was supported by the European Union's Horizon Europe program, Microprot project, Grant Agreement number 101090313.*

OP-S14

Safety features and cell envelope proteinase presence inferred from the whole genome sequences of lactobacilli associated with Slovakian Bryndza cheese

Barbara Brežná[1], Janka Koreňová[1], Zuzana Rešková[1], Zuzana Čaplová[1], Alexandra Burdová[2], Ema Holbíková[2], Hana Drahovská[2], Tomáš Kuchta[1]

[1]*Department of Microbiology, Molecular Biology and Biotechnology, Food Research Institute, National Agricultural and Food Centre, Priemyselná 4, 82475 Bratislava, Slovakia;*

[2]*Department of Molecular Biology, Faculty of Natural Sciences, Comenius University in Bratislava, Ilkovičova 6, 84215 Bratislava, Slovakia*

Lactobacillaceae are candidates for starter or adjunct cultures for the production of bryndza cheese with traditional organoleptic properties. In particular, well adapted strains isolated from bryndza cheese or from ewes' whey are considered. Whole genome sequencing of 34 such strains was carried out, their taxonomic classification was done and the genomes were analysed. None of the strains was found to harbour in the genome any acquired antimicrobial resistance genes to clinically relevant antimicrobials. None of the strains contained genes conferring production of the two most hazardous biogenic amines, histamine and tyramine. All the strains were predicted to be nonpathogenic for humans based on the specialised software analysis. Qualified presumption of safety (QPS) status as defined by European Food Safety Authority could be assigned to 25 of the strains, based on their species identification as *Lacticaseibacillus paracasei/casei, Limosilactobacillus fermentum, Lactobacillus helveticus, Lactiplantibacillus plantarum* and *Leuconostoc lactis*, respectively.

Cell envelope proteinases are enzymes advantageous for the adaptation of lactobacilli to the milk environment, since they initiate the utilisation of milk proteins. Searching for homologs of the well known cell envelope proteinase PrtP, numbers from 0 to 3 were found in the genomes depending on the strain and species. In our *L. helveticus* isolates, proteinase genes atypical for Europe were found.

Acknowledgment: *This research was supported by the Ministry of Agriculture and Rural Development of the Slovak Republic, contract No. 1131/2024/MPRVSR-930, within the project PVV11 "Transfer of knowledge and innovations in support of Slovak production of food and food products with higher added value" and by the Slovak Research and Development Agency under the Contract No. APVV-20-0001.*

OP-S15

Efficacy of fining agents in the removal of ochratoxin A (OTA) and aflatoxins (AFB1 and AFB2) and their impact on the wine quality

Fernanda Cosme[1,2], António Inês[1,2], Davide Silva[1], Luís Filipe-Ribeiro[1], Luís Abrunhosa[3], Fernando M. Nunes[1,4]

[1]*Food and Wine Chemistry Lab, Chemistry Research Centre – Vila Real (CQ-VR), Portugal;*

[2]*Department of Biology and Environment, School of Life Sciences and Environment, University of Trás-os-Montes and Alto Douro, 5000-801, Vila Real, Portugal;*

[3]*CEB-Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710-057, Braga, Portugal;*

[4]*Chemistry Department, School of Life Sciences and Environment, University of Trás-os-Montes and Alto Douro, 5000-801, Vila Real, Portugal*

Mycotoxins are toxic secondary metabolites produced by filamentous fungi, of which OTA and AFB1and AFB2 are of particular concern in wines. OTA is commonly detected, with a maximum allowable limit of 2.0 µg/L, while AFB1and AFB2, are less common, but highly toxic. To optimize OTA removal, several commercially available deodorizing activated carbons were tested at high OTA levels (10.0 µg/L) in white and red wines. OTA removal from white wines was highly effective with all activated carbons tested, except one with the lowest total pore volume. In red wines, only activated carbons with a higher abundance of mesopores achieved complete OTA removal, as anthocyanins competed for adsorption sites. Activated carbon treatment improved the color characteristics of white wine by reducing yellowness and brownish hues, while its effect on red wine color was limited to a 24% reduction. Currently, there is no established solution for the removal of aflatoxins from wines. To address this issue, the efficiency of approved fining agents—activated carbon, potassium caseinate, chitosan, and bentonite—was evaluated. Their performance depended on the wine matrix, with higher efficiencies in white wine. Bentonite was the most effective, completely removing both aflatoxins (10 µg/L total) from white wine and achieving 100% reduction of AFB1 and 82% reduction of AFB2 in red wine. It had a minimal effect on the color of white wine (ΔE^*=1.35), but caused a more significant change in red wine (ΔE= 4.80) due to anthocyanin reduction, although the color intensity decreased by 1.5 only points. Overall, these results demonstrate that activated carbon with an appropriate pore size distribution can effectively remove OTA from both white and red wines. Moreover, bentonite proves to be a highly efficient solution for aflatoxin removal, particularly in white wines, while remaining a viable option for red wines despite its moderate impact on color.

Funding: *We would like to thank the financial support from the Portuguese Foundation for Science and Technology (FCT) to CQ-VR (https://doi.org/10.54499/UIDB/00616/2020 and https://doi.org/10.54499/UIDP/00616/2020).*

OP-S16

Mechanistical insights into browning reactions of hydroxycinnamic acids in the Maillard reaction

Leon Valentin Bork, Sascha Rohn, Clemens Kanzler
Department of Food Chemistry and Analysis, Technische Universität Berlin, Berlin, Germany

Food browning occurs throughout every step of food production, including harvesting, fermentation, thermal processing, and storage. Important contributors are the oxidative conversion of phenolic compounds to colored melanins and the heat-induced conversion of sugars and amino acids to brown melanoidins. Melanin formation can be induced enzymatically, e.g., in freshly cut or damaged fruits, and chemically. The latter is associated with an undesired discoloration during the storage of beverages. However, the incorporation of phenolic compounds into melanoidins, which occurs during roasting of cocoa or coffee, is poorly understood. This might be owed to the fact that heat-induced browning reactions are primarily associated with the Maillard reaction despite the evidence that phenolic compounds are vital constituents of coffee melanoidins.
To investigate this, hydroxycinnamic acids – a ubiquitous group of phenolic compounds – were heated in binary and ternary reaction systems. Caffeic acid and ferulic acid were heated in equimolar reaction mixtures with key reactants of the Maillard reaction, including α-dicarbonyl compounds (glyoxal, methylglyoxal, diacetyl), heterocyclic carbonyl compounds (furfural, 5-hydroxymethylfurfural, pyrrole-2-carbaldehyde), sugars (galactose, arabinose), and alanine. The reactivity was characterized by analysis of the browning (420 nm) and the conversion of the reactants (HPLC-DAD, GC-MS). Changes in the antioxidant properties were monitored using a TEAC assay. Browning intermediates were isolated (preparative HPLC) and structurally elucidated (NMR). Furthermore, the composition of oligomer colorants was elucidated using HRMS.
The findings revealed that hydroxycinnamic acids form characteristic colorants, individually and in combination with the aforementioned melanoidin precursors. In this regard, decarboxylation reactions were identified as the driving force of this novel type of color formation. These reactions are catalyzed in the presence of amines, which subsequently partook in color formation. Furthermore, hydroxycinnamic acid-derived vinylphenols were found to react as donors and acceptors in nucleophilic reactions, enabling crosslinking and thus the formation of heterogenous and conjugated chromophores.

OP-S17

The fate of apple pulp phenolic compounds during in vitro gastrointestinal digestion: from oral ingestion into intestinal absorption

Ana Fernandes[1], Iva Fernandes[1], Ana Rita Monteiro[1], Clarisse Nobre[2, 3], Ana Cristina Pinheiro[2, 3], Nuno Mateus[1], Victor de Freitas[1]

[1]*LAQV-REQUIMTE, Chemistry and Biochemistry Department, Science Faculty, Porto University, Rua do Campo Alegre, s/n, 4169-007 Porto, Portugal;*

[2]*CEB – Centre of Biological Engineering, University of Minho, Campus de Gualtar, 4710–057, Braga, Portugal;*

[3]*LABBELS – Associate Laboratory, Braga, Guimarães, Portugal*

Fruits and vegetables account for approximately 22% of food losses and waste along the supply chain. However, these by-products remain rich in valuable compounds, such as phenolic compounds, which offer nutritional, health, and technological benefits. In recent years, there has been growing interest in valorizing these co-products, as they release bioavailable metabolites during digestion, exerting local and systemic health effects after absorption. This has reinforced their potential as functional food ingredients.

This work aims to study the fate of phenolic compounds present in a fruit-processing by-product, during gastrointestinal digestion. By understanding phenolic compounds' release and in vitro transformation, we aim to boost the development of highly innovative functional ingredients.

Methods: Apple pulp was processed into fiber- and polyphenol-rich flour. This matrix was subjected to in vitro simulated gastrointestinal digestion following the INFOGEST protocol, and the release of simple sugars and phenolic compounds were assessed.

The most abundant phenolic compounds identified in apple pulp flours were chlorogenic acid, (-)-epicatechin, and phloretin derivatives. Their bioaccessibility increased from the gastric to the intestinal phase, with the antioxidant activity of the bioaccessible fraction also increasing. To assess absorption, intestinal digests were subjected to purification steps (enzymatic inactivation, conductivity adjustments, dilution optimization) to minimize cytotoxicity before being tested using a Caco-2 cell barrier model over 2 hours. A dilution of 1:10 was established as the non-toxic condition to perform the intestinal absorption of the intestinal digesta.

The findings highlight the health potential of apple pulp flours, presenting new opportunities to valorize agri-food waste as a functional ingredient rich in phenolic compounds and dietary fibers.

Funding: *This work received financial support from PT national funds (FCT/MCTES, Fundação para a Ciência e Tecnologia and Ministério da Educação, Ciência e Inovação) through the project UIDP/50006 – Laboratório Associado para a Química Verde – Tecnologias e Processos Limpos.*

OP-S18

Reaction of glycoalkaloids during potato processing – Formation of fatty acid esters and oxidation products

Keven Mittau[1], Christina Meyers[1,2], Inga Smit[2], Marcus Schmidt[3], Sascha Rohn[1]
[1]Department of Food Chemistry and Analysis, Institute of Food Technology and Food Chemistry, Technische Universität Berlin, Berlin, Germany;
[2]Department of Safety and Quality of Cereals, Max Rubner-Institut, German Federal Research Institute of Nutrition and Food, Detmold, Germany;
[3]Eberswalde University for Sustainable Development, Eberswalde, Germany

Glycoalkaloids (GA) are endogenous contaminants in nightshades, such as potatoes. An excessive intake can lead to heavy gastrointestinal symptoms. [1, 2] Currently, the EFSA pursues a strategy to reduce the content of GA in potatoes and potato products. [2] On one hand, a reduction can be achieved by peeling the tubers. Also, boiling can lead to a diffusion to the boiling water. [3] On the other hand, a decrease can be seen in the deep-frying process. Reports are ranging from less than 10 % to almost 90 % decrease of the initial GA during frying, depending on the procedure. [2] This decline is thought to be based on chemical reactions. While a few authors reported a hydrolysis of the glycosides in model experiments, [1] only very few is known about the transformation during the high temperature processing of potatoes. The project "MinGlyKa" of the German Industrial Collective Research aims at characterizing the stability of the GA during processing of potato crisps and French fries, especially during deep frying. Therefore, reaction models were established and degradation products were investigated by LC-MS/MS and high resolution MS. Consequently, two reaction pathways are proven for the first time to occur in real products. Firstly, multiple esters of GA with potato-endogenous fatty acids and acetic acid have been found. Secondly, oxidation taking place at the sterol alkaloid backbone were observed. Furthermore, hydrolysis products could be confirmed and products that have been formed from multiple pathways have been detected. In conclusion, a high number of compounds and isomers could be described only from reactions with fatty acids, whose relevance is not yet fully evaluated.

***References*:**

[1] Friedman et al., J. Agric. Food Chem, 2006, 54, 8655-8681.
[2] EFSA, EFSA Journal, 2020, 18, e06222.
[3] Mäder et al., J. Agric. Food Chem. 2009, 57, 6292–6297.

SESSION OP-A: ATTRACTIVENESS OF FOODS

KN-A

Flavour development in alternative proteins

Jane K Parker
Department of Food and Nutritional Sciences, University of Reading, Reading, UK

The limited consumer acceptance of alternative proteins is often rooted in their flavour profile—characterised by unpleasant off-notes, a lack of savoury depth, and the absence or distortion of familiar meat-like flavours. This talk will present an overview of flavour formation in plant-based and mycelial-based protein systems, examining the chemical and biochemical origins of off-notes. It will explore the challenges of creating authentic meat flavours in plant-based meat analogues, and the importance of in situ flavour generation, particularly via Maillard chemistry and flavour protein interactions.

The talk will also present two case studies of solid-state fermentation (SSF) to enhance flavour in upcycled protein-rich by-products. The first used *Rhizopus spp*. to ferment brewers' spent grain, significantly improving its flavour by generating umami, savoury, and smoky notes while modulating bitterness. Volatile analysis (SPME-GC-MS) combined with sensory profiling revealed that fermentation time influenced aroma characteristics, allowing fine-tuning of flavour outcomes. The second study explored SSF of surplus bread crusts and perennial ryegrass with three fungal strains. Fermentation reduced undesirable vegetal and sulfurous odours, while increasing pleasant bakery-like aromas. Principal component analysis linked specific volatiles to substrate and strain, and a predictive model of aroma perception was validated against trained panel results.

Finally, the PLANTOMYC project will be introduced. The aim of this project is to create hybrid meat alternatives combining plant-based materials with mycelial protein biomass. The project will focus on integrated flavour development, including valorisation of by-products as flavour precursors, to achieve both sustainability and sensory appeal.

OP-A01

Food by-products as a bioactive and aromatic source to ferment kombucha beverage

Eva Tejedor-Calvo[1], Diego Morales[2,3]
[1]*Laboratory for Flavor Analysis and Enology, Department of Analytical Chemistry, Faculty of Sciences, University of Zaragoza, Spain;*
[2]*Departmental Section of Galenic Pharmacy and Food Technology, Veterinary Faculty, Complutense University of Madrid, Spain;* [3]*Nutrigenomics Research Group, Department of Biochemistry and Biotechnology, Universitat Rovira i Virgili, Spain*

Kombucha is a fermented beverage celebrated for its health benefits, attributed to its bioactive compounds, including organic acids, polyphenols, and probiotics. With rising interest in functional foods and sustainability, alternative substrates for kombucha fermentation, particularly food industry by-products, have gained attention. Utilizing these by-products not only supports circular economy initiatives but also addresses food waste reduction while enhancing the nutritional and sensory qualities of the beverage.

Food by-products from different industries have been investigated as substrates for kombucha fermentation: leaves from *Borago officinalis* (borage), fruits of the Strawberry Tree (*Arbutus unedo*), non-commercialized summer (*Tuber aestivum*) and black (*Tuber melanosporum*) truffles, and wine residues obtained during vinification. These by-products, rich in bioactive compounds such as polyphenols, vitamins, and aromatic compounds, were selected for their potential to produce kombucha with enhanced functional and sensory properties.

Three symbiotic cultures of bacteria and yeast (SCOBYs) with varying microbial compositions were used to ferment these substrates. The fermentation process was monitored to evaluate physicochemical properties (pH and viscosity), biochemical changes (ethanol, sugars, proteins, and phenolic compounds), and sensory attributes (volatile organic compounds and aromatic profiles). The aim was to study the influence of these by-products on the fermentation dynamics and to identify key bioactive and aromatic compounds produced.

This research highlights the potential of food by-products as sustainable substrates for kombucha production, promoting their valorization into high-value functional beverages. It provides insights into how specific substrates and SCOBY compositions impact fermentation processes, offering an innovative approach to sustainable beverage production while addressing global challenges in food waste management and functional food development.

Acknowledgment: *Eva Tejedor-Calvo acknowledges the grant JDC2022-048252-I funded by MICIU/AEI/10.13039/501100011033 and the "European Union NextGenerationEU/PRTR".*

OP-A02

Kinetic modelling of the formation of aroma during kilning of barley malt

Dimitris P. Balagiannis

Department of Food and Nutritional Sciences, School of Chemistry, Food and Pharmacy, University of Reading, UK

Barley malt kilning is a pre-fermentation process during beer production where volatile compounds are formed via the Maillard reaction; it affects the flavour profile of the malt as well as the aroma of the final product (i.e. beer with or without alcohol). Kinetic modelling of this brewing step can assist maltsters to understand, control and predict the formation of aroma in malts and by extension in beer.

Multiresponse kinetic modelling is a methodology that has been successfully employed to model the Maillard reaction and the subsequent formation of aroma compounds in thermally processed foods. It comprises a simplified mechanism that reflects the kinetically important steps of the complex Maillard reaction network, and estimates critical physicochemical properties, e.g. reaction rate constants and activation energies, that allow the quantitative elucidation of the underlying reaction kinetics.

In this study, the formation of Strecker aldehydes during the curing step of kilning was examined and modelled. These aldehydes have a significant contribution to the aroma of malt. Two different varieties of germinated barley were employed and cured at different time/temperature combinations. The key precursors (sugars and amino acids) and intermediate compounds (Amadori Rearrangement Products) as well as the generated Strecker aldehydes were quantified in order to decode the kinetics of the studied reaction and build, train and test the proposed model.

The kinetic model indicated that the degradation of key reaction intermediates was more sensitive to temperature changes than the degradation of the precursors since the former had higher activation energies. The model showed very good predictive potential therefore it could be used to control the formation of Strecker aldehydes by manipulating the kilning time/temperature profile and/or the composition of the raw materials.

OP-A03

Stabilizing flavor in low-sodium canned tuna with encapsulated extracts

Beatriz Fernandes[1,2], Gabriel Mota Ribeiro[3], Sara Sousa[4], Cristina Delerue-Matos[4], Valentina F. Domingues[4], Carmo Serrano[1,5]

[1]*INIAV, Instituto Nacional de Investigação Agrária e Veterinária, Oeiras, Portugal;*
[2]*CERENA, DEQ, Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal;*
[3]*FMSI, Lda, Rio de Mouro, Portugal*
[4]*REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Porto, Portugal*
[5]*LEAF, Linking Landscape, Environment, Agriculture and Food – Research Center, Instituto Superior de Agronomia, University of Lisbon, Lisbon, Portugal*

Tuna is a rich source of omega-3 and omega-6 polyunsaturated fatty acids, which provide numerous health benefits, including the prevention of cardiovascular diseases, diabetes, and obesity. However, canned tuna often contains high levels of sodium, posing potential health risks. To address this, the food industry is actively exploring salt alternatives that can reduce sodium content and maintain flavor, product stability, and consumer acceptance.
Essential oils (EOs) and oleoresins (ORs) are natural plant extracts that can enhance flavor while reducing sodium levels in fish products. However, their direct incorporation into food can lead to undesirable sensory changes due to degradation, oxidation, poor solubility in aqueous environments, or interactions within the food matrix. Microencapsulation of EOs and ORs offers a solution by preserving the taste, aroma, color and bioactivity of these extracts during processing and storage. Controlled release mechanisms further enhance stability, ensuring a more flavorful and long-lasting canned product.
In this study, a blend of lemon EO and pepper OR was encapsulated using a combination of inulin, modified maize starch, and pea protein. The microcapsules were produced via spray drying, resulting in a powdered formulation. To assess their stability and quality over time, the samples underwent accelerated aging tests for eight months at 25°C and 40°C. Every two months, samples were analyzed for physicochemical properties, including lipid oxidation, antioxidant activity, encapsulation efficiency, total phenolic content, hygroscopicity, water activity, moisture content, solubility, color, and particle size distribution. Volatile compounds were identified using HS-SPME-GC-MS.
The analysis confirmed that the microcapsules maintained their stability and quality throughout storage when kept in vacuum-sealed, opaque multilayered packaging composed of paper, aluminum and polyethylene. This packaging effectively preserved the sensory properties and safety of the encapsulated extracts, ensuring their potential as a viable salt-reducing ingredient in canned tuna.

OP-A04

Harmonization on non-targeted testing in food and food packaging analysis

Thomas Gude

Thomas Gude GmbH & AOAC Europe, Aarau Rohr, Switzerland

Non-targeted methods have been gaining ground in recent decades, especially with the tremendous development of high-resolution mass spectrometry. The challenges for non-targeted methods are becoming increasingly necessary as there are limited guidelines to regulate and harmonize the methods worldwide. AOAC-Europe and have been signed a Memorandum of understanding for this sector. Two years ago, a series of Webinars on "Trends & Challenges for Non-Targeted Methods" have been started. As a result of this webinars a joint working group was set up with the aim of providing guidelines for the harmonization of non-targeted methods, mainly based on Mass Spectrometry. So far, the starting working group was now split into five subgroups dealing with food, authenticity, environmental/water, packaging and metabolomic testing. As an initial step the five groups are summarizing definitions and workflows for non-target testing. Based on the theses results a harmonized wording and where possible a harmonized workflow incl. validation should be created. The aim of this presentation is to present especially the result of the packing (food contact material area). The current status of definition of common parameters as well harmonized criteria for reporting Screening (NIAS) results. The focus of this harmonisation activity is on descriptive physico-chemical parameter, which allow the reader of such Screening reports to find out easily, if it worthwhile to compare results or are the test results achieved based on different assumptions. Currently the focus is only on the results but not on comparability, which lead to massive problems in understanding.

OP-A05

Colorimetric smart labeling systems based on pH-responsive pyranoflavylium-containing membranes for real-time monitoring of food freshness

Vânia Gomes, Mariana Cunha, Victor de Freitas, Luís Cruz
REQUIMTE/LAQV, Departamento de Química e Bioquímica, Faculdade de Ciências, Universidade do Porto, Rua do Campo Alegre 687, 4169-007, Porto, Portugal

The development of sustainable, smart and functional (bio)materials has been emerging in modern society to address global challenges related with the reduction of food loss, waste, and greenhouse gas emissions, which have a huge economic, social and environmental impact. Among these innovations, pH-responsive membranes or films fabricated from food by-products have emerged as promising tools for monitoring food shelf-life in real-time. These smart membranes integrate natural, pH-sensitive dyes capable of detecting spoilage through colorimetric changes triggered by shifting the environmental pH, which results from the release of acidic or basic volatile metabolites during food degradation.
The main goal was to perform the rational synthesis of novel pH-responsive natural-inspired dyes, the respective incorporation into bio-based polymers for further fabrication of smart membranes.
Pyranoflavylium dyes were synthesized according to Gomes V. et al., J. Photochem. Photobiol. A Chem. 2021, 415, 113313. Chitosan was obtained from shrimp shells and chemically modified. Pyranoflavylium-biopolymer conjugates were obtained through click chemistry procedures or directly encapsulated into the biopolymer. The films were then fabricated using different techniques such as Layer-by-Layer assembly technology and solvent casting.
The pyranoflavylium-biopolymer conjugates were chemically characterized by FTIR, NMR and UV-Vis spectroscopy with pH variation, confirming the covalent conjugations and a pH-dependent chromatic variation in the food spoilage range. The pH-responsive membranes were characterized in terms of morphology, barrier properties, opacity, swelling index, water solubility, and pH-dependent chromatic variation. Their chromatic variation was validated in buffer solutions at different pH levels and in biogenic amine-enriched model solutions. The most promising ones were demonstrated in real food samples, which showed their feasibility and effectiveness as sensitive materials for fish spoilage monitoring.
The incorporation of naturally-inspired pH-responsive dyes into biopolymer-based membranes has unlocked the fabrication of innovative and sustainable materials with smart and bioactive functionalities, foreseeing their applications in the emergent food packaging industry.

OP-A06

Color formation in caramel and liquid sugars – pathways of carbohydrate-based browning reactions in food

Clemens Kanzler, Tatjana Rüger, Leon V. Bork, Sascha Rohn
Technische Universität Berlin, Institute of Food Technology and Food Chemistry, Department of Food Chemistry and Analysis, Berlin, Germany

Browning food is probably the most obvious change in food during thermal processing. Nevertheless, the structure and formation mechanisms of these colorants known as melanoidins are still not comprehensively understood, even though they make up around 10 g per day of a Western diet [1]. The aim of this study was to unravel reaction pathways leading to carbohydrate-derived colorants in caramel and liquid sugars during thermal processing.
Different carbohydrates (glucose, fructose, sucrose) were heated at 160 to 200 °C at low water content (25 wt% to 75 of sugar) for up to 60 min in absence or presence of milk protein. The samples were analyzed in regards of color (420 nm, L*a*b color space), molecular weight distribution (size exclusion chromatography), and antioxidant activity (TEAC). In addition, early carbohydrate degradation products, such as 1,2-dicarbonyl compounds and heterocycles (HPLC), as well as oligomeric colorants (HRMS) were investigated.
Even though the absorbance at 420 nm increased over the whole heating period of 60 min the content in 1,2-dicarbonyl compounds and heterocycles approached a maximum after 40 min of heating for most carbohydrates. HRMS revealed the formation of oligomers comprising intact carbohydrate backbones in different stages of dehydration. In addition, the integration of different carbohydrate fragments was observed.
Overall, the results highlight the high complexity of carbohydrate browning pathways and the structural variety of the formed colorants. Hundreds of compounds arise from aldol and Michael reactions of the native and dehydrated carbohydrates as well as of their cleavage products. Also, new glycosidic bonds might form, producing high-molecular-weight end-products. However, the formation of C-C bonds before or after dehydration reactions is crucial to produce conjugated, chromophoric systems within these colorants.

References:

[1] V. Fogliano, F. J. Morales, *Food Funct.*, **2011**, *2*, 117–23.

OP-A07

Yellowness of selected legume flours as function of nutritional composition, mineral content and total free phenolic content

Jelica Kovačević, Tung Pham, Thomas Bechtold
Research Institute of Textile Chemistry and Textile Physics, University of Innsbruck, Dornbirn, Austria

The yellow colour of certain legume flours may present limitations in their utilisation, particularly in the production of white, creamy products. The yellow colour of protein-enriched legume flour can be correlated with the content of selected constituents present in the respective flour. A comprehensive study was conducted to analyse legume flours from sacha inchi (*Plukenetia volubilis*), pea (*Pisum*), faba bean (*Vicia faba*), chickpea (*Cicer arietinum*) and lentil (*Lens culinaris*) in order to identify potential sources of yellow colour development, which could limit their use in fortified food.
The nutritional quality, macro and microelements, total free phenolics and fatty acid profile using gas chromatography–mass spectrometry were compared to identify the main sources of yellowness. The CIELab colours of the flours were determined by measurement of the diffuse reflectance of legume flour. The data then were used for calculation of the yellowness index which is a valuable tool to estimate the impact of a chosen product on the final colour of a product.
A correlation was established between the yellowness index and the content of total soluble phenolics and Fe content, indicating that soluble yellowing flavonoids and the presence of Fe hydroxides are two major factors contributing to the development of yellow colour.
Acknowledgments: *This research was supported by funding from the State of Vorarlberg under project (grant number IIb–17.04–014).The financial support of the COMET project "Textile Competence Centre Vorarlberg 2 – FFG 882502" within the framework of COMET – Competence Centres for Excellent Technologies – is gratefully acknowledged by the Federal Ministry of Climate Action, Sustainability and Energy (BMK) and the Federal Ministry of Digital and Economic Affairs (BMDW), with additional co-financing from the Federal State of Vorarlberg. The COMET funding programme is overseen by the Austrian Research Promotion Agency (FFG).*

OP-A08

Changes in temperature and light regime drive seasonal variations in glucosinolate hydrolysis and affect the nutritional value of red cabbage

Vanda Púčiková[1,2], Stefanie Ines Kluge[1], Sascha Rohn[2], Andreas Dunkel[3], Katja Witzel[4], Franziska Sabine Hanschen[1,5]

[1]*Plant Quality and Food Security, Leibniz Institute of Vegetable and Ornamental Crops (IGZ) e.V., Grossbeeren, Germany;*

[2]*Food Chemistry and Analysis, Institute of Food Technology and Food Chemistry, Technische Universität Berlin, Berlin, Germany;*

[3]*Integrative Food Systems Analysis, Leibniz Institute for Food Systems Biology at the Technical University of Munich, Freising, Germany;*

[4]*Biotic Interactions, Leibniz Institute of Vegetable and Ornamental Crops (IGZ) e.V., Grossbeeren, Germany;*

[5]*Phytonutrient Management, Institute of Food Technology and Food Chemistry, Technische Universität Berlin, Berlin, Germany*

Glucosinolates (GLS) found in *Brassica* vegetables are valued for their health benefits, mainly attributed to their hydrolysis products, isothiocyanates (ITC), which are released enzymatically when plant tissue is damaged. However, in many *Brassica* vegetables, often less bioactive nitriles (CN) and epithionitriles (ETN) are released due to the presence of specifier proteins, such as epithiospecifier proteins (ESP). Abiotic growth factors can affect GLS biosynthesis, but their effect on GLS hydrolysis is even more pronounced, resulting in 40 times more ITC being formed in summer red cabbage compared to autumn (Púčiková et al. (2025). *Food Chemistry*, 465, 142100.). Thus, studying abiotic factors influencing GLS hydrolysis is essential for improving the quality of *Brassica* vegetables.

Therefore, the effect of temperature and light regime in simulations of summer and autumn cultivation on GLS hydrolysis using mature red cabbage and sprouts was investigated. GLS were analyzed by UHPLC-DAD-ToF-MS, and their hydrolysis products by GC-MS. Nano-LC-MS/MS was used for proteomics to gain a deeper understanding of the regulation of GLS degradation. Relevance networks and functional enrichment analysis were carried out to integrate the datasets. Also, *BoESP* expression was assessed.

The combination of high temperatures, high light intensities, and long photoperiods was more effective for increasing ITC formation in mature red cabbage than the individual factors. Furthermore, low light and short photoperiods shifted the hydrolysis towards more pronounced ETN formation, and the abundances of ESP corresponded to these shifts. An induction of *BoESP* transcripts already one day after transfer of sprouts to autumn growth conditions was shown, but GLS hydrolysis outcome changed only after seven days.

Multivariate analyzes of the data sets help to further elucidate the regulation of the formation of health-promoting metabolites in cabbage, thus supporting the improvement of the nutritional value of *Brassica* vegetables in human diets.

OP-A09

Challenges in chromatographic and effect-directed analyses of phytonutrients in food matrices

Irena Vovk[1], Vesna Glavnik[1], Maja Bensa[2], Breda Simonovska[1], Etil Guzelmeric[3], Nisa Beril Sen[3]
[1]Laboratory for Food Chemistry, National Institute of Chemistry, Ljubljana, Slovenia;
[2]Research Institute of Faculty of Health Sciences, Faculty of Health Sciences, University of Ljubljana, Ljubljana, Slovenia;
[3]Department of Pharmacognosy, Faculty of Pharmacy, Yeditepe University, Istanbul, Türkiye

Phytonutrients are a large group of compounds with a variety of chemical structures and bioactivities. Because of their diversity, a significant number of phytonutrients present in our diet remain unknown. Despite this knowledge gap, several phytonutrients are nowadays used as ingredients of food supplements or functional foods. The growing demand of such phytonutrients products is increasing the demand for new sources of these bioactive compounds.
This presentation will focus on methods based on chromatographic and hyphenated techniques as well as effect-directed analysis (EDA) for targeted and non-targeted analyses of phytonutrients in different food matrices (e.g., food supplements and their raw materials (Japanese knotweed), bee pollen, food waste, etc.). Methods based on high-performance thin-layer chromatography (HPTLC–densitometry, HPTLC–image analysis, HPTLC–MS/(MS) and HPTLC–EDA) and high-performance liquid chromatography (HPLC–UV/Vis, (U)HPLC–MS/(MS)) for analyses of phytonutrients in different food matrices (e.g., food supplements and their raw materials (Japanese knotweed), bee pollen, food waste, etc.) will be discussed. Lack of commercial standards and standard reference materials, lack of chromophores, isomeric structures and stability of the analytes were the main challenges in the development of chromatographic methods. Challenges in non-targeted (HPTLC–EDA analyses of antioxidants and enzyme inhibitors were mostly related to the influence of the stationary phase, detection reagents and detection modes. Methods based on complementary chromatographic techniques and EDA are indispensable in discovery of new sources of phytonutrients, development of new food products, as well as control of quality and safety.

Acknowledgements: *This study was supported by the Slovenian Research and Innovation Agency (ARIS; research core funding No. P1-0005; project J4-50138, project J4-4561, bilateral project BI-TR/20-23-004 and "Young Researchers" program – Maja Bensa) and the Scientific and Technological Research Council of Türkiye (TÜBİTAK; project No: 119N569).*

OP-A10

Pigmented rice: healthy food for healthy diet. Chemical composition, technology, cooking impact and bioaccessibility insights

Marco Arlorio, Vincenzo Disca, Fabiano Travaglia, Jean Daniel Coïsson, Matteo Bordiga, Yassine Jaouhari, Monica Locatelli

Department of Pharmaceutical Sciences – Food Chemistry, Biotechnology and Nutrition Unit – University of Piemonte Orientale, Novara, Italy

Rice (*Oryza sativa* L.) is the most consumed cereal by the human population, present in gastronomic traditions all over the world. The white refined rice is usually consumed worldwide, but the interest in pigmented varieties has recently grown in Western countries. Italy is the leading producer of rice in Europe, with 1,4 million tons, in 2024. The pigmented rice varieties (a small percentage of the overall production) are mainly black, red, and dark purple coloured, containing a variety of polyphenols. The anthocyanins, located in the external layer of the caryopsis, are considered a peculiar "functional" component of pigmented rice. Black rice could be considered a sort of "natural" functional food, due to their significant content of polyphenols and their antioxidant properties. Polyphenols exert a beneficial action on the human organism, which depends not only on their quantity present in the diet, but especially on their bioaccessibility/bioavailability. The impact of technological processing, particularly the impact of cooking and digestive process could modify these healthy properties, modulating the bioaccessibility and the bioavailability of nutrients and bioactive compounds.
The aim of this oral communication is first to describe the biodiversity of the chemotypes of some pigmented rice from Italy, particularly focusing on polyphenol fraction. The use of spray dried anthocyanins-rich extracts for the functionalization of cookies (as model food) will be then discussed. Moreover, the effect of different type of cooking, as well as the impact on the nutritional properties, will be debated beside the evaluation of the impact of the digestive process (INFOGEST) on the polyphenolic fraction of Artemide black rice, clarifying some key points regarding the bioaccessibility.
Concluding, these studies confirm a significant role of pigmented rice in the diet, allowing us to open new perspectives about the preservation of the antioxidant capacity in this commodity.

OP-A11

Amadori rearrangement products and volatile formation through high moisture extrusion processing

Chloe Mayo[1], Dimitris Balagiannis[2], Valentina Stojceska[1], David A. Baines[3], Jane K. Parker[2], George R. Fern[1]

[1]Department of Chemical Engineering, Wolfson Centre for Sustainable Materials Development and Processing, Brunel University of London, Kingston Lane, Uxbridge UB8 3PH, UK;

[2]Department of Food and Nutritional Sciences, University of Reading, Whiteknights, Reading, RG6 6DZ, UK;

[3]Flavour Horizons, 22 Elizabeth Close, Bristol, BS35 2YN, UK

High-moisture extrusion is commonly used to produce plant-based meat analogues (PBMAs) due to its ability to create a desirable meat-like texture. However, current processes rely on post-extrusion marination, often resulting in a flavoured coating and a bland centre. Incorporating flavour precursors before extrusion can enhance homogeneity but may lead to significant flavour losses due to volatilisation, oxidation, and matrix interactions. Consequently, research into flavour formation during extrusion has gained increasing attention.

This study investigates the formation of Amadori intermediates and volatiles from mixtures of single amino acids (glycine, arginine, leucine, methionine, or cysteine) and single sugars (glucose or xylose) added to the liquid feed during extrusion. Samples were processed at 37°C, 78°C, 119°C, and 160°C. To isolate the effect of temperature from shear, extrusion was conducted using either the full or partial temperature profile in the final barrel. Post-extrusion, volatiles were analysed via GC-MS, while freeze-dried samples were assessed for Amadori intermediates and amino acids (LC-MS/MS) and sugars (HPLC).

As expected, amino acids and sugars were depleted with increasing temperature due to Maillard reaction participation. However, the formation and degradation of Amadori products varied depending on the sugar–amino acid pair. Most pairs exhibited an increasing trend in Amadori formation, but methionine-based Amadoris degraded after 119°C. Volatile formation also varied, with acetic acid and pyrazines increasing with temperature, while furfural and Strecker aldehydes peaked at 119–160°C before volatilisation and further reactions lead to a decline.

These findings suggest that optimising volatile and Amadori formation requires tailoring to specific amino acid–sugar combinations. For complex mixtures, a balance must be achieved to maximise desirable flavour compounds while minimising losses.

OP-A12

New reaction pathways, formation of aroma-active methyl ketones during lipid oxidation

Sandra Grebenteuch[1,2], Clemens Kanzler[2], Sascha Rohn[1,2]
[1]*Institute for Food and Environmental Research e. V. (ILU), Bad Belzig, Germany;*
[2]*Technische Universität Berlin, Berlin, Germany*

Lipid oxidation is one of the most significant reactions in food chemistry. In food it is linked to the loss of essential ω-fatty acids and the formation of a variety of flavor-active secondary volatile organic compounds (VOCs). In addition to the typical compounds such as alkanes, aldehydes and alcohols, methyl ketones (2-alkanones), e.g., 2-hexanone and 2-heptanone, have also been described as aroma-active substances. While the formation pathways of most VOCs are well understood, the origin of methyl ketones is still not comprehensively described.
This study aimed at investigating the formation of methyl ketones from unsaturated fatty acids (e.g., linoleic acid) and their unsaturated oxidation products (e.g., 2,4-decadienal, 2-octenal).
Different methyl ketones in foods, and model systems were determined using static headspace gas chromatography-mass spectrometry. Isotope-labeled starting compounds and MS and MS^n experiments were also used to elucidate the reaction mechanism.
The experiments revealed that methyl ketones predominantly arise from secondary degradation products of fatty acids mainly unsaturated VOCs such as 2,4-decadienal and 2-octenal. Initially, unsaturated aldehydes and their corresponding imines form various aldol products. From these aldol condensation products (or imines), water addition at the terminal double bond of the conjugated system is proposed, initiating an intramolecular cyclization to pyridine or pyrrole derivatives, with methyl ketones eliminated as leaving groups. In these follow-up reactions, oxidative conditions are not necessary anymore. Free water exerting a slight inhibitory effect on methyl ketone formation.
The proposed reaction pathways for the formation of aroma-active methyl ketones in food are crucial and warrant further investigation. The identification of various intermediates and products through $HRMS^n$ experiments supports the derived mechanisms, highlighting the complexity of lipid oxidation processes. In future experiments, the influence of different amino compounds will be investigated.

OP-A13

Effects of pasteurisation, processing atmosphere, storage and production year on the aroma stability of orange juice with pulp

Mária Kopuncová[1], Jana Sádecká[1], Blanka Tobolková[1], Martin Polovka[1], Ján Durec[2], Xiaoshuan Zhang[3]

[1]*Department of Chemistry and Food Analysis, Food Research Institute, National Agricultural and Food Centre, Priemyselná 4, 82475 Bratislava, Slovakia;*

[2]*McCarter Ltd., Bajkalská 25, 82101, Slovakia; production premises: Budovateľská 1247/7, 92901 Dunajská Streda, Slovakia;*

[3]*Laboratory of Food Quality and Safety, College of Engineering, China Agricultural University, Beijing, 100083, PR China*

Technological operations applied in the industrial processing of fruit into juice, as well as the storage of final product in the commercial chain, can have a significant impact on the quality and stability of juice aroma. Degradation of sensory properties of juice can be reduced by its processing under protective atmosphere of inert gas.

The aim of this study was to evaluate the effectiveness of three processing atmospheres in preserving the aroma-active compounds of orange juice with pulp during a four-month shelf-life. Application of conventional "air" (O_2), nitrogen (N_2) and carbon dioxide (CO_2) was evaluated in 2014 and 2015 in selected stages of processing. Subsequently, the efficiency of N_2 used in all stages of orange juice production process was verified during two consecutive seasons (2018 and 2019). Headspace solid-phase microextraction, gas chromatography-mass spectrometry and gas chromatography coupled to flame ionisation detection and olfactometry were used for volatile extraction and analysis.

Results confirmed the comparable efficacy of the two gases used as protective atmospheres. Neither was able to completely inhibit changes in volatile composition. However, they were not significant enough to lead to a deterioration of the overall juice flavour. Conversely, negative sensory changes were observed in juices processed in a conventional atmosphere as early as the second month of the four-month shelf-life. The ability of nitrogen to protect orange juice aroma was also confirmed by repeated storage experiments carried out in two consecutive years. In addition, these experiments showed that different climatic conditions, especially different seasons of orange harvesting, together with variability in parameters such as pH and pulp content, can affect not only the quality of the raw juice but also the range of chemical reactions that take place in juice during its pasteurisation and storage.

Acknowledgement: *Publication was supported by the projects Drive4SIFood 313011V336, APVV-23-0234 and SK-CN-23-0013.*

OP-A14

Can selenium-induced off-flavors be relevant in beer?

Zeiler Sophie, Schligtenhorst Evelyn Johanna, Horneck Jan Ferdinand, Hellwig Michael
Special Food Chemistry, TU Dresden, Dresden, Germany

Selenium is an essential trace element for humans. It is absorbed by plants from the soil and mainly metabolized to selenoamino acids [1]. Out of the total selenium content of grain, 45 % is present as selenomethionine (SeMet) [2]. Furthermore, barley can be enriched with SeMet during the malting process [3]. Sulfur-containing amino acids such as methionine (Met) can lead to off-flavors at various points in the beer brewing process. Maillard reaction, Strecker degradation, fermentation and degradation by the yeasts in the Ehrlich pathway and incorrect storage can lead to different off-flavors: dimethylsulfide (cabbage), methional (potato), 2-mercaptoethanol (rotten eggs), methionol (sour, cheesy) and 3-methylbut-2-enthiol (skunk like) [4,5,6].

The aim of this study is to find out whether the chemical similarity between sulfur and selenium can also result in off-flavors due to selenium amino acids.

Various model systems were used to demonstrate the potential formation of selenium off-flavors: incubation of SeMet with glucose (50–78 °C, 100 °C mash/wort model), fermentation of SeMet and $(SeCys)_2$ by various commercial brewer's yeasts strains in nitrogen minimal medium and beer wort (fermentation model) as well as irradiation of the spiked wort at 366 nm (storage model). The formation of volatile reaction products was analyzed by GC-MS, not-volatile products by LC-MS/MS. The degradation of selenoamino acids by yeasts was quantified by HPLC-UV after derivatization and LC-MS/MS.

The first results of the study show that SeMet can be metabolized to Se-methional and Se-methionol by all yeast strains examined. The results of further investigations are still pending.

References:

[1] Winkel et al. *Nutrients* (2015) 4199–4239
[2] Wolf, Goldschmidt. *Anal Bioanal Chem.* (2004) 1175–1181.
[3] Cheng et al. *J. Agric. Food Chem.* (2023) 5240-5249.
[4] Ferreira, I. M., Guido, L. F. *Fermentation* (2018)
[5] Perpète et al. *FEMS Yeast Res.* (2006) 48–56
[6] De Keukeleire D. et al. *Cerevisia* (2008)

SESSION OP-F: FOOD PRODUCTION AND ITS SUSTAINABILITY

KN-F

Metabolomic profile of food and natural products through ambient mass spectrometry techniques

Paola Dugo
University of Messina, Italy

The increasing awareness toward the topic of functional diet posed the need for the detailed characterization of foods. The aim of the present contribution is to show the potential of ambient mass spectrometry (AMS) for the characterization of complex foods, in their native form, avoiding complex sample preparation strategies.
Extra virgin olive oils (EVOOs) and aromatic plants were analyzed by two AMS techniques: 1) Rapid Evaporative Ionization MS (REIMS) coupled with a quadrupole-time of flight MS detector and an electroknife as sampling device (iknife); 2) Direct Analysis in Real Time (DART) connected to a single quadrupole by using quickstrip cards and solid phase microextraction (SPME) fibers as sampling devices. Spectra were collected through a chemometric software and used for the development of classification and predictive models based on Principal Component Analysis and Linear Discriminant Analysis.
EVOOs were directly analyzed through DART, while frozen cubes were made as ready to cut materials for the iknife technology. Whereas, herbs were mixed with distilled water to create a conductive paste for the iknife, while they were dissolved in few mL of solvents prior to be spotted on quickstrip cards. The iknife spectra of EVOOs highlighted the presence of major constituents, triacylglycerols, while DART also enabled the detection of minor compounds, such as sterols, which are responsible for sample discrimination. Moreover, if SPME is used, phenols can be selectively detected resulting in more effective statistical models.
DART spectra of herbs were dependent on the solvent employed for dissolution, while the iknife allowed to achieve a holistic profile including both volatiles and non-volatiles. As a result, the iknife model was more accurate compared to DART.
AMS techniques provided a full metabolomic profile of foods in a very short time. The statistical models can be used against fraudulent activities.

OP-F01

Sustainability driven innovation for the zero-waste biorefining of sour cherry pomace into the high nutritional value ingredients

Laura Jūrienė, Vita Morkūnienė, Petras Rimantas Venskutonis
Department of Food Science and Technology, Kaunas University of Technology, Kaunas, Lithuania

Processing of sour cherries for juice and other products generates large amounts of by-products, which are called pomace. Currently, sour cherry pomace is used inefficiently, e.g. for composting or producing animal feed. Moreover, large amounts of pomace are discarded as a waste causing environmental pollution problems. Considering that sour cherry pomace is a rich source of health beneficial bioactives, including anthocyanins, flavonoids and phenolic acids, there is an urgent need of its valorization for the recovery of high added value food grade ingredients. For this purpose, the application of biorefining concept seems to be a preferable approach for developing effective processes for the recovery of various nutrients from sour cherry pomace, which may serve as health beneficial ingredients for foods and nutraceuticals. The aim of this work was to develop multistep biorefining scheme for the recovery of lipophilic and hydrophilic constituents from the mechanically separated into six different particle size cherry pomace fractions by the consecutive supercritical fluid extraction with CO_2 (SFE-CO_2) and pressurized liquid (PLE) extraction with ethanol/water (70:30). The temperature and time of PLE were optimized for the highest yields and proanthocyanin content by using Central Composite Design and Response Surface Methodology. The products obtained were evaluated by determining compositional characteristics and their antioxidant potential using in vitro ABTS$^{•+}$ scavenging, oxygen radical absorbance capacity (ORAC) and Folin-Ciocalteu total phenolic content assays. Antioxidant capacity of solid substances was evaluated by Quencher method. Fatty acids and volatiles were determined in the lipophilic extracts by GC-FID and GC-MS; triacylglycerols by UPLC-QTOF and total carotenoids by spectrophotometry. Anthocyanins and proanthocyanins were determined in hydrophilic extracts. The results obtained revealed significant differences between mechanically separated fractions. For instance, the yields of lipophilic compounds recovered by SFE-CO_2 was from 3.38 to 8.69%, the concentration of proanthocyanins in the extracts from 66.6–184.9 mg/g.

OP-F02

Investigating the influence of starter cultures on the peptide profile of yogurt using an untargeted LC-MS/MS approach

Eva Beck[1], Lena Riedinger[1,2], Sevim Dalabasmaz[1], Monika Pischetsrieder[1,2]

[1]*Food Chemistry, Department of Chemistry and Pharmacy, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany;*

[2]*FAU NeW – Research Center New Bioactive Compounds, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany*

Yogurt is produced by fermenting milk with lactic acid bacteria (LAB). On the European market, two different yogurt varieties (mild, non-mild) are available, distinguished by the LAB used for production. According to European regulations, non-mild yogurt only contains two bacterial strains, *S. thermophilus* and *Lb. bulgaricus*, while a variety of different LAB are used for mild yogurt. Since they are multiauxotrophic, LAB digest proteins, causing significant changes in the peptide profile of milk. Peptides released from milk proteins may have a strong impact on physiological activity and product quality. Different LAB possess different proteolytic enzymes, leading to differences in the peptide profile. Understanding proteolysis during the fermentation process and the influence of starter cultures on the peptide profile is important to gain insight into product characteristics.
Thus, the peptide profiles of ten commercial yogurt samples (five mild, five non-mild) were analyzed using untargeted microLC-IM-QTOF-MS/MS after micro-SPE of peptides. Peptides were identified using PEAKS® Online, followed by data evaluation in RStudio. Cleavage sites were determined using a Microsoft Excel workflow. Proteolytic activity was determined by an OPA assay.
While six of the ten samples showed comparable peptide profiles overall, two specific LAB combinations used in the remaining four samples create distinct peptide patterns separating those products from the rest. Peptides mostly originated from β- and κ-casein. Containing up to 2000 different peptide sequences, non-mild samples showed a higher average peptide number than mild samples. Peptides in non-mild samples also showed a lower average length. 228 peptides were found in all samples, yet each product also contained a significant number of unique peptides. Cleavage site analysis showed both universally present and product-specific sites. In conclusion, the peptide profile of yogurt can be controlled by the species and combination of the applied starter cultures, thus optimizing physiological and functional properties of the product.

OP-F03

Incorporation of fermented and non-fermented edible mushroom by-products in penne pasta: a sustainable approach to nutritional enhancement

Ana Saldanha[1,2], Mikel Añibarro-Ortega[1], Diogo Salvati[1,3], Laura Roman[3], Maria Inês Dias[1], Carla Pereira[1]
[1]*CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;*
[2]*LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal;*
[3]*Food Technology Area, College of Agricultural Engineering, University of Valladolid, Av. Madrid 50, 34004, Palencia, Spain*

Lactic fermentation enhances the preservation of edible mushrooms, extending their shelf life while improving their sensory qualities and health benefits. This study aimed to use *Agaricus brunnescens* by-products to fortify novel food products and, simultaneously, reduce waste. To achieve this objective, fermented (F) and non-fermented (NF) by-products of *A. brunnescens* were incorporated into penne pasta at different substitution levels. Physicochemical, color, rheological and textural analyses were performed, as well as comparative analysis of nutritional composition (official AOAC methods), chemical profile (organic acids and fatty acids using chromatographic techniques), and antioxidant activity (OxHLIA and TBARS) of the samples, to ensure the quality of the formulated products. Cooking time and firmness decreased with greater mushroom replacement, especially in the F samples, possibly due to starch dilution. Solids loss increased, particularly in the 10% F formulation, with no differences in swelling power. Greater replacement of mushroom flour resulted in darker pastas with reduced hardness, shorter cooking times, lower pH, higher fiber, protein, and malic acid content, as well as similar water-binding capacity (WBC), swelling, and fatty acid profile. Sensory analyses were carried out to assess the acceptability of the formulated products, showing a very positive response from the population tested. According to these findings, fermented mushroom flour could be a valuable ingredient in the development of innovative food products for health-conscious and sustainability-focused consumers.
Acknowledgements: *FCT/MCTES (PIDDAC): CIMO, UIDB/00690/2020 (DOI: 10.54499/UIDB/00690/2020) and UIDP/00690/2020 (DOI: 10.54499/UIDP/00690/2020); and SusTEC, LA/P/0007/2020 (DOI: 10.54499/LA/P/0007/2020); scientific employment program contract with J.P. (10.54499/CEECIND/01011/2018/CP1578/CT0002) and institutional scientific employment program contract with M.I.D. (10.54499/CEECINST/00016/2018/CP1505/CT0004) and C.P. (10. 54499/CEECINST/00016/2018/CP1505/CT0010); A.S. doctoral scholarship (2021.08346.BD). The project Safe2Taste (MTS/BRB/0056/2020, http://doi.org/10.54499/MTS/BRB/0056/2020) and M.A.O. research scholarship through this project. L.R. acknowledge Ramon y Cajal funding (RYC2021-032926-I) by MICIU/AEI/10.13039/501100011033 and EU "NextGenerationEU/PRTR", as FEDER Interreg VI A Spain–Portugal (POCTEP) 2021-2027 cooperation project TRANSCoLAB PLUS (0112_TRANSCOLAB_PLUS_2_P).*

OP-F04

Tracking soybean origin and assessing environmental impact using elemental profiling and chemometrics

Maria Aparicio Muriana[1], Yunhe Hong[1], Cynthia A. Chilaka[1], Brian Quinn[1], Alfredo M. Montes Niño[2], Nicholas Birse[1], Christopher T. Elliott[1,3]

[1]Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast, Belfast, UK;

[2]Microbioticos Paraguay SRL, San Lorenzo, Paraguay;

[3]School of Food Science and Technology, Faculty of Science and Technology, Thammasat University, Bangkok, Thailand

Soybean (Glycine max) is one of the most significant global agricultural commodities, accounting for a substantial portion of protein supply for both human consumption and animal feed. However, soybean production is closely linked to environmental concerns, particularly deforestation and land-use change in key producing regions such as South America. In response to these challenges, regulatory frameworks such as the 2023 EU Deforestation Regulation (EUDR) aim to ensure that soy and other commodities entering the European market are free from links to illegal deforestation and ecosystem degradation. The EUDR emphasizes the need for clear documentation of country of origin, making reliable analytical tools essential for supply chain traceability. To support compliance with such regulations and enhance transparency and integrity in the soybean supply chain, we present a robust, user-friendly and cost-effective analytical approach combining inductively coupled plasma mass spectrometry (ICP-MS) and chemometric modeling to assess the geographical origin of soybean samples. In this study, more than 330 soybean samples were collected from the seven major producing countries – Brazil, the United States, Argentina, China, India, Paraguay and Canada—representing over 95% of global production. Multi-elemental profiling was conducted using ICP-MS, and the data were processed through multivariate analysis techniques to explore classification patterns based on elemental composition. The supervised model successfully distinguished soybean samples from different countries with over 98% accuracy, with specific elements identified as key contributors to geographical differentiation. Beyond country-level classification, this study also explores regional distinctions within major producing countries. An attempt was made to differentiate soybean from Brazil's largest production regions, assessing whether regional environmental conditions influence elemental profiles. Additionally, elemental differences between soybean meal samples from deforested and non-deforested areas in Brazil were explored, aiming to provide insights into the potential impact of deforestation on soybean composition.

OP-F05

Food byproducts as eco-innovative solutions for natural dyeing and mordanting for the 21st textile dyeing industry, inspired by ancient practices

Natércia Teixeira[1], Paula Nabais[2], Mara Santo[2], Nuno Mateus[1], Victor de Freitas[1]
[1]*LAQV-REQUIMTE, Faculty of Sciences, Universidade do Porto, Porto, Portugal;*
[2]*LAQV-REQUIMTE, Department of Conservation and Restoration, NOVA School for Science and Technology, Monte da Caparica, Portugal*

Before the advent of synthetic colors, natural dyes were widely used to dye natural fibers including wool, linen, cotton and silk. The use of natural products is currently of great interest due to increase awareness concerning environmental and health-related issues. If these natural products are obtained from usually discarded agro-food byproducts/wastes (ABW), symbiosis between circular economy and environmentally responsible practices is achieved.
Traditional knowledge is a unique source of inspiration and, although most people are convinced that the use of natural dyes may lead to poor to moderate light/colour-fastness, the truth is that we still see the brightness and colour hue of some of these natural colours in artworks, which have lasted for centuries. This resilience is related to the colour formulations, i.e., the recipes developed in the past.
Most natural dyes have little to no affinity for the natural fibers requiring the use of metal salts as mordants (Al, Sn, Fe) to bind to the textile, which can also lead to ecological distress. Previous works on the use of biomordants have shown promising results. However, the lack of well-documented research, and their influence on colour stability downplays their role in natural textile dyeing. Eco-friendly biomordants recovered from ABW such as oak galls, pomegranate peels, and nut shells have been selected for wool broadcloth dyeing.
This project is the first approach to the development of new sustainable dyeing and mordanting methods for the 21st-century textile industry, inspired by the ancient practice of natural dyeing. Following these recipes, we will prove that antient knowledge can be the answer for natural resilient dyeing.
Funding: *This work received financial support from PT national funds (FCT/ MECI) through the project UID/50006 -LAQV- Tecnologias e Processos Limpos.*
Acknowledgements: *NT and PN thanks FCT for the Scientific Employment Stimulus – Individual Call 2023.06024.CEECIND/CP2842/CT0010 and CEECIND/01344/2021.*

OP-F06

Combination of bioactive compounds, stable isotopes and multivariate data analysis for controlling tea quality and authenticity and developing its labels

Tran-Thi Nhu-Trang[1,2], Nguyen Cong-Hau[1], Quoc-Duy Nguyen[1], Philippe Behra[2]
[1]*Nguyen Tat Thanh University, Vietnam;*
[2]*Laboratoire de Chimie Agro-Industrielle (LCA), Université de Toulouse, INRAE, Toulouse, France*

Tea (*Camellia sinensis*) is the world's second most consumed beverage. The quality of tea products is determined by metabolite profiles, influenced by factors such as genetics, manufacturing process, harvesting season, geographical region, and cultivation. The global tea supply chain is complex and vulnerable to fraud, particularly in the European Union. The authentication of tea types, origins, and adulteration is mandatory, and this requires stricter regulatory enforcement, advanced analytical methods and technologies, and greater transparency in labelling and certification. The establishment of an accessible database will benefit consumers, producers and tea houses, both at the local and international levels.
A comprehensive analysis of 186 authentic and 54 commercial teas from diverse origins in Vietnam and other countries was conducted, encompassing five distinct tea types: green, raw Pu'erh, oolong, black, and white teas. A multi-isotopic approach (^{13}C, ^{2}H, ^{15}N, ^{18}O) has been employed on leaf samples using an EA-IRMS system. The analysis of caffeine, gallic acid, and major catechins, utilising UPLC-MS/MS, revealed significant variations primarily influenced by processing, geographical origin, and variety. Furthermore, a correlation between amino acid content and the sensory characteristics of tea was established. The study revealed that variations in geographic location (latitude and altitude), climate, tea variety, tree age (ranging from 3–10, 100 and > 200 years old) and processing (particularly oxidation level) resulted in significant disparities in tea composition. This facilitates the development of multivariate data analysis techniques that can accurately distinguish tea quality and authenticity. The application of PCA-X, PCA-Class and PLS-DA models has yielded a robust framework for distinguishing authentic and commercial teas. Moreover, the database has facilitated the systematic documentation and refinement of tea cultivation, harvest, and processing methodologies, ensuring their foundation in empirical evidence.
Acknowledgements: *We thank the DOST Ho Chi Minh City (Vietnam) and Toulouse INP (France) for providing the financial support.*

OP-F07

Tracing the geographic origin of tomatoes through soil geochemical fingerprinting

Raffaela Ofano, Carmine Amalfitano, Luigi Ruggiero, Diana Agrelli, Paola Adamo

Department of Agricultural Sciences, University of Naples Federico II, Piazza Carlo di Borbone I – Portici, Naples, Italy

The globalization of food markets has increased consumer concern about the authenticity and traceability of food products. Geographic traceability ensures the transparency of food origins, safeguarding quality and food safety while preventing fraud. Soil, as the main source of mineral elements for plants, reflects regional differences in geochemical properties that are transferred to agricultural products, making multielement fingerprinting an essential tool for distinguishing food origins. This study explores the relationship between mineral content in cultivation soils and PDO tomatoes grown on the slopes of the Somma-Vesuvius volcanic complex, a region with unique pedoclimatic conditions that strongly influence the quality and organoleptic properties of the tomatoes. Tomato fruits and soils were collected from representative farms both inside and outside the PDO cultivation area over three consecutive years (2021-22-23). Soils were analyzed for physical-chemical properties and extracted for both potentially bioavailable elements (0.05 M EDTA, pH 7) and readily bioavailable elements (1 M NH_4NO_3). A total of 22 elements were quantified in both soils and tomatoes using ICP-MS. Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) were employed to classify and compare the geochemical profiles of the soils and corresponding tomatoes.
The results revealed a strong correlation between the mineral composition of soils and tomatoes, with samples naturally clustering by farm origin rather than by tomato variety. Notably, eight elements (Sr, Rb, Cs, Zn, Cu, P, Ca, Cd) were identified as key discriminators of geographical origin, achieving a high classification accuracy (99%) in the geographical identification of tomato fruits. These findings underscore the potential of soil geochemical fingerprinting as a reliable method for ensuring the authenticity and traceability of PDO tomatoes and other agri-food products susceptible to origin fraud.

Acknowledgements: *Research granted by METROFOOD-IT project [code IR0000033] funded by the NextGenerationEU under the National Recovery and Resilience Plan (NRRP), M4C2 Investment 3.1.*

OP-F08

Sustainability of energy efficiency of the modern beverage industry – opportunities, challenges and their effective use

Ján Durec
McCarter, a.s., Slovakia

Changing external economic and political conditions directly affect the competitiveness of food producers. Sustainability of production, processes, technologies and products represents a serious challenge. Functioning processes, energy efficiency are key in today's modern world. Starting from the modernization of buildings, technology, efficient use of energy resources is a daily topic. Efficiency in all processes, in the food industry especially heating, cooling, movement, media, better use of existing resources and technology and the application of new renewable resources are and will be the key to success. The lecture will balance, analyze and propose solutions. Implementations in practice will also be presented.

SESSION FP: FLASH PRESENTATIONS

KN-FP

Occurrence and formation of oxidized fatty acids in edible oils and their use as novel parameters to evaluate oil quality and authenticity

Elisabeth Koch[1], Ariane Löwen[1], Michelle Wiebel[1], Nadja Kampschulte[1], Ina Willenberg[2], Nils Helge Schebb[1]

[1]*Faculty of Mathematics and Natural Sciences, University of Wuppertal, Wuppertal, Germany;*

[2]*Institute of Safety and Quality of Cereals, Max Rubner-Institut (MRI) – Federal Research Institute of Nutrition and Food, Detmold, Germany*

The polyunsaturated fatty acids (PUFA) linoleic acid and α-linolenic acid in plant oils are precursors for a multitude of fatty acid oxidation products, so-called oxylipins. The oxylipin pattern of an oil is a complex picture of both, the enzymatic activity of fatty acid oxidizing enzymes in the oil seed and (non-enzymatic) oxidation during oil production, storage and processing. The presence and concentrations of specific oxylipins thus depend on the origin of an oil and the processing conditions and may allow to draw conclusions about the quality and authenticity of oils.

Screening of different plant oil revealed that the widely known autoxidation- and lipoxygenase-derived products occurred in relevant concentration; however, in rapeseed and flaxseed oil, other oxylipins dominated which were so far almost unknown in edible oils. A deeper insight in the oxylipin patterns of oils by non-targeted LC-HRMS screening unveiled several new, in part highly abundant hydroxy-PUFA and a new possible formation pathway of oxylipins in seeds.

Processing of plant oils such as storage, strong heating or refining had a strong impact on oxylipin patterns. Storage of freshly pressed oils revealed a rather low lipid peroxidation in flaxseed oil despite the high PUFA content, while autoxidation was massive in rapeseed oil. High temperatures such as during deep-frying promote the formation of *E*,*E*-hydro(per)oxy-PUFA as well as of *trans*-epoxy-PUFA, while the refining process caused a distinct hydrolysis of epoxy-PUFA to the corresponding dihydroxy-form.

Thus, the oxylipin pattern of oils were found to be specific for the oil source as well as the pressing and processing conditions and might help to answer urgent questions of food fraud.

Acknowledgement: *We thank the current and former members of the Schebb group for their contribution, the Max Rubner-Institute for the collaboration and the Ev. Studienwerk Villigst e.V. for supporting the work with a PhD fellowship.*

FP01

Utilizing non-targeted LC-IMS-MS metabolomics to explore the basal chemical profile of olive cultivars with varying tolerance to *Verticillium dahlia*

Irene Serrano-García[1], Lucía Olmo-García[1], Ioannis C. Martakos [2], Lorenzo León[3], Raúl de la Rosa[3], Marilena E. Dasenaki[2], Nikolaos S. Thomaidis[2], Alegría Carrasco-Pancorbo[1]

[1]*Department of Analytical Chemistry, Faculty of Sciences, University of Granada, Granada, Spain;*

[2]*Analytical Chemistry Laboratory, Chemistry Department, National and Kapodistrian University of Athens, Athens, Greece;*

[3]*IFAPA Centro Alameda del Obispo, Córdoba, Spain*

Verticillium wilt of olive (VWO) is a destructive disease causing plant wilting and severe economic losses. Since no effective chemical fungicides exist, utilizing resistant olive cultivars in new plantations and breeding programs is the most sustainable control strategy.

This study comprehensively analyzes the basal metabolomes of roots, stems, and leaves in 43 olive genotypes with varying resistance to *Verticillium dahliae*, using an advanced UHPLC-ESI-TimsTOF MS/MS platform. A non-targeted metabolomic approach combined with multivariate statistical analysis revealed significant metabolic differences between highly resistant (HR) and susceptible (S) cultivars. Principal component analysis (PCA) demonstrated natural clustering of genotypes based on tolerance, further discriminated by supervised statistical models (PLS-DA).

The classification models identified key markers associated with VWO vulnerability and helped define their characteristic compositional patterns. Stem tissue exhibited the highest predictive capability for distinguishing resistant and susceptible genotypes, followed by roots and leaves. HR genotypes' stems were characterized by the levels of secoiridoids and flavonoid derivatives, while S genotypes were defined by metabolites from the lignans family. In leaves, HR genotypes were characterized by iridoids and fatty acids, whereas a substantial number of compounds, mainly flavonoids, simple phenols, and fatty acids, were relevant in leaves of S-genotypes. These metabolic markers provide valuable insights into the mechanisms underlying VWO resistance and offer a foundation for improving olive breeding strategies.

Additionally, this study presents a preliminary $^{TIMS}CCS_{N2}$ experimental database with over 80 olive metabolites, which will enhance compound identification accuracy in future studies. Moreover, the ion mobility dimension enabled the detection of isomeric species in olive tissues for the first time. These findings contribute to a deeper understanding of the basal metabolome associated with VWO resistance and support future research on olive resilience and disease control.

FP02

Metabolomics of gold sesame oils produced by different drying methods during storage

Busra Dokmetas[1], Ayse Burcu Aktas[2]
[1]*Food Engineering Department, Institute of Science, Sivas Cumhuriyet University, Türkiye;*
[2]*Biochemistry Department, Faculty of Science, Sivas Cumhuriyet University, Türkiye*

Golden sesame is an endemic oil seed that grown in the coastal areas of Türkiye. This oil seed is differentiated from other sesame species by its unique golden color, aroma compounds, smell and as well as chemical components. The purpose of this study was to investigate the changes in metabolomics of sesame oils obtained from golden and regular sesame seeds produced by using different drying techniques throughout storage. For this purpose, a factorial design was created by considering the sesame seed type (golden and regular), drying technique (freeze, vacuum, convectional drying) and storage time (0-3-6-9-12 months) as factors. According to the design table, 30 different sesame oils were obtained and stored at +4 ℃. The metabolomics of sesame oil samples were investigated by Q-TOF-LC MS. The effects of factors and their levels on metabolomics components of sesame oils were statistically analyzed by ANOVA and Principal Components Analysis. Lignans (sesamol, sesamin, sesamolin, and (+)-pinoresinol) and phenolic acids (m-coumaric acid, ferulic acid, and syringic acid) were identified as major metabolomics. Sesamolin is the most common lignan (17.55–53.41%). found in regular and golden sesame oils. Sesamol percentages of sesame oils increased with the convection drying process. The pinoresinol percentages of golden and white sesame oils were constant during storage. The only detected flavonoid in sesame oils was apigenin-7-rutinoside (2.08–23.08 %). The findings indicated that sesame oils could be kept at +4℃ up to 9 months.

FP03

Spawn to spoon: Quality and traceability of Mediterranean Anchovies (*Engraulis encrasicolus*) through multi-element profile and machine learning

Nidhi Dalal[1], Antonio Giandonato Caporale[1], María José Sáiz[2], Diana Agrelli[1], Paola Adamo[1]
[1]*Department of Agricultural Sciences, University of Naples Federico II, Napoli, Italy;*
[2]*Research, Development and Innovation, National Centre for Food Technology and Safety (CNTA), San Adrian, Spain*

Food fraud has made food traceability an essential component for a fair and safe food network. In this study, multielement profile of Mediterranean anchovies (*Engraulis encrasicolus*) was used to discriminate between anchovies from three regions (Adriatic, Balearic, Tyrrhenian Sea) of Mediterranean Sea. Anchovies were bought from local markets over a period of 21 months from April 2021 to December 2022. Additionally, multi-element profiles (23 elements) of anchovies were compared for their quality based on location, size and season. Balearic Sea anchovies had higher concentration of K, Ca, P, Ze and Fe, and some microelements (Sr, Cu, Rb, Se, Mo), whereas anchovies from Tyrrhenian Sea exhibited higher amounts of B, Ba, V, Li, and Ni. The multi-element concentration also differed based on size and season of fishing. Machine leaning strategies were used for provenance discrimination. Linear and polynomial support vector machines (L-SVM and P-SVM), Random Forest (RF), Gradient Boost (GB), and k-nearest neighbors (k-NN) were compared (test:train ratio of 80:20, with 309 samples). GB, P-SVM, K-NN and RF had 100% classification accuracy (CA) for training set while GB, P-SVM and RF had >95% CA for testing set as well. Each model was cross-validated with internal 20-fold stratified cross-validation to check model robustness. GB, P-SVM and RF had cross-validation CA of 97.5%, 98.9% and 96.6% respectively. P-SVM model had performed slightly better than RF followed by GB based on Area under ROC curve, precision and recall scores for all models. Based on P-SVM model, discriminatory power of each element was calculated and Cu exerted maximum discriminatory power, followed by Hg, Na, Se, B, Mg, Ba, Mn, Cs and As. Out of all these elements, except Na and Mg, the rest are trace non-essential elements. Thus, non-essential trace elements are responsible for provenance discrimination of anchovies in Mediterranean Sea.

FP04

Phenolic-rich extract from chestnut by-product as a natural preservative in fish burgers

Ítala Marx[1], Feliciano Priego-Capote[1], Joana T. Martins[2,3] Fernanda L. Ludtke[2,3], Jorge M. Vieira[2,3], João Carlos Gonçalves[4] and António A. Vicente[2,3]

[1]*Department of Analytical Chemistry, Campus Rabanales, University of Cordoba, 14014, Cordoba, Spain;*

[2]*Centre of Biological Engineering (CEB), University of Minho, Portugal;*

[3]*LABBELS Associate Laboratory, Braga/Guimarães, Portugal;*

[4]*Tree Flowers Solutions, Lda, Edificio Brigantia Ecopark, Av. Cidade de Léon, 5300-358 Bragança, Portugal*

Fish-derived food products are highly perishable due to the rapid proliferation of microorganisms, naturally present or introduced through contamination. To mitigate spoilage and extend shelf life, synthetic preservatives are commonly employed; however, growing consumer demand for natural preservation strategies and concerns regarding synthetic additives have prompted the food industry to explore bio-based alternatives. Chestnut (*Castanea sativa* Mill.) by-products, characterised by a high concentration of phenolic compounds, exhibit promising antioxidant properties suitable for application as natural preservatives. This study investigates the chestnut male flower extract (CFE) phenolic profile and its potential as a natural antioxidant preservative in fish burgers. Key phenolic constituents, including phenolic acids, flavonoids, and tannins, were identified using Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS). Analysis revealed phenolic acids as the most representative group in CFE. A 10-day storage study at 4 °C was conducted to evaluate the effectiveness of CFE in preserving fish burgers. Four formulations were prepared: a negative control, a positive control containing 0.02% butylated hydroxytoluene (BHT), and two test groups supplemented with 0.25% and 0.5% CFE. Initial pH measurements were approximately 5.90 across all formulations, with minor fluctuations observed throughout storage. By day 10, the pH of the negative control decreased slightly to 5.83, whereas the BHT and CFE-treated groups maintained stable pH values. Lipid oxidation was assessed via TBARS assays. The negative control demonstrated a substantial increase in lipid peroxidation, reaching 6.80 mg MDA/kg by the end of storage. In contrast, CFE-treated samples exhibited significantly lower TBARS values (1.73 and 2.08 mg MDA/kg for 0.25% and 0.5% CFE, respectively), indicating effective inhibition of lipid oxidation, attributed to the rich CFE phenolic composition. These findings underscore the potential of CFE as a natural preservative, enhancing fish burgers' shelf life under refrigeration, and supporting the worldwide efforts to develop sustainable and health-conscious food preservation strategies.

FP05

Risk assessment of chlorpyrifos residues via consumption of tomato and cucumber. case study of Armenia

Meline Beglaryan[1], Davit Pipoyan[1], Alberto Mantovani[2], Sara Monteiro Pires[3]
[1]*Informational-Analytical Center for Risk Assessment of Food Chain, Center for Ecological-Noosphere Studies, NAS RA, Yerevan, Armenia;*
[2]*Italian National Food Safety Committee, Rome, Italy;*
[3]*National Food Institute, Technical University of Denmark, Kongens Lyngby, Denmark*

The health benefits of vegetable consumption are well-documented, however dietary exposure to pesticide residues presents a complex challenge in both developed and developing countries. Chlorpyrifos (CPF) is a widely used organophosphate insecticide, yet, concerns exist about its significant potential health risks, particularly developmental neurotoxicity (DNT).
This study aimed to quantify the levels of CPF residues in locally sourced tomatoes and cucumbers and assess the potential chronic risks associated with their consumption by the adult population of Armenia. Within the national residue monitoring program, tomato and cucumber samples were collected from various regions of Armenia and analyzed using GC-MS/MS. For dietary exposure calculations, two databases were combined: one containing CPF residue levels in samples and another containing 24-hour individual-based average food consumption data for 1400 Armenian adults. Chronic dietary exposure and associated risks were assessed by calculating the estimated daily intake (EDI) and the margin of exposure (MOE), considering the DNT lowest observed adverse effect level (LOAEL) of 0.3 mg/kg as defined by EFSA. Considering that CPF may also be genotoxic, MOE values higher than 10^4 were considered indicative of low concern.
CPF residues, with a mean concentration of 0.003 mg/kg, were detected in 28.5% of cucumber samples and 15% of tomato samples, respectively. Considering the average daily consumption of vegetables with mean residue concentration, the EDI values were 5.1×10^{-6}, 3.6×10^{-6}, and 8.7×10^{-6} mg/kg/day for cucumber, tomato, and overall consumption, respectively. MOE well above 10^4 indicated no risk to consumers.
The risk assessment showed that CPF exposure via tomato and cucumber consumption is of no concern for the general population. However, further research should include a broader variety of products and an assessment of CPF exposure levels for high consumers.

Acknowledgment: *The research was supported by the HESC of MESCS RA (Research project №24LCG-4A011).*

FP06

Kukoamines A and B in potato and pepper and their impact on κ opioid receptor signaling

Jule Fiori[1], Imen Ceteci[1,2], Harald Hübner[3], Peter Gmeiner[3,4], Monika Pischetsrieder[1,4]
[1]Department of Chemistry and Pharmacy, Food Chemistry, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany;
[2]Department of Biochemistry, Faculty of Pharmacy, Karadeniz Technical University, Trabzon, Turkey;
[3]Department of Chemistry and Pharmacy, Medicinal Chemistry, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany;
[4]FAU NeW-Research Center New Bioactive Compounds, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany

The phytochemicals Kukoamine A (KuA) and Kukoamine B (KuB) are originally known as the main physiologically active compounds in the root bark of Lycium chinense, used in traditional Chinese medicine to treat hypertension and type II diabetes. Additionally, they are present in other plants of the Solanaceae family, including vegetables, like potatoes and peppers.
Studies show physiological effects including anti-inflammatory, antioxidant, cyto- and neuroprotective effects. On receptor level, the activation of the μ opioid receptor (OR) has been demonstrated [1]. In the present study, we used receptor binding and activation assays to screen several GPCRs to better understand the mechanisms of Kukoamines, with the κOR being the most affine candidate. KuA and KuB antagonize the κOR with binding affinities of about 2 μM, indicating potential therapeutic effects against depression, anxiety and addictive disorders.
In order to evaluate if dietary Kukoamines may have physiological effects, their concentration in different food must be known.
Using LC-MS/MS, we observed that KuB is more abundant than KuA, while concentrations depend highly on varieties. In pepper, concentrations range from non-detectable to 181 and 758 μg/g dry weight KuA and KuB, respectively, with maximal concentrations in the placenta. In potatoes we found 4–21 and 11–73 μg/g dry weight KuA and KuB. Furthermore, we noticed a reduction in Kukoamines of up to 44% due to storage over several weeks and up to 78% due to frying processes. Those findings were in accordance with our results, showing comparably low concentrations of Kukoamines in processed potato products. Summing up the consumed quantities of dietary Kukoamines, concentrations in the nano- and micromolar range are awaited and therefore physiological responses at receptor level can be expected. Nevertheless, absorption and metabolism of Kukoamines need to be considered to transfer the obtained results.

References:

[1] Saller, J. et al. (2023). Food Chem 427: 136637.

FP07

Synthesis and identification of 3-oxazolines in cocoa

Heather Spooner[1], Dimitris Balagiannis[1], Andreas Czepa[2] , Barbara Suess[2], Martine Trotin[2], Paul O'Nion[3], Jane Parker[1]

[1]*Department of Food and Nutritional Sciences, University of Reading, Reading, UK;*
[2]*Mondelēz International, Reading, UK;* [3]*Reading Scientific Services Ltd, Reading, UK*

Adding water to chocolate is known to cause a large increase in the concentration of Strecker aldehydes, key aroma compounds in cocoa. 3-Oxazolines may be precursors responsible for this, however only a low concentration of 2-isobutyl-5-methyl-3-oxazoline was previously identified in chocolate. This study investigates the possibility of other types of 3-oxazolines being the relevant precursors present in cocoa. A range of novel 3-oxazolines were synthesized and characterized by gas chromatography–mass spectrometry (GC-MS) and nuclear magnetic resonance (NMR) spectroscopy. Using the synthesized compounds as references, four of these were identified by GC-MS for the first time in aroma extracts of cacao nibs, cocoa liquor and chocolate, obtained by solvent-assisted flavor evaporation (SAFE). This study may reveal a new focus for enhancing cocoa aroma, and potentially other roasted food products as well.

FP08

Lipophilization of chlorogenic acid by biodegradable biocatalysts immobilized on spent coffee grounds

Karina Jasińska, Bartłomiej Zieniuk, Rita Brzezińska, Agata Fabiszewska
Department of Chemistry, Institute of Food Sciences, Warsaw University of Life Sciences—SGGW (WULS—SGGW), 159c Nowoursynowska St., 02-776 Warsaw, Poland

Phenolic compounds found in plants and fungi are being increasingly studied for their antioxidant, anti-inflammatory, and antimicrobial properties. However, these compounds have low solubility in fats and oils, thus limiting their use in food matrices. To address this, a process called "lipophilization" is employed, which involves enhancing their solubility by adding hydrophobic moieties, such as fatty acids or fatty alcohols residues, forming esters. In Green Chemistry, enzymes known as lipases can facilitate these reactions. The study aimed to use lipases of microbial origin immobilized on food waste in enzymatic modification of chlorogenic acid with alcohol with different carbon chain lengths. The research assumed preparing the biocatalysts by adsorbing the lipases on spent coffee grounds, using obtained immobilized enzyme preparations in the esterification reaction of chlorogenic acid and alcohol with a 4-, 6-, 8-, 10- and 12-carbon chain, purification, and analysis of received esters, including their solubility, antioxidant and antimicrobial properties. As a result of the study, it was confirmed that it is possible to catalyze the above-mentioned reactions in a specific way by a waste-based biodegradable biocatalyst and obtain specific chlorogenic acid derivatives, confirmed by NMR analysis. The obtained compounds retained their high antioxidant activity, which was attributed to chlorogenic acid, but exhibited a more lipophilic character. Their hydrophilic/lipophilic structure enhances their potential for diverse applications. Relative to the substrate, these functional properties suggest that the compounds could be effectively used as additives in lipid-rich foods.

FP09

Effect of ultrasonication-assisted extraction on antioxidant capacity, phenolic, and flavonoid content of white and black garlic before and after lyophilization

Derya Ozalp Unal
Institute of Field Crops Central Research, Ankara, Turkey

In this study, garlic cultivars grown in Turkey, specifically Taşköprü garlic and its fermented form, black garlic, were subjected to different extraction and processing methods to evaluate their bioactive compound content. Ethanolic, methanolic, and aqueous extracts of both garlic types were prepared and treated with ultrasonication for 2 hours. After ultrasonication, the samples were centrifuged and filtered, and their antioxidant capacity (DPPH assay), total phenolic content (TPC), and total flavonoid content (TFC) were analyzed. Subsequently, the same garlic samples were lyophilized and subjected to another round of 2-hour ultrasonication followed by the same analytical assessments.
The results indicated that lyophilization significantly enhanced the levels of all measured bioactive compounds compared to the pre-lyophilization samples. The highest DPPH IC50 value (indicating the lowest antioxidant capacity) was observed in lyophilized, water-extracted black garlic, while the lowest IC50 value (highest antioxidant activity) was found in ethanol-extracted Taşköprü garlic. Regarding phenolic content, the lyophilized samples exhibited higher levels than their non-lyophilized counterparts. The highest TPC was recorded in lyophilized aqueous black garlic extract, followed by, in descending order, lyophilized Kastamonu methanolic extract, Kastamonu aqueous extract, black methanolic extract, Kastamonu ethanolic extract, and black ethanolic extract. A similar trend was observed for flavonoid content.
These findings suggest that both lyophilization and ultrasonication effectively enhance the bioactive properties of garlic. In particular, lyophilized black garlic extracted with water exhibited superior phenolic and flavonoid content, indicating that it may serve as a potent source of bioactive compounds with enhanced antioxidant properties. This study highlights the importance of processing methods in optimizing the functional properties of garlic for potential applications in the food and pharmaceutical industries.

FP10

Halophytic plants as natural sources of bioactive compounds for enhancing oxidative stability of edible vegetable oils

Madalena Antunes[1,2], Carla Tecelão[1], Vítor Alves[2,3] & Suzana Ferreira-Dias[2]
[1]*MARE—Marine and Environmental Sciences Centre, Associate Laboratory ARNET, Politécnico de Leiria, Peniche, Portugal;*
[2]*LEAF—Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, Universidade de Lisboa, Lisbon, Portugal;*
[3]*Associate Laboratory TERRA, Instituto Superior de Agronomia, Universidade de Lisboa, Lisbon, Portugal*

This study explores halophytes as sources of bioactive antioxidants to incorporate in frying oils, improving their quality and shelf life. Leaves from *Carpobrotus edulis* (Ce), *Crithmum maritimum* (Cm), *Corema album* (Ca), *Helichrysum italicum* (Hi), *Sedum sediforme* (Ss), and *Juniperus turbinata* (Jt) were analyzed for total fat content, chlorophyll a and b, carotenoids, fatty acid composition (FAc), and antioxidant potential. Ca showed the highest fat content (15.45 ± 0.72% DW), followed by Jt (10.64 ± 0.068% DW). Concerning FAc, Cm and Jt showed higher PUFAs content (50.37 ± 0.33% and 46.66 ± 0.75%, respectively), whereas Ss and Hi had higher SFAs content (87.92 ± 0.17% and 79.14 ± 0.79%, respectively). Hi exhibited the highest levels of carotenoids and chlorophylls content. Since chlorophylls act as prooxidants and carotenoids as antioxidants in edible oils, high carotenoid/chlorophyll ratio may indicate greater oil stabilization potential. Jt had the highest carotenoid/chlorophyll ratio (0.228), followed by Ca (0.207) and Ss (0.176). The extracts obtained by solid-liquid extraction with hexane (5% w/v) from Ca and Hi had the highest total phenolic content (2.40 and 1.88 µg EqGAE/g DW), while those from Ss and Cm had the highest flavonoid content (0.69 and 0.41 µg EqCAT/g DW). Ss extracts exhibited the highest antioxidant activity for DPPH (2.03 µg EqTrolox/g DW) and ABTS (2.53 µg EqTrolox/g DW), while Jt had the highest FRAP activity (1.93 µg EqTrolox/g DW). These results highlight the potential of halophytic plants as source of antioxidants to incorporate in oils, improving their stability and oxidative resistance in frying applications.

Acknowledgements: *This research was funded by FCT – Fundação para a Ciência e a Tecnologia (FCT), Portugal, to research units LEAF (UIDB/ 04129/2020; UIDP/04129/2020) and MARE (UIDB/04292/2020; UIDP/04292/2020). Madalena Antunes granted with a PhD scholarship from FCT (2022.11509.BD).*

FP11

***Ex-situ* cultivation of Trametes versicolor from Montesinho Natural Park under monitored conditions**

Ana Saldanha[1,2], Mikel Añibarro-Ortega[1], Gonçalo S.A. Martins[3], Higor Rosse[4], Estefânia Gonçalves[4], José Pinela[1,5], Maria Inês Dias[1], Carla Pereira[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;
[2]LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal;
[3]Ostras do Campo, Baçal estrada de Rabal, 5300-432 Bragança, Portugal;
[4]MORE – Laboratório Colaborativo Montanhas de Investigação /Edifício do Brigantia Ecopark, Avª Cidade de León 506, 5300-358 Bragança, Portugal;
[5]National Institute for Agricultural and Veterinary Research (INIAV), I.P., Rua dos Lágidos, Lugar da Madalena, 4485-655 Vairão, Vila do Conde, Portugal

Trametes versicolor is one of the 168 edible mushroom species identified in the Montesinho Natural Park. To overcome seasonal and climatic limitations to which this wild species is subjected and enable its consumption throughout the year, this study aimed to achieve its *ex-situ* cultivation. To support this process, a system employing Internet of Things (IoT) technologies and blockchain was developed to ensure data quality and reliability throughout the cultivation process. By integrating IoT technologies with blockchain, the system guarantees data immutability and enhances the overall integrity of the mushroom cultivation lifecycle. *T. versicolor* was inoculated in chestnut logs under monitored temperature and humidity conditions. Subsequently, a comparative analysis of the nutritional composition (official AOAC methods), chemical profile (sugars, organic acids, and fatty acids through chromatographic techniques), and antioxidant activity (OxHLIA and DPPH) between wild and cultivated samples was performed. The results showed that *ex-situ* cultivation significantly increased protein, fat, ash, and fiber content while reducing carbohydrate levels compared to the wild counterpart. The cultivated sample exhibited higher levels of organic acids (malic and ascorbic acids) and free sugars (fructose and mannitol), lower levels of polyunsaturated fatty acids and higher amounts of monounsaturated fatty acids. It also demonstrated greater antioxidant activity in both assays. These results demonstrated that the ex-situ cultivation of this mushroom is feasible, maintaining and even enhancing some properties of its wild counterpart. This approach contributes to the preservation of the mycological diversity of MNP and ensures the availability of this mushroom throughout the year.

Acknowledgements: *FCT/MCTES (PIDDAC): CIMO, UIDB/00690/2020 (DOI: 10.54499/UIDB/00690/2020) and UIDP/00690/2020 (DOI: 10.54499/UIDP/00690/2020); and SusTEC, LA/P/0007/2020 (DOI: 10.54499/LA/P/0007/2020); scientific employment program contract with J.P. (10.54499/CEECIND/01011/2018/CP1578/CT0002) and institutional scientific employment program contract with M.I.D. (10.54499/CEECINST/00016/2018/CP1505/CT0004) and C.P. (10. 54499/CEECINST/00016/2018/CP1505/CT0010); A.S. doctoral scholarship (2021.08346.BD). The project Safe2Taste (MTS/BRB/0056/2020, http://doi.org/10.54499/MTS/BRB/0056/2020) and respective M.A.O. research scholarship.*

FP12

Formation of Maillard reaction products in sprouted-fermented whole cereals as a result of thermal treatment

Süleyman Yıltırak[1], Vural Gökmen[1], Tolgahan Kocadağlı[1], Ecem Evrim Çelik[1], Evrim Özkaynak Kanmaz[2]
[1]*Food Quality and Safety (FoQuS) Research Group, Department of Food Engineering, Hacettepe University, 06800 Beytepe, Ankara, Turkey;*
[2]*Department of Nutrition and Dietetics, Artvin Çoruh University, 08100 Seyitler, Artvin, Turkey*

Sprouting changes the concentrations and compositions of reducing sugars and free amino acids as Maillard reaction (MR) precursors in grains. In this study, the formation of early and advanced glycation products and α-dicarbonyl compounds after heating in grains sprouted and/or fermented with sourdough/commercial yeast, separately or in combination, were examined. The sprouting process increased the formation of MR products due to the increased amount of reducing sugars. The increases in the amounts of furosine and α-dicarbonyl compounds were more significant than the increase observed in CML/CEL levels. Although there was a general decrease in the amount of reducing sugars with commercial yeast fermentation, this was not enough to reduce the furosine concentration. The main reason of this situation is that the amount of reactive lysine side chains, which can react with reducing sugars, has increased. During sourdough fermentation, the amount of furosine increased through increased glucose release from polysaccharides due to low pH. Glyoxal, methylglyoxal and diacetyl were found to be generated during yeast and sourdough fermentation as microbial metabolites. Although the amounts of MR precursors were similar in the grains examined, buckwheat was the grain with the lowest amount of MR products.

FP13

From structure to function: How microwave-assisted hydrothermal treatment modifies gluten-free flours

Ainhoa Vicente[1], Raul R. Mauro[1], Marina Villanueva[1], Pedro A. Caballero[1], Bruce Hamaker[2], Felicidad Ronda[1*]
[1]PROCEREALtech group, Research Institute on Bioeconomy (BioEcoUVa) and Department of Agriculture and Forestry Engineering, University of Valladolid, Valladolid, Spain;
[2]Whistler Center for Carbohydrate Research, Department of Food Science, Purdue University, West Lafayette, IN, USA

Native gluten-free cereal and pseudocereal flours have limited functionality, which affects the sensory properties of the products made with them and limits their use in the food industry. In order to adjust the technological characteristics of the flours to the requirements of the food industry, the physical modification of these flours by microwave-assisted hydrothermal treatment (MWT) is proposed. In this study, samples of amaranth, quinoa, buckwheat, and sorghum in both grain and flour form were subjected to MWT (25% humidity, 100 °C, 30 min) to analyse the structural changes in the main components (starch and protein) of the resulting flours and their correlation with the effects observed on their pasting properties. MWT resulted in hydrolysis of amylose and amylopectin molecules, with amylopectin molar mass decreasing by up to 39% and amylose long chains by up to 18%. MWT also disrupted the short-range molecular order of starch (1047/1022 ratio reduced by up to 23%), disordered the secondary structure of proteins (α-helix content decreased by up to 5%), and modified the morphology of starch granules and proteins. In general, these changes were more pronounced in flour treatments than in grain treatments, with the most pronounced changes in amaranth and the least marked changes in buckwheat. The pasting properties of the resulting flours were modified differently depending on the intrinsic characteristics of the treated matrices and the structural modifications. The findings of this study contribute to the understanding of the structural modifications of starch and proteins by MWT and their impact on the modification of pasting properties of the treated samples.

Acknowledgments: *Spanish Ministerio de Ciencia, Innovación y Universidades projects PID2019-110809RB-I00, EQC2021-006985-P, PID2023-153330OB-I00, and doctorate grants of A. Vicente (FPU) and R. Mauro (FPI). Junta de Castilla y León CLU 2019-04 – BIOECOUVA Unit of Excellence of the University of Valladolid.*

FP14

Lupin-enriched bakery products: a strategy for lowering glycemic index and enhancing nutritional value

Tatiana Holkovičová, Lucia Minarovičová, Michaela Lauková, Zlatica Kohajdová
Department of Food Technology, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia

The rising prevalence of metabolic disorders, such as diabetes and obesity, has driven the demand for functional foods with a lower glycemic index (GI). One strategy for improving the nutritional quality of bakery products is the partial replacement of wheat flour with protein and fiber rich alternatives [1]. Lupin (*Lupinus* spp.), a leguminous crop, has gained attention for its high protein (30–40%) and dietary fiber (15–20%) content, as well as abundance of bioactive compounds, including polyphenols and oligosaccharides, which have been linked to improved glycemic response and lipid metabolism [2].
To assess its potential benefits, this study examined the effect of substituting wheat flour with lupin flour at levels of 5–25% on the nutritional composition and GI of bread rolls. The results revealed a significant ($p < 0.001$) improvement in the macronutrient composition. The incorporation of lupin flour led to a notable increase in protein content, rising from 10.8% in the control sample (wheat rolls) to 19.75% in the 25% lupin formulation. Dietary fiber content increased nearly fourfold, from 3.24% to 13.65%, contributing to improved satiety and potential benefits for blood sugar management. Importantly, the predicted GI of the rolls decreased considerably, with values ranging from 67.49 (control) to 44.79 (LP25), classifying them as medium to low GI foods.
These findings suggest that lupin flour can improve the nutritional profile of bakery products while moderating glycemic response. Further research is needed to optimize processing and sensory characteristics to enhance consumer acceptance and facilitate broader application in commercial baking.

Acknowledgments: *This publication was supported by the grant scheme Excellent Team of STU, Slovak Republic, grant No. 1631.*

References:

[1] Zarzycki, P., Wirkijowska, A., Teterycz, D., Łysakowska, P. (2024). Appl. Sci. 14(10), 3976.
[2] Pleming, D., Farahnaky, A., Majzoobi, M. (2021). Int. J. Food Sci. Technol., 56(12), 6707–6718.

FP15

Biogenic amines detection in foods using a luminescent sensor platform

Cláudio M. R. Almeida[1], Daniela Tenreiro[1], Tiago Rato[1], Telma Costa[2], Luisa Durães[1]
[1]University of Coimbra, CERES, Department of Chemical Engineering, 3030-790, Coimbra, Portugal
[2]University of Coimbra, CQC-IMS, Department of Chemistry, Rua Larga, 3004-535 Coimbra, Portugal.

Biogenic amines (BA) are a class of nitrogen-based molecules with potential toxicological effects on humans. BAs are formed during the food spoilage and are associated to cardiovascular, neurological and gastric disorders. They also can react with nitrites and nitrates resulting in the formation of carcinogenic nitrosamines[1].
Due to the quality control patterns in the food sector, it become necessary the development of portable, easy-to-use, cost-effective and reliable analytical strategies, able to detect the presence of high levels of these compounds[2]. Optical sensors present several advantages for on-site inspection operations, mainly because they offer information without the need for complex analytical equipment[3].
In this work, we report a paper luminescent platform for BA vapours detection. The sensor probes are based on co-doped Tb^{3+} and Eu^{3+} silica films[4] containing different molecules as antenna. The developed sensors display different colours and values in the relative emission intensity ratio (I_{Eu}/I_{Tb}) induced by the amine vapours, such as cadaverine and putrescine. Tests on real samples showed the capacity of the sensor platform to detect spoilage in different foods.

Acknowledgements: *Cláudio M.R. Almeida acknowledge the PhD grant SFRH/BD/150790/2020 by Fundação para a Ciência e a Tecnologia (FCT, Portugal).*
Cláudio M.R. Almeida also acknowledge the UC Proof of Concept by Santander Foundation 2024 program for funding the ISense4Food project.

References

1 Klockow, J. L., Hettie, K. S., Glass, T. E., 2017, 2nd ed.; Elsevier, Vol. 8.
2 Li, Y., Wang, Z., Sun, L., Liu, L., Xu, C., Kuang, H.,TrAC Trends in Analytical Chemistry, 2019, 113, 74-83.
3 Almeida, C. M., Magalhães, J. M., Barroso, M. F., Durães, L., Journal of Materials Chemistry C, 2022, 10(41), 15263-15276.
4 Almeida, C. M., Pina, J., Magalhães, J. M., Barroso, M. F., Durães, L., Optical Materials, 2023, 145.

FP16

Electrochemical sensors based on molecularly imprinted polymers and nanomaterials for rapid detection of milk adulterants

Adeel Afzal

Sensors and Diagnostics Lab, School of Chemistry, University of the Punjab, Quaid-i-Azam Campus, Lahore 54590, Pakistan

Despite its detrimental impact on health due to the presence of harmful additives, milk adulteration is still one of the major food safety issues. Traditional methods for the detection of additives are highly reliable but pricey in addition to being time-consuming and utilizing high-end instrumentation. This paper discusses the design of molecularly imprinted polymers (MIPs) based electrochemical sensors with integrated nanostructured functional materials for sensitive and selective detection of adulterants in milk such as *urea*, *melamine*, and *formaldehyde*. High selectivity is maintained in MIPs, as they were synthesized using functional monomers, designed to recognize particular adulterants. Graphitic carbon nitride nanosheets and metal oxide nanoparticles are dispersed in the MIP matrices for further improvement in sensor performance. Characterization of fabricated sensors is performed by Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), and scanning electron microscopy (SEM). Electrochemical performance is tested by cyclic voltammetry (CV), differential pulse voltammetry (DPV), and electrochemical impedance spectroscopy (EIS). Results reveal that the sensors have excellent sensitivity, with detection limits in the nanomolar-to-micromolar range and fast response times. The MIP-based approach provides high specificity, effectively distinguishing target adulterants from structurally similar compounds. The developed sensors offer a cost-effective, portable, and user-friendly alternative to conventional analytical techniques, enabling on-site milk quality monitoring. This work brings into focus the potential of electrochemical sensors in ensuring food safety through possible fast and accurate detection of milk adulterants.

ABSTRACTS OF POSTER PRESENTATIONS

SESSION PP-W: WASTE-LESS FOOD PRODUCTION

PP-W01

Comprehensive valorisation of Tommy Atkins mango (*Mangifera indica* L.) pulp and by-products for sustainable agroindustrial applications

Francine Albernaz Lobo[1], M. José Jara-Palacios[2], Carla M. Stinco[3], Ana M. Benítez-González[3], Dolores Hernanz[2]

[1]*Faculdade de Nutrição, Universidade Federal do Estado do Rio de Janeiro. Brazil;*

[2]*Dept. Analytical Chemistry, Universidad de Sevilla. Facultad de Farmacia, 41012 Sevilla, Spain;*

[3]*Food Colour & Quality Laboratory, Department of Nutrition and Food Science, Universidad de Sevilla. Facultad de Farmacia, 41012 Sevilla, Spain*

The fruit of the mango tree (*Mangifera indica* L.) is characterised as one of the most harvested tropical fruits in the world, whose processing generates inevitable amounts of potential by products that present themselves as matrices rich in valuable compounds. This fact generates a need, but also an opportunity, to value them with the intention of creating new value-added products to be exploited in the food industry, encouraging a circular economy, and the promotion of more sustainable biodiversity.

This study aims to provide scientific and technological support for the valorisation and sustainable use of mango by-products.

Tommy Atkins mangoes were manually washed and peeled to obtain pulp and by-products. Five types of mango flour were analysed: three obtained from pulp, differentiated by drying method (LF: lyophilised flour, CF: conventional flour and FF: foam mat dried flour) and two from by-products (KF: kernel flour and PF: peel flour). Mini cupcakes were prepared using each flour at substitution levels ranging from 10% to 50%, selecting 35% as optimal due to improved dough properties and preliminary sensory properties. The chemical composition (phenolic and carotenoid composition) and colour parameters of the mango flour and cupcake samples were analysed. Additionally, the biological activity of the cupcakes was evaluated through in vitro digestion of bioactive extracts (phenolics and carotenoids). In the final stage, the sensory attributes of the cupcakes were evaluated by sensory analysis.

In general, pulp flour showed higher bioaccessibility of phenolic compounds, especially phenolic acids and mangiferin, while by-product flours exhibited a higher initial content of total phenolics.

Despite slight differences in sensory scores, cupcakes made with kernel and peel flour demonstrated acceptable and distinctive qualities, supporting their potential as nutritious ingredients and sustainable alternatives to reduce food waste.

Acknowledgements: *VII Plan Propio de Investigación y Transferencia (2024) US and (FAPERJ) (Process 211.022/2024).*

PP-W02

Distilled solid residue from *Rosmarinus officinalis* L. essential oil extraction as a source of bioactive compounds

Bianca R. Albuquerque[1], Virginie Xavier[1], Tiane Finimundy[1], Filipa Mandim[1], Tânia C.S.P Pires[1], Sandrina Heleno[1], Irene Mediavilla[2], Luis Esteban[2], Lillian Barros[1]
[1]*CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300- 253 Bragança, Portugal. Instituto Politécnico de Bragança (CIMO-IPB), Bragança, Portugal;*
[2]*CEDER-CIEMAT, Autovía de Navarra A-15, Salida 56, 42290 Lubia, Spain*

Rosmarinus officinalis L. (ROS), native to the Mediterranean, is widely used in culinary, cosmetic, and medicinal fields. Its essential oil, rich in bioactive compounds, has antimicrobial, anti-inflammatory, and antioxidant effects, making it valuable in pharmaceuticals, food, and cosmetics. However, its extraction generates significant organic waste [1,2].
As part of the BeonNAT project, this study explored the reuse of distilled residue (DR) from ROS essential oil production via steam distillation. Bioactive compounds in DR were extracted using maceration (ME), microwave-assisted extraction (MAE), and ultrasound-assisted extraction (UAE), and phenolic compounds were identified through HPLC-DAD-MSn. The extract's antioxidant activity was assessed using thiobarbituric reactive substances (TBARS) and cellular antioxidant (CAA) assays, while antibacterial effects were tested against eight foodborne bacteria.
As a result, MAE achieved a high extraction yield (10.3–14%); however, the extract with the highest phenolic content (10.14 mg/g extract (E)) was obtained through ME, while UAE showed lower extraction efficiency. Among the 24 identified polyphenols, rosmarinic acid was the most abundant (0.13–1.93 mg/g dry weight), followed by quercetin-3-*O*-rutinoside (0.237–1.58 mg/g dry weight). Despite UAE yielding a lower total phenolic content, its extracts demonstrated superior anti-lipid peroxidation activity (IC_{50} = 3.0–6.64 μg/mL) and cellular oxidation inhibition (82–85%). The extracts also exhibited strong antibacterial activity (MIC = 0.15–0.6 mg/mL) against *Staphylococcus aureus*, *Listeria monocytogenes*, and *Bacillus cereus*.
These findings highlight the potential of utilizing ROS-distilled residues as a sustainable source of bioactive compounds, particularly phenolics, for antioxidant and antibacterial applications.
Acknowledgments: *To the EU project BeonNat (H2020-BBI-JTI-2019), under grant agreement No 887917, the JU receives support from the European Union's Horizon 2020 research and innovation program and the Bio Based Industries Consortium, whom B. Albuquerque thanks for her contract. National funds supported this work through FCT/MCTES (PIDDAC): CIMO, UIDB/00690/2020 and UIDP/00690/2020; and SusTEC, LA/P/0007/2020*

PP-W03

Turning poultry by-products into value: functional proteins from enzymatic hydrolysis

Helena Araújo-Rodrigues[1], Sandra Borges[1], Tânia C. F. Ribas[1], Maria Leonor Castro[1], Débora Campos[2], Maria João Mota[3,4], Manuela Pintado[1]

[1]Universidade Católica Portuguesa, CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal;
[2]AgroGrIN Tech – Molecule Message Unipessoal Lda, Porto, Portugal;
[3]SORGAL – Sociedade de Óleos e Rações, S.A., São João de Ovar, Portugal; [4]SAVINOR – Sociedade Avícola do Norte S.A., Trofa, Portugal

The increasing global demand for protein-rich foods has led to a rise in poultry by-product generation. These protein-rich materials are underutilized but have potential as sources of bioactive compounds. This study evaluated the use of bromelain, a proteolytic enzyme derived from pineapple by-products, to hydrolyze poultry by-products into protein hydrolysates (PH) with bioactive properties.

Poultry by-products were subjected to enzymatic hydrolysis using bromelain. Optimal hydrolysis conditions were an enzyme-to-substrate ratio of 2.0% (w/w) during 180 min. PH was analyzed for protein content, mineral composition, molecular weight profile, antioxidant capacity, angiotensin-converting enzyme (ACE) inhibitory activity and probiotic growth support.

The optimized process yielded PH with a protein content of 56.3%. Mineral analysis showed high levels of potassium (5079 ± 268 mg/100 g), sodium, and phosphorus, with trace amounts of magnesium, copper, and selenium. Molecular weight profiling indicated that peptides were mainly <10 kDa, which are associated with higher bioavailability and bioactivity. PH exhibited antioxidant activity (ORAC: 144.41 μmol eq. Trolox/g) and ACE inhibitory effects (IC_{50}: 1585 μg protein/mL). PH at 1% (w/v) supported the growth of *Lactobacillus casei* 01 effectively, comparable to standard media. *Lacticaseibacillus rhamnosus* LGG required ≥1% PH for optimal growth.

Bromelain-assisted hydrolysis effectively valorized poultry by-products into functional protein hydrolysates with bioactive potential and mineral value. PH also supported probiotic growth, indicating its applicability in functional foods and microbiological culture media. This sustainable approach contributes to the circular bioeconomy by transforming poultry waste into valuable ingredients.

Acknowledgment: *This work has been developed within the scope of "BLUE BIOECONOMY INNOVATION PACT" (Project Nº. C644915664-00000026) financed by NextGenerationEU, under the incentive line "Agendas for Business Innovation" of the Recovery and Resilience Plan (PRR). We would also to thank the scientific collaboration of CBQF under the FCT project UID/Multi/50016/2020.*

PP-W04

Unlocking mandarin potential: Postharvest treatment effects on phenolic content

Dora Bošnjak[1], Irina Tanuwidjaja[1], Marko Vuković[2], Goran Fruk[2], Luna Maslov Bandić[1]
[1]*Department of Chemistry, Faculty of Agriculture, University of Zagreb, Zagreb, Croatia;*
[2]*Department of Pomology, Faculty of Agriculture, University of Zagreb, Zagreb, Croatia*

Mandarins have become widely popular around the world due to their subtle sweetness, unique flavor, and high nutritional value. In addition to their appealing taste, they provide numerous health benefits, including antioxidant, anticancer, anti-inflammatory and anti-diabetic effects. However, due to its perishable nature, mandarins cannot be transported or stored for an extended period. The Unshiu mandarin (*Citrus unshiu* Marc.) is the major Citrus crop in Croatia, which in 2022, together with clementines, were cultivated on 2040 ha with a total yield of 41950 t (FAOSTAT, 2024). This study investigates the effects of edible coatings formulated with guar gum (0.15%) and chitosan (0.75%), enriched with mandarin peel extract, on the postharvest quality of mandarins under both ambient (21 °C) and cold storage (5 °C) conditions. Furthermore, the influence of the application temperature of the coating solution, and including a hot water treatment at 50 °C for 3 minutes, was examined. Untreated fruits were used as the control group. Quality assessments were conducted at multiple time points and included spectrophotometric measurements of total polyphenolic content (TPC) and total flavonoid content (TFC), in the mandarin juice and the quantification of individual flavonoid compounds via HPLC analysis in the pulp. The results showed that using higher temperatures in the coating or water treatment notably improved the preservation of individual flavonoid compounds, while for total phenolic and flavonoid content, the utilization of a cold layer independently resulted in improved preservation outcomes. The content of narirutin and hesperidin examined on the last day of shelf life was 2,87 mg/g and 8,20 mg/g for hot edible coating and 3,70 mg/g and 10,94 mg/g for hot water, respectively. Also the values on the last day of shelf life for TPC was 37,32 mg GAE/100g edible part and for TFC 18,77 mg GAE/100g edible part both for cold layer treatment.

PP-W05

Evaluation of black cumin (*Nigella sativa* L.) cake as a sustainable plant-based protein source and investigation of extraction methods

Gülşah Çalışkan Koç[1], Özge Süfer[2]

[1]Uşak University, Eşme Vocational School, Food Processing Department, Food Technology Program, Eşme, Uşak, Türkiye;

[2]Food Engineering Department, Osmaniye Korkut Ata University, Osmaniye, 80000, Türkiye

Today, changing consumer preferences and rising demand for plant-based proteins are driving the importance of protein production from plant sources, supported by sustainability goals, cost-effectiveness, and growing vegan/vegetarian dietary trends. Concerns about the potential scarcity of animal-based protein sources in the future have encouraged efforts to explore alternative proteins from edible insects, algae, and plant-based sources. Additionally, negative environmental impacts of animal protein production, particularly its contribution to global warming through CO_2 emissions, have led to an increase in the popularity of plant-based proteins. Black cumin seeds (BCS) and oil have been utilized in dietary supplements, baked goods, cosmetics, animal feed, and in food and pharmaceutical industries. In recent years, BCS oil and BCS based skincare products have developed into a rapidly expanding market. Known for its antibacterial, antioxidant, anti-inflammatory, antidiabetic, and antitumor properties, BCS is also recognized for its immune-boosting and cholesterol-lowering effects. It is nutritionally rich, containing carbohydrates (30–40%), high levels of fat (30–40%), protein (20–30%), fiber (5–10%), vitamins (A, B, C, etc.), minerals (Ca, K, Mg, etc.), linoleic acid, tocopherols, polyphenols, and thymoquinone. Oil from BCS is obtained through methods such as cold and hot pressing, and supercritical CO_2 extraction. The remaining defatted seed cake, often regarded as waste, is actually rich in proteins, phenolics, essential amino acids (Arg, Asp, Glu, etc.), and bioactive compounds, giving it significant nutritional value. By removing oil from oilseeds like black cumin, protein can be extracted from the remaining cake to create sustainable plant-based protein sources. In this context, evaluating BCS cake as a plant-based protein source aligns with several United Nations Sustainable Development Goals, including Zero Hunger, Responsible Consumption and Production, and Climate Action. This study aims to investigate protein extraction methods from black cumin seed cake and to explore its potential use as a novel protein source.

PP-W06

Development and characterization of pH-sensitive biopolymer-based smart films for food freshness monitoring

Saliha Esin Çelik[1], Saida Huseynova[2], Betül Özdemir Şenyer[1], Reşat Apak[1,3]
[1]*Istanbul University-Cerrahpaşa, Faculty of Engineering, Department of Chemistry, Avcilar 34320, Istanbul, Turkiye;*
[2]*Istanbul University-Cerrahpaşa, Institute of Graduate Studies, 34320, Avcilar, Istanbul, Turkiye;*
[3]*Turkish Academy of Sciences (TUBA), Vedat Dalokay Caddesi No: 112 06670, Çankaya, Ankara, Turkiye*

Biopolymer-based films have emerged as promising materials for improving food quality and safety, extending shelf life, and enhancing stability as part of innovative packaging and processing technologies. This study focuses on the production and characterization of environmentally friendly biopolymer-based food packaging films composed of carboxymethyl cellulose (CMC), carrageenan (CAR) and polyvinyl alcohol (PVA). pH-sensitive anthocyanins were incorporated to enable real-time food freshness monitoring. Industrial *Aronia melanocarpa* fruit juice pulp was used as a sustainable anthocyanin source, contributing to waste valorization. Aronia pulp powder extracts (APPE) were obtained through an optimized ultrasonic extraction process. Given that anthocyanins are highly susceptible to degradation due to environmental factors such as light and temperature, microencapsulated aronia pulp powder extracts (MAPPE) were synthesized by forming molecular inclusion complexes with β-cyclodextrins to enhance stability (encapsulation efficiency: 55 ± 3%). Structural and physicochemical characterization of the microcapsules was conducted using Fourier-transform infrared and ultraviolet-visible spectroscopy, differential scanning calorimetry, and scanning electron microscopy (SEM).

Time- and temperature-dependent stability studies revealed that microencapsulation significantly improved anthocyanin stability. The physical, optical, colorimetric, mechanical, thermal, and morphological properties of biopolymer films were evaluated. Furthermore, total antioxidant capacity, radical scavenging activity, and total anthocyanin content were analyzed. The antibacterial activity of the films against *E. coli* and *S. aureus* was also assessed. The smart films were successfully applied for real-time monitoring of fish freshness. The films exhibited clear colorimetric changes, effectively tracking freshness over a period of 0–96 hours at room temperature and 48–96 hours under refrigeration (+4°C). These findings demonstrate the potential of biopolymer-based smart packaging as a sustainable and functional solution for the food industry, providing real-time quality assessment and reducing food waste.

Acknowledgment: *The authors would like to thank to Scientific Research Projects Coordination Unit of Istanbul University-Cerrahpasa for the financial support given to Research Project FBA-2023-36519.*

PP-W07

Photooxidation of biotin

Anna Gabel, Nina Eisfeld, Kristina Fleischer, Michael Hellwig
Chair of Special Food Chemistry, TU Dresden, Dresden, Germany

Biotin is a water-soluble vitamin and an essential component of human nutrition. As a coenzyme of various carboxylases, the vitamin is involved in carbohydrate, protein and fatty acid metabolism [1]. Biotin also participates in gene regulation and gene expression [2]. To maintain these functions, EFSA recommends a daily intake of 40 µg of biotin for adults, which can be obtained from a balanced diet [3]. Many supplements contain biotin in combination with other vitamins, including riboflavin, which is a known photosensitizer [4]. This may cause oxidation of biotin in the supplements.

The aim of this work was to investigate the photostability of biotin. Besides the known oxidation products biotin sulfoxide and biotin sulfone, further degradation products were to be identified and analysed in supplements.

First, the photosensitized degradation of free biotin in the presence of the photosensitizer riboflavin was investigated in a model system. In addition, various supplements were analysed with regard to the photooxidation of biotin. The measurements were performed by HPLC-QQQ-MS.

Biotin was determined to be highly susceptible to photooxidation in the presence of riboflavin. In addition to biotin sulfoxide, three other mono-oxidised biotin derivatives are formed during photooxidation. One of them, a hemithioacetal of biotin, has been characterised. The identification of further degradation products and the analysis of supplements with regard to the degradation of biotin are still open.

Biotin is highly degraded during photooxidation in the presence of riboflavin, which may reduce the bioavailability of biotin in supplements and foods.

***References* :**

[1] Karachaliou, C. ; Livaniou, E. *Int. J. Mol. Sci.* 25 (2024). 6578.
[2] Zempleni, J. Et al. *Biofactors* 35.1 (2009). 36–46.
[3] EFSA NDA Panel. *EFSA Journal* 12(2):3580 (2014). 24 pp.
[4] Cardoso, D. et al. *Food Funct.* 3 (2012). 487–502.

PP-W08

AutoPro: An automated bioprocess for the cultivation of the microalgae *Galdieria sulphuraria* for improved utilization of aquacultural side streams

Corina Kleps[1], Stephanie Schönfelder[1], Sandra Grebenteuch[1], Daniel Pleissner[1], Michael Ogurek[2]
[1]*Institute for Food and Environmental Research (ILU e. V.), Bad Belzig, Germany;*
[2]*Institute for Automation and Communication, Magdeburg, Germany*

In 2021, Vietnam's aquacultures produced 3.3 M t fish, 1 M t shrimps and 0.5 M t other species, with residuals being usually emitted to the environment. The use of macroalgae and autotrophic microalga to produce food and fodder in free water and aquaculture has a tradition in Vietnam, while heterotrophic algae cultivation is widely unknown. Even though the cultivation of *Galdieria sulphuraria* on various organic residues has been proved, an industrial implementation, which allows a decentralized utilization, has not been achieved. The reasons are uncertain yield forecasts and challenging process control when organic residues are applied as complex nutrient source.
The project aims at overcoming associated challenges and implementing a (digital twin) and automated process control for the cultivation of *G. sulphuraria* to steer aquacultures towards resource efficiency.
Aquacultural residues to be used in AutoPro are unused feed material as well as wet and solid organic side streams appearing at aquacultures in Vietnam. A mathematical model describing substrates-related changes in the biochemistry of *G. sulphuraria* will be developed.
Based on data from metabolic analysis of both substrates used and biomass gained, a model has been developed that includes all essential fractions (biomass, liquids, chemicals), kinetics (growth, respiration, enzymatic reactions) and stoichiometric dependencies to describe the process under varying operational conditions and production targets.
The model was iteratively validated by comparison with experimental data and contributes to model future cultivation processes. The formed protein rich algal biomass can be applied as feed for shrimps, and thus contributes to an on-site circular biomass and nutrient management.

Acknowledgements: *Funding of this project by the German Federal Ministry of Education and Research is gratefully acknowledged. Funding agreement: 031B1434A.*

PP-W09

Clustering analysis of European countries based on food waste, carbon footprint, and sustainable food chemistry practices

Didem Guleryuz[1], Erdemalp Ozden[2]
[1]*Faculty of Applied Science, Bayburt University, Bayburt, Türkiye;*
[2]*Faculty of Economics and Administrative Sciences, Bayburt University, Bayburt, Türkiye*

Food production and consumption play a critical role not only for food security and economic development, but also for environmental sustainability and public health. Ecological impacts such as food waste, greenhouse gas emissions, pesticide use and chemical fertilizers pose significant challenges for policy makers and researchers. This study examines European countries in terms of sustainable food waste, carbon footprint and chemical impacts and clusters countries with similar characteristics.

The study uses five key indicators: (i) food waste per capita, (ii) agricultural greenhouse gas emissions, (iii) pesticide use, (iv) organic agriculture as a share of total agricultural area, and (v) chemical fertilizer use. In addition, the indicators determined by analyzing the policies of the European Union overlap with sustainable development goals. Food waste reflects consumption patterns and resource management efficiency, while agricultural emissions are an important indicator of carbon footprint. The use of pesticides and chemical fertilizers was chosen to examine the environmental impacts of food chemistry practices, while the proportion of organic farming was chosen to show the transition to ecological farming practices. In this study, k-means algorithm, a data mining and AI-based method, is applied to cluster EU countries. This method is preferred over traditional statistical approaches due to its scalability, adaptability and effectiveness in analyzing high-dimensional data. In addition, certain patterns were identified across countries in terms of sustainability, classifying countries with high food waste and greenhouse gas emissions, regions where organic and integrated agricultural practices are widely adopted, and countries where the use of pesticides and chemical fertilizers creates environmental pressure.

The research results provide important contributions in identifying priority policy intervention areas and identifying countries that have successfully implemented sustainable food practices. The findings provide a comprehensive perspective on sustainability in the agri-food sector, supporting science-based decision-making by policy makers, researchers and supply chain managers.

PP-W10

Recycled plastics in focus: Analytical strategies for assessing food contact safety

Elise Hecht, Andrea Hochegger, Erich Leitner
Institute of Analytical Chemistry and Food Chemistry, Graz University of Technology, Graz, Austria

To support the transition towards a circular economy for plastics, the European Union has set ambitious targets for the recycling and reuse of packaging materials, including food-packaging. By 2030, the minimum content of post-consumer recycled (PCR) plastic should be 30% for PET-based packaging and single-use plastic bottles, and 10% for non-PET packaging in contact-sensitive applications.[1]
This is supported by the recently introduced Regulation (EU) 2022/1616, which deals specifically with recycled plastics intended for food contact. In this regulation, a framework for the development of new recycling technologies (novel technologies) for polymers beyond PET is established. Products that result from a novel technology are allowed to enter the market before the process is fully evaluated and authorized by the European Food Safety Authority (EFSA). To ensure that the materials meet the safety standards for food contact materials set out in regulations (EC) No 1935/2004 and (EU) No 10/2011, strict monitoring and regular safety reports are required. This includes providing detailed data on contaminants in both the input and the output material of the recycling process.[2]
However, to date, no standardized analytical methods are available to generate the required data. Therefore, the aim of this work is to characterize different post-consumer recycled plastics, focusing on polyolefins such as HDPE, LDPE or PP. This is done by applying different sample preparation methods such as solid-phase microextraction (SPME), solvent extraction or migration experiments. These are then combined with targeted and untargeted analytical methods, primarily based on gas chromatography (GC-FID, GC-MS, GC×GC-ToFMS) as well as liquid chromatography. In addition, a genotoxic screening of the materials is performed. The resulting data will contribute to the development of a comprehensive database, which will serve as a foundation for an automated assessment strategy for PCR plastics.

[1] http://data.Europa.eu/eli/reg/2025/40/oj
[2] http://data.Europa.eu/eli/reg/2022/1616/oj

PP-W11

Comprehensive analyses of brewery spent grains chemical composition

Andrejs Banis, Tatjana Kince, Zanda Kruma, Darius Sargautis

Food Institute, Faculty of Agriculture and Food Technology, Latvia University of Life Sciences and Technologies, Jelgava, Latvia

Brewers' spent grain (BSG) constitutes approximately 85% of the total by-products produced during the beer brewing process however its rich nutritional profile also makes it a promising source for the development of food-grade protein concentrates and other valuable products. The present study aimed to conduct a comprehensive chemical composition analysis of light and dark BSG, with a view to exploring their potential for use in the development of new products. 11 BSG samples (from Latvia's largest breweries, as well as from several small breweries) using standard methods were analysed for protein, dietary fibre, fats content and amino acids profile as well as for phenolic compounds and antioxidant activity. In this study, sample 6 (dark BSG), which exhibited the highest protein (influenced by factors such as barley genotype, brewing process, and the timing of extraction) and fat content (can be attributed to differences in beer styles) along with moderate fibre levels, appears to be well-suited for further extraction processes. Its composition closely aligns with the characteristics of optimal substrates used in enzymatic extraction methods. In contrast, sample 11 (light BSG), has high fibre content. These findings provide insight into the broader technological context – while high fibre content is nutritionally beneficial, it may hinder extraction efficiency unless selectively removed or enzymatically degraded. Analysed amino acid profile shows high levels of glutamic acid, proline, and leucine in samples 1, 5, and 9, indicating potential for applications functional products, however sample 9 offers the most balanced, nutrient-rich composition overall. BSG may serve as a source of phenolic compounds and other antioxidants, with results indicating significantly higher concentrations in dark BSG samples.

***Acknowledgement**: Research has been conducted within the project VP46 Research-based solutions for sustainable agri-food system addressed to the European Green Deal objectives (GreenAgroRes), Nr. VPP-ZM-VRIIILA-2024/1-0002.*

PP-W12

Optimized recovery of valuable bioactive fractions from CO_2-delipidated hop residues using pressurized ethanol extraction

Nóra Emilia Nagybákay[1], Michail Syrpas[1], Andrius Jaskūnas[2], Aušra Šipailienė[1], Petras Rimantas Venskutonis[1], Vaida Kitrytė-Syrpa[1]

[1]*Department of Food Science and Technology, Kaunas University of Technology, Kaunas, Lithuania;* [2]*Department of Physical and Inorganic Chemistry, Kaunas University of Technology, Kaunas, Lithuania*

Hops (*Humulus lupulus* L.) are widely used in brewing for their aroma- and bitterness-enhancing compounds. Although hop cones or pellets are used during brewing, standardized extracts are increasingly favored for consistent flavor and quality control. Supercritical CO_2 extraction (SFE-CO_2) is commonly employed at an industrial scale to produce hop extracts, rich in bitter acids and essential oils. However, the resulting hop biomass is often discarded or used as fertilizer, despite being a valuable source of phytochemicals, particularly prenylated flavonoids. Among these, xanthohumol (XN) has attracted significant interest for its broad range of health benefits, including antioxidant, anti-inflammatory, antimicrobial, and anticancer properties [1,2].

This study aimed to optimize pressurized ethanol extraction (PLE-EtOH) to valorize dual-purpose hop (variety Ella) residues remaining after SFE-CO_2, targeting the production of extracts with high XN content, strong *in vitro* antioxidant and antimicrobial activity. CCD-RSM was used to assess the effects of PLE-EtOH temperature and time, identifying two optimal extraction conditions: (1) 40 °C for 15 minutes to maximize XN content, and (2) 85 °C for 18 minutes to achieve high antioxidant yield. PLE at 40 °C yielded an extract with 83.5 mg/g of XN, which showed strong inhibitory activity against *Staphylococcus aureus*, while extraction at 85 °C resulted in ~2-fold higher yield, total phenolic content and enhanced oxygen radical absorbance capacity. Physical modelling of the PLE-EtOH was additionally carried out using Aspen Plus® software, enabling assessment of its scalability and suitability for industrial-scale applications. Rich in valuable bioactive constituents, extracts from residual hop biomass could find multipurpose applications in the food, pharmaceutical, nutraceutical, and cosmetics industries

References:

1. Karabín, M., et al. Biologically active compounds from hops and prospects for their use. *Compr. Rev. Food Sci. Food Saf.*, 2016, *15*, 542–567.

2. Sanz, V., et al. What is new on the hop extraction? *Trends Food Sci.Technol.,* 2019, *93*, 12–22.

PP-W13

Flavor profile of rapeseed and sunflower fiber matrix upon adsorption of tart cherry flavour compounds

Dubravko Pichler[1], Vesela Chalova-Zhekova[2], Ivana Ivić[3], Josip Šimunović[4], Anita Pichler[3], Mirela Kopjar[3]
[1]*Water Supply-Osijek, Osijek, Croatia;*
[2]*Department of Biochemistry and Molecular Biology, University of Food Technologies, Plovdiv, Bulgaria;*
[3]*Faculty of Food Technology Osijek, Josip Juraj Strossmayer University, Osijek, Croatia;*
[4]*Department of Food, Bioprocessing and Nutrition Sciences, North Carolina State University, Raleigh, USA*

Rapeseed and sunflower meals are obtained as by-products after oil production. Usually, this material is utilised for extraction of proteins, however after extraction there is still considerable amount of fibres. These by-products contain over 60% of fibres mostly insoluble fraction and these matrices have characteristic flavour.

The aim of this research was to explore possibility of utilisation of rapeseed and sunflower fibres as carriers for flavour compounds of tart cherry juice with the goal to mask natural flavour of fiber matrix. For the preparation of dried powders, fibers were complexed with tart cherry juice followed by freeze-drying to obtain dry powders, rapeseed fibres/tart cherry flavours (RF/TC) and sunflower fibres/tart cherry flavours (SF/TC) powders. Flavour compounds of tart cherry juice, fiber matrices and dried powders were extracted by SPME technique and were analysed by GC-MS.

Determined compounds were divide into acids, alcohols, carbonyl compounds, terpenes and esters and by their flavour description. Tart cherry juice has characteristic flavour, and the most abundant compounds were benzaldehyde and benzyl alcohol, making 50% of total flavour compounds, both of them characteristic by almond, sweet flavour note. Compering sunflower and rapeseed fiber matrix, sunflower contained much higher amount of flavour compounds. Sunflower fibers were characterised dominantly by green, followed by citrus and oily flavour notes. Rapeseed fibers were also characterised dominantly by green, followed by equally sweet and oily flavour notes. Adsorption of tart cherry flavours onto fibers changed their flavour profile. Both fibers adsorbed almond flavour compounds. RF/TC powders retained green and citrus flavour notes while oily note was less pronounced. All major flavour notes of sunflower fiber decreased after adsorption of tart cherry flavours.

Results obtained through this investigation showed that by-products can be used as carriers of flavour compounds changing its flavour profile.

PP-W14

Valorisation of cabbage core: Composition and potential use in plant-based products

Anda Dubrovska, Evita Straumite, Ruta Galoburda, Ilze Gramatina, Zanda Kruma
Food Institute, Latvia University of Life Sciences and Technologies, Jelgava, Latvia

Cabbage processing generates a considerable amount of by-products, with the core typically discarded despite its potential nutritional and functional value. As sustainability and zero-waste approaches gain importance in the food industry, valorising such by-products becomes essential. This study explores the potential of cabbage core as an ingredient in new plant-based food formulations, focusing on its compositional and functional properties in both fresh and freeze-dried forms.

Fresh cabbage by-products were obtained from local food processing companies and sorted into two subgroups: (1) the solid core (central stem) and (2) the adjacent leaf portions surrounding the core. Samples were pretreated by steaming and blanching to preserve quality and reduce enzymatic activity. A total of four samples were obtained. Further samples were freeze-dried to produce stable, powdered samples for further testing. Initial analyses included determination of moisture content, rehydration ratio, total fiber content, total phenolic content, and antiradical activity. The powdered form was incorporated into a model plant-based formulation to assess its impact on functionality, taste, and texture.

The dried powder showed high dietary fiber content (27.49±0.32 to 29.79±0.50 g 100 g^{-1}) and a notable concentration of phenolic compounds. The product rehydration ratio ranged from 3.9±0.2 to 4.6±0.1 depending on sub-group and pretreatment applied. In preliminary evaluations, when added to powdered potato puree formulations, the cabbage core powder did not negatively impact texture or sensory acceptability.

Cabbage core, traditionally considered waste, exhibits valuable nutritional and functional properties. Freeze-dried cabbage core powder can serve as a fiber-rich, phenolic-containing ingredient in plant-based formulations, promoting waste reduction and product diversification.

Acknowledgements: *Research was funded by the program strengthening the institutional capacity of LBTU for excellence in studies and research (ANM1) Project No. 5.2.1.1.i.0/2/24/I/CFLA/002.*

PP-W15

The potential of *Quercus suber* flour for sustainable food applications

Maria Luz Maia[1], Cristina V. Rodrigues[1], Pedro Babo[2], Manuela Pintado[1]
[1]*Universidade Católica Portuguesa, CBQF – Centro de Biotecnologia e Química Fina – Laboratório Associado, Escola Superior de Biotecnologia, R. de Diogo Botelho 1327, 4169-005 Porto, Portugal;*
[2]*LandraTech, Largo do Esteiro 6, 2050-261 Azambuja, Portugal*

Quercus trees cover 34% of Portugal's forests and produce 300 thousand tons of nutrient-rich acorns annually. Acorns are rich in fatty acids, phenolic compounds, and minerals. Their co-products offer bioactive compounds, reducing waste and promoting upcycling, making them a strategic resource for sustainability and functional food innovation in the food sector. This study aimed to evaluate the nutritional composition of *Quercus suber* flour, provided by Landratech, from different locations, namely, Santiago do Cacém (JM), Ferreira do Zêzere (VM), Castelo Branco (JS) and Courelas de Azaruja (PAS).
The moisture content ranged between 9.33±0.00% (w/w) for JM to 13.74±0.00% (w/w) for JS and PAS. The ash and protein content were lower for PAS, 1.96±0.01% dry weight (DW) and for JS 7.60±0.00% DW, respectively, and higher for JM (3.39±0.53% DW and 11.58±0.62% DW, respectively). Total lipid and total sugar content were higher in JM (7.15±0.80%), and in JS (33.62±7.83 mg glucose equivalents/g DW), respectively. Total starch content was highest in the JS sample (32.62±1.29% DW), which was harvested further north. Vitamin E values ranged from 9.86±0.27 mg/100g DW for PAS (harvested further south) to 12.12±0.18 mg/100 g DW for JS. The mineral profile was similar across samples, with K, P, and Mg as the predominant elements. The fatty acids profile was also consistent, with oleic acid (C18:1 n-9c) at 58–65%, linoleic acid (C18:2 n-6c) at 18–24%, and palmitic acid (C16:0) at 12–14%. The total phenolic compounds and total tannins in the extracts, revealed values of 23.48±1.59 mg gallic acid equivalents (GAE) /100 g DW and 17.82±0.87 mg GAE/100 g DW in PAS, compared to 37.97±3.48 and 34.20±3.91 mg GAE/100 g DW for JS, respectively.
Overall, the characterization of a corn flour from *Q. suber* highlights the significant potential of native Portuguese oaks as valuable raw materials for sustainable and innovative food applications.

PP-W16

Upcycling olive pomace to improve the nutritional profile of breaded foods

Ítala Marx[1,2], Carlos Ledesma-Escobar[1,2], Ana Castillo-Luna[1,2], Mónica Calderón-Santiago[1,2], Mario Marostica[3], Feliciano Priego-Capote[1,2]

[1]*Department of Analytical Chemistry, University of Cordoba, Spain;*

[2]*Chemistry Institute for Energy and Environment, University of Cordoba, Spain;*

[3]*Food Science and Nutrition Department, School of Food Engineering, The State University of Campinas, 13083-862, Campinas, São Paulo, Brazil*

The disposal and recycling of olive oil production by-products remain significant challenges in olive oil-producing regions. Olive pomace, which accounts for approximately 80% of the total olive mass, is often underutilised despite being a rich source of phenolic compounds with antioxidant properties. This study explores an upcycling strategy by incorporating olive pomace powder into breaded food formulations to reduce lipid oxidation and enhance nutritional profile. Two food models—chicken and hake—were breaded using two flour options: commercial whole wheat flour (control) and flour enriched with 10% olive pomace powder. The samples were cooked in an air fryer with the addition of 7.5% (w/w) of three different oils: ordinary olive oil (OOO) and monovarietal extra virgin olive oils (EVOOs) from the Arbequina (AR) and Picual (PI) cultivars. Consumer acceptability was also evaluated using a 9-point hedonic scale. Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS) analysis allowed the identification of more than 30 phenolic compounds in olive pomace powder, with 3,4-DHPEA-EDA being the most abundant. Hydroxytyrosol and its derivatives were found in all cooked foods breaded with enriched flour. TBARS analysis demonstrated that enriched breaded samples exhibited lower lipid oxidation than the control across all oil types. In enriched breaded chicken, TBARS values decreased from 1.252 mg MDA/kg (OOO), 1.0658 mg MDA/kg (AR), and 0.986 mg MDA/kg (PI) in the control samples to 1.0259 mg MDA/kg, 0.7035 mg MDA/kg, and 0.5439 mg MDA/kg, respectively. Sensory evaluation indicated that the enriched formulations were well-accepted by consumers, with scores comparable to conventional products. Enriched breaded chicken samples presented higher taste and overall acceptance scores compared with those breaded with control flour. These findings highlight the viability of upcycling olive pomace into a value-added ingredient for breaded foods, contributing to waste valorisation while aligning with global efforts to promote health-focused and environmentally friendly food innovations.

PP-W17

Giving juice intermediates an opportunity: From bioactives characterization to innovative food developments

Raquel Nunes da Silva[1,2], Bárbara Maurício[2,3], Jorge Vieira[4,5], Irina Ribeiro Alves[6], Maria João Alegria[6], Rui Rodrigues[4,5], Ana Fernandes[2], Iva Fernandes[1,2], António Vicente[4,5], Nuno Mateus[1,2], Victor de Freitas[1,2]

[1]*Chemistry and Biochemistry Department, Faculty of Sciences, University of Porto, Rua do Campo Alegre 689, 4169-007 Porto, Portugal;*

[2]*LAQV-REQUIMTE, Chemistry and Biochemistry Department, Faculty of Sciences, University of Porto, Rua do Campo Alegre 689, 4169-007 Porto, Portugal;*

[3]*Faculty of Engineering, University of Porto, s/n, R. Dr. Roberto Frias, 4200-465 Porto, Portugal;*

[4]*CEB – Centre of Biological Engineering, University of Minho, 4710-057 Braga, Portugal;*

[5]*LABBELS – Associate Laboratory, Braga/Guimarães, Portugal ;*

[6]*SUMOL+COMPAL Marcas S.A, Estr. Portela 24, 2790-179 Carnaxide, Portugal*

Despite efforts, fruit consumption remains insufficient. Developing nutrient-rich, convenient foods can promote healthier eating while valorising phytochemical-rich fruit by-products, reducing waste, and supporting a circular economy.

This study up-cycles fruit pulp into innovative food formulations, reducing potential waste while enhancing nutrition and fruit consumption.

Samples from a Portuguese juice producer were analyzed for their polyphenol and vitamin content, as well as antioxidant activity, using colorimetric and chromatographic techniques. Further studies focused on developing functional foods by combining these bioactive-rich ingredients with cherry and bilberry extracts to enhance color. To refine texture and mouthfeel, ingredients such as agave syrup and maltodextrin were incorporated. The bioactive profile, texture, water content, color measurements, and mechanical properties of the products were evaluated to ensure their nutritional value and functional performance.

In collaboration with the food industry, we analyzed pulps for bioactive compounds and food application potential. These products retained 80% and 66% of their polyphenol content (quantified by Folin-Ciocalteu and HPLC, respectively), with antioxidant activity retention of 84% (DPPH) and 90% (FRAP). Dehydration provided the best texture, while agave syrup enhanced flavor and appearance. Furthermore, the combination of agave syrup and maltodextrin enhanced texture, reducing hardness, chewiness, and gumminess compared to 100% pulp only. Water activity was optimized at 0.60. Various formulations were developed, resulting in functional, nutrient-enriched food prototypes, leading to stability and improved consumer appeal.

By transforming pulps into value-added food products, this work contributes to sustainability, waste reduction and public health. These innovations promote a circular economy, enhancing sustainability and healthier dietary options in the food industry.

Acknowledgements: *This work was supported by FCT/MCTES through national funds (LA/P/0008/2020 DOI 10.54499/LA/P/0008/2020, UIDP/50006/2020 DOI10.54499/UIDP/50006/2020, and UIDB/50006/2020 DOI10.54499/UIDB/50006/2020) and by the Agenda VIIAFOOD project (C644929456-00000040), funded by the PRR – Recovery and Resilience Plan and the European NextGeneration EU Funds.*

PP-W18

Unveiling the acetogenin profile of avocado: LC-IMS-MS/MS Analysis of bacon, fuerte, and hass tissues (peel, pulp and seed)

María Gemma Beiro-Valenzuela[1], Lucía Olmo-García[1], Sara Rodríguez-Rodríguez[1], Aiub Mohamed-Barara[1], Romina P Monasterio[1], Irene Serrano-García[1], Elena Hurtado-Fernández[2], Romina Pedreschi[3], Alegría Carrasco-Pancorbo[1]

[1]*Department of Analytical Chemistry, Faculty of Sciences, University of Granada, Granada, Spain;*

[2]*Department of Biological and Health Sciences, Faculty of Health Sciences, Loyola University (Universidad Loyola Andalucía), Sevilla, Spain;*

[3]*Facultad de Ciencias Agronómicas y de los Alimentos, Escuela de Agronomía, Pontificia Universidad Católica de Valparaíso, Quillota, Chile*

Acetogenins, bioactive compounds derived from C-18 fatty acids, are naturally present in various avocado tissues such as peels, pulp, seeds, and leaves. They play a crucial defensive role against herbivores and fungal infections, with notable antimicrobial properties, including inhibition of bacterial endospore germination and listericidal activity. These properties have attracted the food industry's interest, positioning acetogenins as natural alternatives to synthetic additives, aligning with clean label and sustainability trends.

This study aimed to optimize acetogenin extraction, establish optimal separation and detection conditions, analyze their distribution across avocado tissues, identify varietal differences, and assess whether their levels varied with fruit ripening. pulp, peel, and seed samples from three avocado varieties—Bacon, Fuerte, and Hass—were analyzed at different ripening stages using LC-IMS-MS/MS. A total of 180 samples were examined, with 5 replicates per tissue, variety, and ripening stage, each consisting of 6 fruits.

Extraction protocols were optimized, testing different solvents and extraction cycles. The optimal method was solid-liquid extraction with methanol in a single cycle, without a clean-up step. Chromatographic parameters like column type, flow rate, and temperature were also assessed to optimize separation conditions.

A comprehensive acetogenin profile was established, identifying 21 metabolites, including several isomers, and 3 fatty acid derivatives. Quantitative analysis revealed that AcO-avocadene was the dominant acetogenin in Bacon seeds, while persenone B was most abundant in Fuerte and Hass seeds. In the peel, persenone A dominated in Bacon, AcO-avocadene in Fuerte, and persin in Hass. The pulp showed similar trends. Principal Component Analysis (PCA) indicated that acetogenins could serve as varietal markers.

This study presents improved extraction and determination methods for acetogenins and contributes valuable insights into their role in avocado, paving the way for the potential valorization of avocado by-products.

PP-W19

Nutritional valorization of fermented melon by-products: novel sustainable ingredients?

Mariana Santos Domingues[1,2], Mafalda Alexandra Silva[1,3], José M. Pestana[2,4], Helena S. Costa[1,3], Tânia Gonçalves Alburquerque[1,3]
[1]*Department of Food and Nutrition, National Institute of Heath Dr. Ricardo Jorge, Lisbon, Portugal;*
[2]*Escola Superior de Hotelaria e Turismo do Estoril, Estoril, Portugal;*
[3]*Faculdade de Farmácia da Universidade do Porto/REQUIMTE-LAQV, Porto, Portugal;*
[4]*Centro de Investigação, Desenvolvimento e Inovação em Turismo/CITUR, Estoril, Portugal*

Although often disregarded as by-products of melon processing, both the peel and seeds contain valuable nutrients and bioactive compounds, making them promising candidates for fermentation studies. To investigate the feasibility and effectiveness of lactic and alcoholic fermentation applied to melon peel, seeds, and by-products, with the goal of evaluating their potential for developing value-added products and promoting sustainability in melon processing.
During 2023, melon by-products, seeds and peels were collected in a hotel in the Lisbon region. After adding 2% salt (lactic fermentation) or 2% sucrose (alcoholic fermentation) of the total weight of melon by-products/seeds or peels, bags were sealed under vacuum and maintained for 7 days at 27 °C ± 1 °C. Samples were homogenized in a blender, dehydrated (55 °C; 12h), homogenized and sieved to obtain flour. The energy and carbohydrates content were calculated after the determination of the nutritional composition (moisture, ash, total protein and fat, dietary fibre and salt) of the fermented products. Six products were obtained: lactic/alcoholic fermented melon by-products flour, lactic/alcoholic fermented melon peel flour, and lactic/alcoholic fermented melon seed flour. According to Regulation (EU) No. 1924/2006, all products (100%) are rich in dietary fiber (>6 g/100 g), and 83% are high in protein (>20% of energy value). Additionally, lactic/alcoholic fermented melon peel flour has a low-fat content. This study emphasizes that cost-effective processes, such as fermentation, can simultaneously reduce waste and generate value-added products, promoting sustainability in melon processing and the development of innovative functional food ingredients.

PP-W20

Potential of currant pomace for stabilisation of oil-in-water-emulsions

Larissa Vivienne Sankowski, Kai Nolte, Rocío Morales-Medina, Stephan Drusch, Monika Brückner-Gühmann

Faculty III Process Sciences, Institute for Food Technology and Food Chemistry, Department of Food Technology and Food Material Science, Technische Universität Berlin, Berlin, Germany

Zero-waste concepts encourage the integration of by-products such as currant pomace into food systems through almost complete utilisation of raw materials and their fractions. Besides the stabilisation of oil-in-water-emulsions with protein-rich extracts from the seed fraction, the fibre fraction offers the opportunity for particle-based stabilisation. However, a major challenge is the high sedimentation tendency of the fibre particles and, thus, their emulsifying properties and the stability of the emulsion depend on the size and shape of the particles and their wettability. Therefore, a combination of thermo-mechanical functionalisation of the fibre fraction is required to obtain a reduction in particle size, a low sedimentation tendency and a sufficient wetting of the fibre particles.

This study investigates the stabilisation of oil-in-water-emulsions with currant pomace fractions at an oil content of 30% or more, suitable for application in cream desserts and mayonnaise-like sauces. Specifically, emulsifying properties of protein-rich extracts from the seed fraction were compared with those of thermo-mechanical functionalised fibre fraction at higher oil content (30%). Furthermore, the particle-based stabilisation of functionalised fibre fraction at different oil contents (10%, 30%, 50%) was studied in more detail. Composition, particle size distribution, water retention and oil holding capacity of the fibre fraction were analysed. The microstructure of emulsions was evaluated by determining particle size and/or droplet size distribution, stability/phase separation and rheological characterisation (i.e. viscosity, amplitude and frequency response).

Thermo-mechanical functionalisation of the fibre fraction enabled the stabilisation of oil-in-water-emulsions independent of the oil content, highlighting its potential and indicating its promising use as particle-based stabiliser.

Acknowledgements: *This IGF Project (AiF 20917 BG) of the FEI was supported within the programme for promoting the Industrial Collective Research (IGF) of the Federal Ministry of Economic Affairs and Climate Action (BMWK), based on a resolution of the German Parliament.*

PP-W21

Reduction of food waste through innovative lighting technologies

Christian Krutzler[1], Andreas Weiss[1], Christian Fragner[1], Stefanie Kern[2], Gabriel Pint[2], Niklas Pontesegger[3], Barbara Siegmund[3]

[1]Joanneum Research, Forschungsges.mbH, Institute for Sensors, Photonics and Manufacturing Technologies – Smart Connected Lighting, Pinkafeld, Austria;

[2]LUMITECH Lighting Solution GmbH, Jennersdorf, Austria;

[3]Graz University of Technology, Institute of Analytical Chemistry and Food Chemistry, Graz, Austria

Food waste has become a topic of increasing concern during the last years. With a European average of 131 kg per capita and year, an incredible amount of food commodities is discarded. Fruits and vegetables account for more than 20% of the wasted food. The increasing awareness for this problem has led to different approaches aiming for waste reduction along the supply chain of different products. In this study, we investigate an innovative approach to maintain and/or prolong the quality and freshness of fruits and vegetables in the retail sector by illuminating the products with optimised light spectra. With the current development of light-emitting diodes (LED), it has become possible to generate light spectra with adjustable distribution and intensity, also changeable over time. Selected types of fruits and vegetables are enlightened with specific light distributions with the aim to (i) reduce the respiration rate and ripening procedures in climacteric fruits or (ii) decelerate decay processes and potentially microbial activities in perishable, non-climacteric fruits.

To achieve this, a test chamber was constructed to guarantee controlled conditions in the course of the storage experiments under different illumination spectra. The quality of the investigated fruits or vegetables will be followed monitoring colour changes of the surface by spectral imaging but also changes in fruit weight, acidity, soluble solids and texture over time. The impact of light on the microbial load is also under investigation.

In this contribution, we will present the concept and methods to obtain reproducible quality parameters for fruits and vegetables under controlled conditions and also preliminary results of this study which will hopefully successfully contribute to a reduction of the overall food waste.

Acknowledgement: *The project LED4foods is funded by the Austrian Research Promotion Agency (FFG) with funds provided by the National Foundation for Research, Technology and Development.*

PP-W22

Incorporating cocoa bean shells in bakery products: nutritional enhancement and prebiotic potential

Margherita Stampini, Vincenzo Disca, Francesca Carrà, Fabiano Travaglia, Matteo Bordiga, Jean-Daniel Coïsson, Monica Locatelli, Marco Arlorio
Department of Pharmaceutical Sciences, Università del Piemonte Orientale "A. Avogadro", Novara, Italy

Cocoa bean shells (CBSs), an abundant byproduct from cocoa beans processing, are rich in dietary fiber and bioactive compounds, making them a promising ingredient for functional food design. This study explores the incorporation of CBSs in bakery products (muffins) to enhance their nutritional properties, particularly their fiber content, antioxidant activity, and potential prebiotic effects.

The muffins added by CBSs were characterized with respect to the aspects mentioned previously and the results were compared to those obtained from two control groups: muffins containing standard fiber (inulin) and muffins without any addition. A sensory evaluation was carried out with a panel of 30 individuals, indicating a strong perception of chocolate flavor and favorable shape and texture attributes, making CBSs an attractive ingredient in bakery applications.

To assess prebiotic potential, an in vitro digestion protocol (INFOGEST) and two fermentation approaches were applied, comparing the effects on the insoluble fraction versus the whole digesta. The results provided insights into the CBSs interaction with the gut microbiota, highlighting its ability to support an increased production of short chain fatty acids.

These findings support the potential of CBSs as a functional fiber ingredient in bakery products, contributing to sustainable food innovation by repurposing a byproduct while enhancing nutritional quality. In fact, CBSs fortification might be beneficial for dietary fiber enrichment, gut health, and antioxidant benefits in food formulations. Further research on shelf-life and storage stability could facilitate the broader adoption of CBSs in functional food formulations.

Acknowledgement: *Special gratitude to Millbo Srl for their contribution to this research. Specifically, for their role in producing the samples analyzed in this study and for co-funding PhD fellowship of Dr. Margherita Stampini. Dr. Margherita Stampini holds a PhD career grant supported by Next Generation EU-MUR.*

PP-W23

Comparison of bioactive potential in 100% *Coffea canephora* and its spent coffee grounds

Terézia Švecová, Alica Bobková, Alžbeta Demianová, Andrea Mesárošová, Lukáš Jurčaga, Ivana Timoracká, Marek Bobko, Judita Lidiková, Ľubomír Belej

Institute of Food Sciences, Faculty of Biotechnology and Food Sciences, Slovak University of Agriculture in Nitra, Trieda Andreja Hlinku 2, 94976 Nitra, Slovakia

The increasing global coffee consumption generates large amounts of by-products, including spent coffee grounds (SCG), often discarded in landfills, raising environmental concerns. However, SCG contains bioactive compounds with potential applications in various industries.

This study aimed to evaluate bioactive properties of 100% *Coffea canephora* coffee and its SCG to assess their potential for sustainable food applications.

We analyzed 5 medium roasted coffee samples. Extracts were prepared from brewed coffee (B) and its dried SCG (G), resulting in 10 extracts. TPC was determined using the Folin-Ciocalteu method (Lachman *et al.,* 2003) and TAC according to Brand-Williams (1995). Statistical analysis used one-way ANOVA (α = 0.05).

Results showed that brewed coffee consistently exhibited a significantly higher TPC than SCG in all samples, with values ranging from 50.102 to 65.343 g GAE·kg^{-1} in brewed coffee and from 12.371 to 22.130 g GAE·kg^{-1} in SCG (GAE – gallic acid equivalent). The % inhibition of DPPH radical scavenging ranged from 77.8 to 87.6 in brewed coffee and significantly higher in SCG, from 81.6 to 85.8%. Interestingly, some SCG samples showed higher TAC than brewed coffee, likely due to degradation of certain compounds during extraction and drying, while new antioxidant-active compounds were formed.

Based on our findings, coffee and SCG are valuable sources of bioactive compounds, such as polyphenols and antioxidants. These findings offer promising applications across various sectors to support sustainable food production and demonstrate the potential for waste valorization within the circular economy.

Acknowledgments: *This research was supported by The Ministry of Education, Science, Research and Sport of the Slovak Republic, grant VEGA 1/0412/25 and by the Grant Agency of the Slovak University of Agriculture (GA SPU), project No. 03-GA-SPU-2024 and by the Slovakia's recovery and resilience plan, project No. 09I03-03-V05-00018 – Early Stage Grants at SUA in Nitra.*

PP-W24

Recovery and fractionation of bioactives of industrial hemp leaves: Green vs traditional methods

Orinta Aleknavičiūtė, Laura Jūrienė, Renata Baranauskienė, Petras Rimantas Venskutonis
Department of Food Science and Technology, Kaunas University of Technology, Lithuania

Industrial hemp accumulates low amount of the psychoactive tetrahydrocannabinol, whereas non-psychoactive phyto-cannabinoids (mainly cannabidiol, cannabigerol and cannabinol) possessing various health beneficial properties may be present at the remarkably higher concentrations. In addition, hemp accumulates essential oil. Due to various bioactivities hemp constituents have attracted significant attention both among the researchers and producers. Phyto-cannabinoids are usually recovered with organic solvents or by supercritical CO_2 extraction. The latter method possesses several advantages: safe, inflammable, food and environment friendly solvent, solvent-free products. However, all methods, besides phytocannabinoids, also extract other soluble substances, particularly the waxes, which are not desirable in the final products. Traditionally, the waxes are removed from hemp extracts obtained by supercritical CO_2 by the winterization, which includes extract dilution in the ethanol, freezing at -20 °C and filtration.
This study aimed at separating hemp CO_2-extracts into the wax and phyto-cannabinoid/essential oil-rich fractions using the supercritical CO_2 system with two separators.
Dried and ground hemp leaves were extracted at 45 MPa pressure and 45 °C temperature. Afterwards the pressure in the 1st separator was reduced to 7 MPa, the temperature changing from 0 °C to -30 °C (subcritical state). Pure CO_2 and its mixture with 5% co-solvent ethanol were used in the experiments.
Two fractions were obtained at all parameters applied; however, separation of hemp extract was rather ineffective in case of using pure CO_2. Application of the ethanol remarkably increased separation effectiveness; for instance, in the 1st separator at -10 °C the precipitated fraction consisted mainly of waxes, while phyto-cannabinoids and essential oil were collected in the 2nd separator. Depending on the applied separation parameters the enrichment factor for hemp bioactive compounds was approx. 3–10.
Effective procedure was developed for the recovery and pre-purification of hemp bioactive constituents using 1-step extraction/separation process.

PP-W25

Revalorization of buckwheat hulls: Effects of green solvent extraction on the phenolic profiles

Murdiati Murdiati, Ainhoa Vicente, Marina Villanueva, Felicidad Ronda*
PROCEREALtech group, Research Institute on Bioeconomy (BioEcoUVa) and Department of Agriculture and Forestry Engineering, University of Valladolid, Valladolid, Spain

Buckwheat hull (BH), a by-product comprising 20–30% of the grain, is a rich polyphenol source with potential for gluten-free product enrichment, offering bioactive compounds known for their antioxidant capacity and ability to slow starch digestion. The aim of this work was to explore ethanol (EtOH) as an environmentally friendly solvent for the extraction of polyphenols from BH as an alternative to methanol (MeOH) and acetone (Ac), which are commonly used in conventional analysis but have environmental and safety concerns. The conventional method for polyphenol quantification involved three sequential extractions using acidified MeOH:H_2O, Ac:H_2O, and acidic MeOH, while the alternative method used two extractions with EtOH:H_2O followed by one with acidic EtOH. The first two extractions quantified free polyphenols (FPC), the third measured bound polyphenols (BPC), and their sum represented the total polyphenols. Additionally, polyphenol extraction kinetics were studied using solutions with different EtOH:H_2O ratios. Each extract was analyzed for phenolic content using the Folin-Ciocalteu method, while HPLC was employed for individual polyphenol identification and quantification. The conventional method yielded the highest polyphenol content, with FPC and BPC values of 1413 and 1642 mg GAE/100 g BH, respectively. The EtOH-based extraction achieved comparable efficiency, with FPC values only 4.6% lower. The phenolic extraction kinetics followed a first-order exponential model, $C(t)=C_\infty$ [1-e^(-k·t)], where C_∞ and k values increased with EtOH concentration. HPLC analysis identified rutin and protocatechuic acid as the predominant polyphenols in BH. EtOH proved to be a promising green solvent for industrial polyphenol extraction given its low toxicity, high biodegradability, and high extraction efficiency.

Acknowledgments: *Authors thank the Spanish Ministry of Science, Innovation and Universities (EQC2021-006985-P, PID2023-153330OB-I00) and the Junta de Castilla y León (CLU 2019-04 – BIOECOUVA Unit of Excellence of the University of Valladolid) for financial support. Murdiati acknowledges the University of Valladolid for her doctoral grant.*

PP-W26

Raspberry pomace as functional food ingredient: in vitro gastrointestinal digestion, anthocyanins profile and bioactivities

Ziva Vipotnik[1], Majda Golob[2]

[1]Laboratory for Food Chemistry, Department of Analytical Chemistry, National Institute of Chemistry, Ljubljana, Slovenia;

[2]Institute of Microbiology and Parasitology, Veterinary Faculty, University of Ljubljana, Slovenia

Raspberry pomace (*Rubus idaeus* 'Rossana') is a by-product of the fruit juice/jam industry that contains a large number of polyphenols, which have several health benefits. Raspberry is an antioxidant berry rich in anthocyanins and proanthocyanidins, which impart flavour and colour to fruits. This work aims to raise awareness of the potential use of raspberry pomace polyphenols as functional food ingredients that provide health benefits while promoting sustainability in the agri-food processing chain. Conventional extraction was optimised to efficiently isolate polyphenols and anthocyanins and evaluate antioxidant and antimicrobial activity. To validate the activity of anthocyanins under the selected conditions, a simulated gastrointestinal digestion process was performed and the bioaccessibility of anthocyanins was evaluated.

This study provides valuable insights into the effect of digestion on the polyphenols in raspberry pomace. The bioactive compounds remain relatively stable during the gastric phase, but their utilization decreases during the intestinal phase, however, some of them are still available for absorption. The total phenolic content was 472.9 ± 5.1 mg gallic acid equivalent g^{-1} dry weight and the total anthocyanin content was 2.6 ± 0.2 mg cyanidin-*3-O*-glucoside equivalent g^{-1} dry weight, with the most abundant cyanidin-*3-O*-glucoside 72.9 ± 0.1 mg/g and pelargonidin 3-*O*-glucoside 21.8 ± 0.2 mg/g. However, their bioaccessibility at the end of the gastric phase was 20.71 % and 5.05 %, respectively. The extract from raspberry pomace showed good antioxidant activity, but this changed as the extract was digested, ranging from 0.6 µmol/g for the undigested extract to 1.9 µmol/g after the final digestion phase.

The natural compounds from raspberry pomace can be used as potential ingredients for functional food formulations, flavors or colorants and contribute to sustainability and waste reduction.

Acknowledgments: *This study was financially supported by ARIS (P1-0005 "Functional foods and food supplements" and P4-0092 "Animal health, environment and food safety")*

PP-W27

The potential of Haskap berry pomace: characterization of phenolic compounds, antioxidative and antimicrobial activity

Ziva Vipotnik[1], Majda Golob[2]

[1]Laboratory for Food Chemistry, Department of Analytical Chemistry, National Institute of Chemistry, Ljubljana, Slovenia;

[2]Institute of Microbiology and Parasitology, Veterinary Faculty, University of Ljubljana, Slovenia

Haskap berry pomace, a by-product of jam/juice production, consists of peel, seeds and pulp and is often considered waste in the food industry, but recent research is increasingly pointing to the significant potential of pomace as a valuable raw material. Due to its high content of fibre, polyphenols, anthocyanins, tannins and other compounds, it can contribute significantly to the nutritional value of various foods.

The aim of this study was to optimize conventional extraction to efficiently isolate the phenols and anthocyanins from haskap berry pomace and to evaluate the antioxidant and antimicrobial activity of the extracts obtained. To validate the nutraceutical activity of the HBP extract (HBPE) under selected conditions, a simulated gastrointestinal digestion process was performed to evaluate the bioaccessible fraction of each phenolic compound by HPLC-ESI-MS.

The results show that high-value bioactive compounds are present in considerable amounts in the pomace. The content of total phenols ranged from 35.86 – 65.85 mg gallic acid equivalent g^{-1} dry weight, flavonoids from 92.88 – 323.28 mg catechin equivalent g^{-1} dry weight and total anthocyanins from 18.51 – 46.14 mg cyanidin-3-glucoside equivalent g^{-1} dry weight, while the radical scavenging activity ranged from 62.28 – 75.58 %. In addition, HBPE shows antimicrobial activity against most of the foodborne pathogens tested.

Haskap berry pomace was found to be an extremely rich by-product of processing, containing large amounts of flavonoids and anthocyanins. The use of haskap berry 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.

Acknowledgments: *This study was financially supported by the Slovenian Research and Innovation Agency (research program P1-0005 “Functional foods and food supplements” and research program P4-0092 “Animal health, environment and food safety”)*

SESSION PP-IN: INNOVATION IN FOODS

PP-In01

Screening of antioxidants of *Paeonia officinalis* and *Paeonia anomala* leaves and roots using high pressure extraction techniques

Sana Abbas, Petras Rimantas Venskutonis
Department of Food Science and Technology, Kaunas University of Technology, Kaunas, Lithuania Radvilėn pl. 19, Kaunas LT-50254, Lithuania

The present study investigates the valorization of *Paeonia officinalis* and *Paeonia anomala* by evaluating their antioxidant potential following a biorefining approach. Bioactive extracts were extracted from the leaves and roots of plants that were 2 and 15 years old. Initially, the lipophilic fraction was removed using supercritical fluid extraction with CO_2 (SFE-CO2) at 400 bar and 50°C for 2 hours. To obtain polar fractions rich in bioactive compounds, the SFE-CO2 residues were then subjected to pressurized liquid extraction (PLE) using ethanol and water as solvents of increasing polarity at 90°C and 120°C, respectively. The antioxidant activity of the PLE extracts was evaluated using total phenolic content (TPC) and ABTS•+ scavenging capacity. The ethanol extracts demonstrated the highest antioxidant potential than water. Notably, Paeonia officinalis leaves had the highest total phenolic content and antioxidant activity, with TPC 269.69±1.9 mg GAE/g DW of extract and $ABTS^{+\bullet}$ scavenging 935.7 mg TE/g DW (at two year old pant) while *Paeonia anomala* roots showed higher TPC and $ABTS^{+\bullet}$ scavenging scavenging capacity in two year old plants than Paeonia Officinalis, indicating a close relationship between extraction conditions, plant component, and antioxidant compound recovery. Paeonia leaves may be considered as a promising source of polyphenolic antioxidants. Further studies will be focused on a more comprehensive phytochemical characterization of the extracts and their application in developing novel nutraceuticals and functional foods.
These findings demonstrate the potential for a sustainable, multi-step extraction technique to enhance the bioactive potential of Paeonia species, hence enabling their use in the functional food, pharmaceutical, and cosmetic industries.

PP-In02

Combining wheat sprouting with fermentation as biochemical modification strategy to decrease immunogenic gluten peptides

Merve Aksoy Dirim[1], Aytül Hamzalıoğlu[1], Ecem Evrim Çelik Yılmaz[1], Evrim Özkaynak Kanmaz[2], Vural Gökmen[1]

[1]*Food Quality and Safety (FoQuS) Research Group, Department of Food Engineering, Hacettepe University, 06800 Beytepe, Ankara, Turkey;*

[2]*Nutrition and Dietetics Department, Faculty of Health Sciences, Artvin Çoruh University, 08000, Artvin, Turkey*

Celiac disease is triggered by the formation of immunogenic gluten peptides due to the being rich of gluten in proline and glutamine amino acids. On the other hand, sprouting process of grains initiates hydrolysis of proteins which result in partial hydrolysis of gluten peptides. However, this might not provide necessary reductions in terms of immunogenic gluten peptides. Therefore, further hydrolysis of immunogenic gluten peptides could be provided by the fermentation of sprouted-wheat-dough such as traditional fermentation *(Saccharomyces cerevisiae)* or sourdough fermentation. In this context, this study aimed biochemical modification of gluten by sprouting in combination with fermentation (both traditional and sourdough fermentation).

For this aim, wheat grains were first sprouted for 24, 36, 48 and 60 h at 20°C and 95% RH under dark conditions. The fermentation processes were carried out by *Saccharomyces cerevisiae* (for 1, 2 and 3 hours at 30 °C) and sourdough starter (for 18, 24 and 36 h at 40 °C) by using 60 h-sprouted wheat. The changes in amino acids of proline and glutamine during sprouting and fermentation and the immunogenic gluten peptides after *in vitro* digestion were monitored. 7.5-fold increase in glutamine content and 10-fold increase in proline content were obtained by 60 h of sprouting, which might be an indication of hydrolysis of proline and glutamine-rich gluten fragments. 33-mer, which is an immunogenic gluten peptide decreased 68% by 24 h of sprouting reaching 85% reduction at the end of 60 h-sprouting. While further reduction (92.49%) was provided by 3 h- *Saccharomyces cerevisiae* fermentation, sourdough fermentation could result in complete reduction. These results suggested that sprouting and its combination with fermentation are promising biochemical processes for reducing the immunogenicity of wheat flour and might be used in various gluten-free or low-gluten food products for those who have celiac disease or non-celiac gluten sensitivity.

PP-In03

Bioactive and functional properties of sweet potato flours: effect of variety and drying method

Nelson Pereira[1,2], Ana C. Ramos.[1,3], Marco Alves[4], Vítor D. Alves[2,5], Margarida Moldão[2,5], Marta Abreu [1,2,5*]
[1]*INIAV – Instituto Nacional de Investigação Agrária e Veterinária, Unidade de Tecnologia e Inovação, Oeiras, Portugal;*
[2]*LEAF – Linking Landscape, Environment, Agriculture and Food Research Center, Instituto Superior de Agronomia, ULisboa, Lisboa, Portugal;*
[3]*GeoBioTec – Geobiociências, Geoengenharias e Geotecnologias, FCT-UNL, Caparica, Portugal;*
[4]*INOV.LINEA/TAGUSVALLEY – Science and Technology Park, Abrantes, Portugal;*
[5]*Associated Laboratory TERRA, Instituto Superior de Agronomia, ULisboa, Lisboa, Portugal*

Sweet potato (*Ipomoea batatas* (L.) Lam.) is a nutrient-rich crop abundant in bioactive compounds, dietary fibre, and minerals. Dehydrating sweet potato (SP) enhances agro-industrial potential while reducing post-harvest losses. The bioactive composition and techno-functional properties of SP flour are influenced by varietal differences and drying methods, thereby impacting its suitability for various food applications.
This study evaluated the effect of two drying methods—hot-air drying (HAD:75 °C/20 h) and freeze-drying (FD:-41 to 30 °C/70 h)—on the bioactive and functional properties of SP flours from three varieties: *Bonita* (white flesh), *Bellevue* (orange flesh), and *NP1648* (purple flesh). The dried samples were milled, and their water (WHC) and oil (OHC) holding capacities, gelatinization temperature (GT), least gelation concentration (LGC), antioxidant activity (AOx), and total phenolic (TPC), anthocyanin (TAC) and carotenoid (TCC) contents were assessed.
Both drying methods and variety significantly influenced SP flour properties. HAD yielded flours with higher WHC (≈3.2 g/g) and lower OHC (≈2.2 g/g) compared to FD (WHC: ≈2.6 g/g; OHC: ≈2.9 g/g). GT varied with the drying method; *Bonita* flour dried by HAD exhibited a higher GT (82.8°C) than its freeze-dried counterpart (80.6°C), whereas *NP1648* and *Bellevue* flours showed lower GTs dried by HAD than by FD. *NP1648* also displayed the lowest LGC (10%).
Regardless of the drying method, TPC losses exceeded 60% during drying and correlated significantly with AOx (DPPH–water-soluble fraction). Conversely, TCC losses were below 30% and correlated with AOx (DPPH–lipid fraction), with HAD inducing higher losses than FD. Furthermore, TAC correlated significantly with AOx (FRAP), accounting for similar losses to TCC (*ca*. 30%), which varied by drying method and variety.
These findings highlight that selecting appropriate drying methods and varieties can optimize the techno-functional and bioactive properties of SP flour for diverse food applications.

Acknowledgements: *NativaLand, Lda.(Portugal); INOV.LINEA, TagusValley (Portugal); FCT(UIDB/04129/2020,UIDB/04035/2020, grant 2023.00711.BDANA).*

PP-In04

Effects of infrared treatment on some constituents of safflower (*Carthamus tinctorius* L.) seed

Elif Nur Dilbirliği, Meltem Laçin, Arzu Başman
Hacettepe University, Food Engineering Department, Beytepe, Ankara, Türkiye

Safflower (*Carthamus tinctorius* L.), a member of *Asteraceae/Compositae* family, is a herbaceous annual oilseed crop. Safflower seeds, with their phenolic, flavonoid components, and serotonin derivatives, exhibit health-beneficial effects due to their antidiabetic, antioxidant, antimicrobial and anti-inflammatory properties.
Infrared (IR) treatment has gained significant interest in the food industry due to its several advantages (short processing time, direct heat penetration, etc.) compared to conventional methods. IR treatment has been used for roasting, drying, enzyme inactivation, and enhancing the extraction of many bioactive components.
To the best of our knowledge, in literature, there is no study about the effects of infrared treatment on some constituents of safflower seeds. In this study, safflower seeds were infrared treated at different powers (800W, 1000W, 1200W) and times (10, 20 min). The effects of infrared treatment on protein, ash, total phenolic and flavonoid content, antioxidant activity (DPPH, CUPRAC) and tannin content of safflower samples were investigated. Infrared treatment caused a slight but insignificant change in the protein and ash content. Infrared treatment caused an increase in total phenolic (except 800W-10min) and total flavonoid content. Higher radical scavenging activity was obtained for safflower sample infrared treated at 800W. As compared to control, higher total antioxidant capacity was observed for 1200W-20min sample, while lower values were observed for other infrared treated safflower samples. Tannin content increased significantly as the infrared power and time increased.
Infrared treatment of safflower seeds may enhance the extractability of phenolics due to thermal breakdown of cellular structures. Infrared treated safflower seeds are promising as an alternative raw material for the food and pharmaceutical industries.
Acknowledgements: *The authors wish to thank Hacettepe University, Scientific Research Projects Coordination Unit for financial support (Project No:FHD-2023-20869).*

PP-In05

Revised EFSA Guidance for novel food applications: spotlight on characterization

Elisa Beneventi, Reinhard Ackerl, Océane Albert, Domenico Azzollini, Wolfgang Gelbmann, Maria Glymenaki, Marcello Laganaro, Irene Nuin Garciarena, Maura Magani, Leonard Matijevic, Vania Mendes, Estefania Noriega Fernandez, Gabriela Precup, Ruth Roldan Torres, Annamaria Rossi, Emanuela Turla, Ermolaos Ververis, Georges Kass, Andrea Germini.

Nutrition & Food Innovation Unit, European Food Safety Authority (EFSA), Parma, Italy

In the European Union (EU) regulatory framework, novel foods are defined as those not significantly consumed by humans in the EU before May 15, 1997. These foods must undergo a safety assessment by the European Food Safety Authority (EFSA) before they can be potentially authorized for the market. This assessment relies on comprehensive datasets and evidence provided in application dossiers prepared by the respective food business operators.

EFSA has recently revised its guidance for applicants on preparing these dossiers, and the present work aims to present the main revisions introduced in this update, specifically focusing on the characterization of novel foods.

This revision represents the first comprehensive update of the scientific aspects of EFSA's novel food guidance, following a request of the European Commission. The update addresses recent EU regulatory changes in the field of novel foods, advancements in food research and innovation, and EFSA's experience in assessing the safety of novel foods since the centralization of the EU assessment process in January 2018. Additionally, to ensure a practical, meaningful and applicable approach, EFSA actively seeks input from academia, researchers, competent authorities, and industry stakeholders.

The updated guidance focuses on technical and scientific aspects including compositional analysis, identity verification, production methods, toxicological assessment, nutritional analysis, exposure evaluation, and allergenicity testing. It covers a broad spectrum of foods and food ingredients, ranging from cell culture and precision fermentation products to plant extracts, novel protein sources, and engineered nanomaterials.

The update emphasizes EFSA's interdisciplinary approach and underscores EU efforts to ensure safe food innovation for its citizens. By further clarifying aspects of the EU's regulatory framework for novel foods and EFSA's safety assessment principles, the updated guidance contributes to support food innovation and foster collaboration between science and progress.

PP-In06

Enhancing *Chlorella vulgaris* fermentation: Investigating effective pre-treatment techniques

Hakki Bilgin, Vaida Kitryte-Syrpa, Michail Syrpas
Department of Food Science and Technology, Kaunas University of Technology, Lithuania

The rising interest in healthy diets has spotlighted microalgae for their rich nutrients and versatile uses. Their high protein and bioactive compounds make them valuable for food and feed. Fermentation further enhances their benefits by improving nutrition, unlocking bioactive compounds, and generating valuable metabolites. Although chlorella vulgaris shows promise as a fermentation substrate, its rigid cell wall poses a major challenge by restricting nutrient accessibility and availability.
This study evaluated the potential of Chlorella vulgaris as a fermentation substrate for lactic acid bacteria (LAB). To improve fermentation, several pretreatment strategies were investigated, including freeze-thawing, ultrasonication, acid exposure, a combination of ultrasonication and acid, and enzymatic hydrolysis with viscozyme and alcalase.
Enzymatic hydrolysis emerged as the most effective method, facilitating the highest release of fermentable carbon compounds essential for microbial proliferation. The impact of *L. plantarum* and *L. brevis* on fermentation performance was analyzed, with *L. plantarum* demonstrating superior results. It exhibited the highest microbial growth, increasing from 6 to 10.12 log CFU/mL, and the fastest acidification rate, as indicated by a pH drop to 3.6 within 24 hours in the viscozyme-pretreated sample. Furthermore, the in vitro antioxidant capacity was assessed, revealing a notable enhancement throughout the process.
In summary, this study demonstrates the potential of *Chlorella vulgaris* and lactic acid bacteria (LAB) in developing fermented algal formulations.
***Acknowledgements**. The study was financially supported by the Research Council of Lithuania, grant no. S-MIP-23-78.*

PP-In07

Biofunctionalization of corn to enhance market competitiveness within the frame of Spanish GO-BIODIF project

Gracia P. Blanch[1], Pedro Revilla[2], Rosa A. Malvar[2], Elena Peñas[1], Cristina Martínez-Villaluenga[1], Begoña de Ancos[1], Juana Frias[1]

[1]Institute of Food Science, Technology and Nutrition (ICTAN-CSIC), C/Jose Antonio Novais, 6, 28040 Madrid, Spain;

[2]Misión Biológica de Galicia (CSIC), Carballeira 8, Salcedo, 36143 Pontevedra, Spain

Maize is one of the most important crops in the European Union, both for animal and human consumption. Maize production in Europe cannot compete on price with other countries that do not have to comply with European health and environmental regulations. The solution to this situation is to identify high quality functional varieties and to apply innovative technologies that guarantee profitability and provide quality. In addition, global consumer is more concerned than ever about healthy lifestyle habits, placing greater emphasis on the nutritional value. However, evidence shows that there is a significant imbalance in the diet due to poor eating habits caused primarily by current lifestyles, giving challenges for Spanish agriculture.

Nanotechnology is currently one of the most active research areas focused mainly on the development of new materials at nanometric scales, with applications in different areas of science such as agriculture. The goal is to identify interesting maize varieties with commercial potential and apply nanofertilizers protocols with functional nanoparticles to strengthen sustainable practices in agriculture and the production chain for appealing nutritional labeling for the consumers ("source of" or "high content of"). The possibility of improving the levels of micronutrients and bioactive compounds in maize through the application of nanotechnology opens up a wide range of opportunities for the primary sector, the agri-food industry, and the end consumer, ultimately having an environmental, economic and social impact focus on:

1) Promoting biodiversity with high commercial potential
2) Fostering sustainable production through the use of nanofertilizers
3) Achieving labeling and nutritional declaration of maize, which will allow their market positioning, improving agronomic characteristics, as well as their social impact in programs to combat malnutrition problems worldwide.

Acknowledgements: *Project GO-BIODIF, ref. REGAGE23E00065226662, is financed by Ministry of Agriculture, Fisheries and Food (Spain) and European Agricultural Fund for Rural Development (EAFRD).*

PP-In08

Optimization of an extraction and analytical method of water and fat-soluble vitamins in mango juices

G. P. Blanch, A. Nicoara, A. Domene, M.L. Ruiz del Castillo, B. de Ancos, C. Sánchez-Moreno
Instituto de Ciencia, Tecnología de los Alimentos y Nutrición (ICTAN), Consejo Superior de Investigaciones Científicas (CSIC), Madrid, Spain

Mango fruit is rich in nutrients and bioactive compounds such as carbohydrates and dietary fiber, protein and amino acids, vitamins and minerals, polyphenols and carotenoids. Vitamins are essential micronutrients and although some can be synthesized in small quantities by the body, they are obtained from the diet. Water-soluble and fat-soluble vitamins have been reported in mango fruit, with vitamins C and A being the predominant vitamins. Vitamin E and K are also found in lower concentrations. Except for vitamin-B7, the pulp includes the entire vitamin-B complex: vitamins B1, B2, B3, B5, B6, B8, and B9. There is a growing demand for foods obtained by sustainable technologies and free of additives, that resent healthy characteristics beyond nutrition. High pressure processing (HPP) of based mango juices meets these conditions and a significant increase is observed in the markets. The aim this work is to develop an extraction and analytical method using HPLC to quantify vitamins in mango juices in order to investigate the effect of HPP on vitamins composition.
Extraction, separation, identification and quantification of liposoluble vitamins was carried out based on (1,2) with some modifications. Extraction of hydrosoluble vitamins was based on (3) and HPLC analyses on (4).
Initially, methods were developed using standard vitamins solutions and then vitamins determination on mango juices were studied. Optimized methods allow adequate sensitivity, repeatability and good recoveries suitable for the study and quantification of vitamins in based mango juices subjected to different treatments.
Grant PID2023-147025NB-I00 funded by MICIU/AEI/10.13039/ 501100011033 and by "ERDF/EU"

References:

(1) Xu et al. 2020, Molecules 25, 839
(2) Barba et al., 2011, Eur, Food Res.Technol. 232, 829
(3) Suh et al., 2011, Bull. Korean Chem. Soc. 32, 2648
(4) Albawarshi et al., 2022, J. Food Quality 2022, 1

PP-In09

Phytochemical profiling of red vine leaves commercial samples: variability of the phenolic fraction

Chiara Carini[1], Vincenzo Disca[1], Fabiano Travaglia[1], Jean Daniel Coïsson[1], Matteo Bordiga[1], Hélder Oliveira[2], Monica Locatelli[1]

[1]*Department of Pharmaceutical Sciences, Università del Piemonte Orientale, Largo Donegani 2, 28100 Novara, Italy;*

[2]*REQUIMTE/LAQV, Chemistry and Biochemistry Department, Faculty of Sciences, University of Porto, 4169-007 Porto, Portugal*

The grapevine (*Vitis vinifera* L.) is a globally significant crop characterized by a long history in wine production. The phytochemical composition of its leaves is very interesting because many of its bioactive compounds are associated with health benefits such as antioxidant and anti-inflammatory properties. Accordingly, the EMA has recognized the "well-established use" of red vine leaves for chronic venous insufficiency and for minor circulation problems, highlighting their therapeutic potential. However, the absence of stringent regulatory standards, coupled with inherent variability within the plant matrix, significantly compromises the consistency and reliability of reported health benefits.

This study investigated the phenolic composition of commercial red vine leaves, aiming to expand current knowledge regarding their chemical constituents, elucidating compositional variations within the matrix. Ethanol-water mixture (50:50) was selected as the extraction solvent, and it was subsequently employed to assess the polyphenolic profile using spectrophotometric assays: total polyphenolic content (Folin-Ciocalteu assay), total flavonoids content (aluminum chloride assay), total anthocyanins content (pH-differential method) and total proanthocyanidin content (DMAC assay) were determined; the antioxidant activity was also evaluated (DPPH and ABTS assays). Finally, a more in-depth characterization of the principal molecules belonging to the different classes of polyphenols, including phenolic acids, flavonoids and anthocyanins was performed using LC-MS method.

The analyzed samples showed differences in their polyphenolic composition (spectrophotometric methods) and the associated antioxidant activity. LC-MS characterization further confirmed the heterogeneity among the analyzed samples, evidencing both qualitative and quantitative differences concerning individual polyphenolic compounds.

In conclusion, this study provides a more in-depth understanding of the phytochemical profile of *V. vinifera* L. leaves, a crucial aspect for ensuring quality and maximizing their applications. The differences observed among the analyzed commercial samples highlighted the necessity to enhance control measures, in order to guarantee the healthy properties of these products.

PP-In10

Phlorotannin-rich extracts from brown macroalgae for novel food applications

M. Carpena[1], P. Barciela[1], F. Chamorro[1], Cláudia S. G. P. Pereira[2], Aurora Silva[3,1], João C. M. Barreira[4,5], M. Beatriz P. P. Oliveira[2], and M.A. Prieto[1]

[1]Universidade de Vigo, Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain;

[2]LAQV/REQUIMTE, Department of Chemical Sciences, Faculdade de Farmácia, Universidade do Porto,R. Jorge Viterbo Ferreira 228, 4050-313 Porto, Portugal;

[3]REQUIMTE|LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida 431, 4200-072, Porto, Portugal, Porto, Portugal;

[4]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia,5300-253 Bragança, Portugal;

[5]Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

In recent years, macroalgae has been gaining relevance as a new source of raw material to obtain active compounds with potential use in biotechnological processes and develop new products. Their metabolic diversity includes molecules with biological properties, such as polysaccharides, proteins, fatty acids, vitamins, and minerals. Polyphenols, also present, are usually less studied because of their complex structure and identification.

This study aimed to optimize the extraction of polyphenols, with a special focus on phlorotannins by ultrasound-assisted extraction (UAE) in four brown macroalgae by comparing two orders: Fucales (*Fucus vesiculosus* and *Pelvetia canaliculata*) and Laminariales (*Laminaria ochroleuca* and *Saccharina latissimi*). The experiments were designed following a *response surface methodology (RSM)* and the independent variables were set at the following ranges: *time (t, 5–55 min), power (P, 100–500°C), and solvent concentration (S, 0–100% ethanol)*. In total, 79 polyphenols were identified and tannins stood out as the most frequent compounds with 45 representatives. Generally, the extraction system preferred short times, high power, and a high percentage of ethanol. Depending on the species, optimum conditions range from *t,* 11–14 min; *P,* 200–450 W and *S,* 60–90% of ethanol, and the maximum yield of total phlorotannins under their respective optimum conditions ranged from 45–156 mg/g of extract. *Laminaria ochroleuca* was highlighted as the species with the highest content in active compounds extracted with UAE.

Thereby, this study demonstrates the effectiveness of UAE for optimizing polyphenol extraction, particularly phlorotannins from brown macroalgae. Additionally, their classification as macroalgae-derived bioactives aligns with the growing demand for sustainable, plant-based, and clean-label ingredients, and pushes forward their inclusion in functional foods, nutraceuticals, or alternative protein sources.

Acknowledgments: *Xunta de Galicia for the pre-doctoral grant of P. Barciela (ED481A-2024-230), the EU-FOR A Fellowship Program (EUBA-EFSA-2023-ENREL-01) supporting F. Chamorro and A. Silva. The authors are grateful to AlgaMar company for the algae provision.*

PP-In11

Natural extracts with high polysaccharides content: effect on wheat dough properties and consumer acceptance of model bakery product

Matej Čech, Tatiana Bojňanská, Anna Kolesárová
Faculty of Biotechnology and Food Science, Slovak university of agriculture, Nitra, Slovakia

Medicinal mushrooms, oats and yeasts products are highly valued for their diverse health benefits and therapeutic potential. Their bioactive compounds, particularly polysaccharides (such as β-glucans) and triterpenoids, contribute to their immunomodulatory, antioxidant, and anticancer properties.
The aim this study was to observe effect of selected polysaccharides-rich medicinal mushrooms extracts (MME) (Shiitake, Maitake, Cordyceps and Reishi) and high β-glucan oat and yeast extracts on selected rheological properties as well as sensory acceptability of selected wheat flour-based bakery products.
The flour mixtures included T650 wheat flour combined with 5, 10 and 15% MME and β-glucan extracts additions. Water absorption was determined by S-protocol measurement (device Mixolab 2, Chopin Technologies, Villeneuve-la-Garenne, France) according to ICC Standard Method 173. Based on doughs quality, model bakery products (breads) were subsequently prepared and tested for their overall sensory acceptance by expert panel of evaluators.
Generally, the addition of all four MME reduced the water absorption values depending on the amount of addition, by up to 25% compared to the control wheat flour. On the contrary, the addition of oat β-glucan and yeast extracts increased the water absorption, by up to 16% and 54%, respectively. However, due to the inappropriate dough properties, β-glucan extracts were not used in bakery products. Sensory evaluation of breads showed a very good acceptance among used MME, mainly in 5 and 10 % concentration, and especially Shiitake extract.
The addition of non-bakery products generally does not improve rheological properties of enriched flour mixtures, however, can improve sensory value of final products, as was monitored in all four MME. The key findings about the extracts properties will lead to finding the balanced formulas (combinations of β-glucan extract and MME) for new, innovative bakery products, which could bring overall nutritional and possibly economic benefits.

Acknowledgments: *APVV-21-0206.*

PP-In12

Innovation in food production: lab-grown meat, cultivated seafood, and advanced food technologies

Yasemin Celebi
Food Technology Programme, Eşme Vocational High School, Uşak University, Uşak, Turkey

Innovations in food production, such as lab-grown meat and cultivated seafood, offer sustainable alternatives to conventional protein sources. Additionally, advancements in minor food ingredients, novel foods, smart sensors, and new methods in food analysis contribute to improved food safety, quality, and efficiency.
This study examines the role of lab-grown meat and cultivated seafood as new raw material sources, alongside emerging food technologies that enhance production, processing, and quality control.
A systematic review of scientific literature and industry reports was conducted to assess the sustainability, technological advancements, and applications of novel foods. The impact of smart sensors and innovative food analysis methods on production efficiency and food safety was also explored.
Findings indicate that lab-grown meat and cultivated seafood significantly reduce environmental impact while providing a scalable solution for food production. Additionally, minor food ingredients and novel food formulations improve nutritional profiles. Smart sensors and advanced analytical methods enhance quality control, safety, and traceability in the food industry. However, challenges such as cost, regulatory approval, and consumer acceptance must be addressed for widespread adoption.
Integrating lab-grown meat, cultivated seafood, and advanced food technologies can revolutionize food production. Further research and investment in smart sensors, minor ingredients, and innovative analytical techniques will be crucial in ensuring sustainable and efficient food systems for the future.

PP-In13

Investigations on *Locusta migratoria*, *Acheta domesticus*, and *Tenebrio molitor* proteins quality

Raffaella Colombo[1], Marta Barberis[1,2], Vanessa Pellicorio[1,2], Adele Papetti[1,2]
[1]*Department of Drug Sciences, University of Pavia, Pavia, Italy;*
[2]*OnFoods, Fondazione OnFoods, Parma, Italy*

Edible insects are emerging as a new protein source to feed a growing population. The nutritional quality of a protein depends on its amino acid composition and digestibility; therefore, their definition as well as the amino acids bioaccessibility may provide predictive information to better understand their impact as new alternative food sources.
The aim of this study was to investigate the proteins digestibility and amino acids bioaccessibility of *Locusta migratoria (*LM*), Acheta domesticus (*AD*)*, and *Tenebrio molitor (*TM*)*.
Protein digestibility and amino acid bioaccessibility were evaluated by INFOGEST 2.0 static *in vitro* digestion protocol. Digested samples collected after the intestinal phase have been processed (protein precipitation and microwave assisted acid hydrolysis) to recover digestible and indigestible fractions. Amino acids (AAs) have been identified and quantified by a validated RP-HPLC-DAD method after a derivatization step.
The results indicated that the protein contents (expressed as the total AAs content) were 41.36%±0.001 for AD, 49.04%±0.161 for TM, and 49.15%±0.156 for LM. All the essential AAs are present in the insects. The most digestible insect was TM (17.67%±0.027). In LM the phenylalanine was the most digestible AA, while in TM the highest digestibility was reached by glycine. In AD, the digestible fraction was mostly represented by cysteine, glycine, and lysine. Aspartic acid and phenylalanine were the main bioaccessible AA in LM, representing up to 50% of the total bioaccessible AA. Differently, in AD and TM the main bioaccessible AA were cysteine and glycine.
These preliminary investigations underline the insects' potential nutritional value, considering them as auspicious choices to overcome future demands.
Acknowledgements: *Project funded under the NRRP, funded by the EU-NextGenerationEU; Project code PE00000003. Project title "ON Foods-Research and innovation network on food and nutrition Sustainability, Safety and Security-Working ON Foods".*

PP-In14

Optimized extraction and characterization of spirulina (*Arthrospira platensis*) proteins for innovative food applications

Elisa Costa[1], Miguel Ribeiro[1,2], Luís Filipe-Ribeiro[1], Fernanda Cosme[1,3], Fernando M. Nunes[1,4]
[1]*Chemistry Research Centre of Vila Real (CQ-VR) – Food and Wine Chemistry Lab, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal;*
[2]*Genetics and Biotechnology Department, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal;*
[3]*Biology and Environment Department, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal;*
[4]*Chemistry Department, University of Trás-os-Montes and Alto Douro, Vila Real, Portugal*

The growing demand for sustainable and non-allergenic protein sources has increased interest in algae-derived proteins as viable alternatives to traditional animal-based ingredients. The aim of this study was the development and optimization of an efficient, scalable method for the extraction and purification of proteins from Spirulina (*Arthrospira platensis*). Different cell disruption techniques, including bead milling and ultrasound-assisted extraction, were evaluated under different extraction conditions (pH, salt concentration) and protein isolation methods (ethanol or ammonium sulphate precipitation).
Among the conditions tested, bead milling in the presence of 1M sodium chloride at pH 7 yielded protein extracts with the highest protein content (58.7 ± 2.0%) and an extraction efficiency of 25.0 ± 0.8%. SDS-PAGE analysis revealed distinct protein bands in the molecular weight ranges of 17–28 kDa, 38 kDa, 49–62 kDa, and 98 kDa. In-solution digestion and protein identification by mass spectrometry extended this range from 5.4 to 197.0 kDa, while in-gel digestion after SDS-PAGE confirmed the presence of phycobiliproteins. In addition, the extract exhibited a near-zero zeta potential (-7.8 ± 0.8 mV), at pH 2.80. These results highlight the potential of Spirulina protein extracts as functional, non-animal-based ingredients suitable for use as additives or processing aids in food and wine production. This is in line with the increasing industry demand for sustainable, non-animal-based alternatives.
Acknowledgements: *We would like to express our gratitude to the Portuguese Foundation for Science and Technology (FCT), for the financial support provided to CQ-VR (https://doi.org/10.54499/UIDB/00616/2020 and https://doi.org/10.54499/UIDP/00616/2020). Additionally, E. Costa acknowledges financial support from the FCT/MCTES PhD studentship (SFRH/BD/144107/2019, https://doi.org/10.54499/SFRH/BD/144107/2019).*

PP-In15

Comparison of chemical composition and bioactive properties of different *Chlorella vulgaris* hydrolysates

Sara A. Cunha, Manuela Machado, Manuela Pintado

Universidade Católica Portuguesa, CBQF Centro de Biotecnologia e Química Fina-Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal

Chlorella vulgaris is a well-studied microalga, known for its high protein content and bioactive peptides. Several bioactive properties have been described in *C. vulgaris* hydrolysates, including antioxidant, anti-hypertensive and antimicrobial activities. As with other microalgae, *C. vulgaris* is considered a sustainable source of nutrients and bioactive compounds due to its rapid growth and low land requirements. Additionally, its ability to capture CO_2 and convert it into O_2 offers potential environmental benefits. Its growth conditions can influence pigment and compound production, leading to variations in colour and composition. This study compares the chemical and bioactive properties of hydrolysates produced from green, yellow and white *C. vulgaris*.

Hydrolysates were produced by acid hydrolysis, followed by enzymatic hydrolysis using cellulase and protease. The soluble fraction was divided in two, and one half was ultrafiltered (3kDa cut-off). Protein content, antioxidant, anti-hypertensive and anti-diabetic properties were evaluated in both fractions.

Results showed that green *Chlorella* had the highest bioactive potential, while white *C. vulgaris* was the least promising. Total phenolic content was similar in all the hydrolysates, whereas protein levels were highest in green hydrolysate. Regarding anti-diabetic potential, green and yellow showed similar activity, while white *C. vulgaris* showed no effect. No statistically significant differences were observed between fractionated and non-fractionated hydrolysates. Additionally, all hydrolysates were safe at 10 mg/mL in CaCo-2 cells and tested negative for mutagenicity (50 mg/mL) (AMES assay).

In conclusion, all hydrolysates demonstrated potential for industrial applications due to their protein content and bioactive properties, with green *C. vulgaris* being the most promising. Furthermore, ultrafiltration did not provide significant advantages, thus eliminating it could have industrial and economic advantages.

Acknowledgments: *This research was funded by Fundação para a Ciência e a Tecnologia through the grant number UIDB/50016/2020 and the PhD research grant (ref. SFRH/BD/144155/2019) for the author Sara A. Cunha.*

PP-In16

Incorporation of insect hydrolysate in canned tuna: effects on appearance and stability, and assessment of bioavailability

Sara A. Cunha, Manuela Machado, Manuela Pintado

Universidade Católica Portuguesa, CBQF Centro de Biotecnologia e Química Fina-Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal

Insect hydrolysates are gaining interest due to the increased demand for alternative protein sources, since they have a high protein content, associated with bioactive properties, while also being aligned with sustainable practices. Thus, these hydrolysates may have the potential to be used as an ingredient for the development of new functional food. This research aims to evaluate the effect of the incorporation of insect hydrolysate into canned tuna with tomato sauce, regarding physical and visual aspects, and also hydrolysate bioavailability after gastrointestinal digestion.

First, insect (*Tenebrio molitor)* hydrolysate was incorporated in tomato sauce, without tuna, in different concentrations (0, 1, 2.5 and 5%). The hydrolysate solubility and the general appearance of the sauce were evaluated. Based on the results, canned tuna with tomato sauce was prepared with 1% hydrolysate. Finally, an *in vitro* simulation of gastrointestinal digestion was done, following the INFOGEST 2.0 protocol. After digestion, protein content, molecular weight profile and bioactive properties were evaluated, to understand the effect of digestion on proteins and peptides.

The hydrolysate showed a good solubilization in the tomato sauce, however the color was altered, becoming brownish, making it less appealing for consumers. Given these findings, canned tuna was prepared with 1% hydrolysate. Regarding digestion, protein content and bioactive properties were not negatively affected, highlighting the potential of using insect hydrolysates to enhance the nutritional composition and the bioactive properties of the traditional canned tuna.

The incorporation of insect hydrolysate into canned food may represent a promising approach for food industries, enabling the development of new high-protein products aligned with nutrition claims, while also providing bioactive properties.

Acknowledgments: *This research was funded by Pacto da Bioeconomia Azul Projeto nº C644915664-00000026 – Vertical FOOD – WP4 and Fundação para a Ciência e a Tecnologia through the grant number UIDB/50016/2020.*

PP-In17

Vegan cheeses – product development and physical- chemistry characteristics

Joana Azevedo[1], Joana Pinto[2, 3], Joana Oliveira[1], Duarte Torres[4,5,6], Daniela Correia[7], Paula Guedes de Pinho[2, 3], Victor de Freitas[1], Susana Soares[1]

[1]*FCUP- LAQV-REQUIMTE, Rua Campo Alegre, 1002, Porto, Portugal;*

[2]*Associate Laboratory i4HB – Institute for Health and Bioeconomy, University of Porto, 4050-313 Porto, Portugal;*

[3]*UCIBIO – Applied Molecular Biosciences Unit, Laboratory of Toxicology, Faculty of Pharmacy, University of Porto, 4050-313 Porto, Portugal;*

[4]*FCNAUP, Rua Campo Alegre, Porto, Portugal;*

[5]*EPIUnit – Instituto de Saúde Pública, Universidade do Porto;*

[6] *Laboratório para a Investigação Integrativa e Translacional em Saúde Populacional (ITR), Porto, Portugal;*

[7]*MC Shared Services S.A., Lugar do Espido, Via Norte, 4470-177 Maia, Portugal*

The search for innovative food solutions and alternatives to animal proteins has become a priority due to their potential to reduce environmental impact and enhance human health[1]. In this context, vegan cheeses have emerged as promising market products, particularly because they eliminate allergens found in dairy-based cheeses[2]. Despite the growing variety of plant-based alternatives, there is still significant room for improvement in key aspects such as appearance, texture, nutritional profile, and flavour[3].

This study explored various plant and grain sources to develop vegan cheeses with physicochemical properties comparable to traditional dairy cheeses but with higher protein content. Key protein sources analysed included chickpeas, lupins, and yellow peas, which were recognized for their protein content and composition.

Different experimental processes were tested, including fermentation and curing. Cheeses made from fermented chickpeas and cured for 20 days demonstrated the most satisfactory texture and flavour profiles. Key parameters such as colour (CieLab system), protein content (Kjeldahl method), and texture properties were evaluated and compared to commercial dairy cheeses. The aromatic composition of cheeses was analyzed by GC-MS, since it is a very important organoleptic characteristic for the consumer. Preliminary results showed protein contents of approximately 19% for chickpea-based cheeses, 18% for yellow pea cheeses, and 28% for a combination of chickpeas and lupins—values competitive with commercial dairy cheeses, which contain around 36% protein per gram of dry weight. The developed vegan cheeses exhibited texture characteristics such as hardness, cohesion, chewiness, and elasticity, similar to those of dairy cheeses. While lupin-based cheeses had a softer texture, chickpea-based cheeses stood out for their hardness, resembling traditional cheeses.

Acknowledgements*: Thanks for FCT/MCTES (UIDB/50006/2020 DOI 10.54499/UIDB/50006/2020) through national funds. UCIBIO (UIDP/04378/2020 and UIDB/04378/2020), and the Associate Laboratory i4HB (LA/P/0140/2020)*

Funding*: This work was financed by PRR-Plano de Recuperação e Resiliência and by European Funds Next Generation EU, under the VIIAFOOD Agenda – Plataforma de Valorização, Industrialização e Inovação 204ommercial para o Agroalimentar (nº C644929456-00000040)*

References**:**

(1) Nezlek, J. B.; Forestell, C. A. Meat substitutes: current status, potential benefits, and remaining challenges. *Current Opinion in Food Science* **2022**, *47*, 100890. DOI: https://doi.org/10.1016/j.cofs.2022.100890.

(2) Viñas, M.; Carnés, J.; López-Matas, M. A.; Hernández, N.; Castillo, M. J.; Ibero, M. Allergy to goat and sheep cheese with tolerance to cows milk and its derivatives. *Allergologia et Immunopathologia* **2014**, *42* (3), 186-190, DOI: 10.1016/j.aller.2012.08.002.
(3) Mefleh, M.; Pasqualone, A.; Caponio, F.; Faccia, M. Legumes as basic ingredients in the production of dairy-free cheese alternatives: a review. *J Sci Food Agric* **2022**, *102* (1), 8-18. DOI: 10.1002/jsfa.11502 From NLM.

PP-In18

The jellying ability of carrageenan in meat products and their analogues

Bernardo A. C. Ferreira[1,2,3], Marta Rendeiro[2], Ricardo Silva[2], Kayane Oliveira[2,3], Pedro A. R. Fernandes[2], José A. Lopes da Silva[2], Maria A. Azevedo[1], Cláudia Nunes[3], Manuel A. Coimbra[2]

[1]*Associação Colab4Food – Laboratório Colaborativo para a Inovação da Indústria Agroalimentar, Vairão, Portugal;*

[2]*LAQV-REQUIMTE – Department of Chemistry, University of Aveiro, Aveiro, Portugal;*

[3]*CICECO – Department of Materials and Ceramic Engineering, University of Aveiro, Aveiro, Portugal*

Carrageenan is a group of sulphated galactans derived from red algae. These polysaccharides are used in the formulation of meat products or their analogues to enhance textural properties. Meat analogue products usually rely on the protein gel capability or hydrocolloid to firm up sufficiently and be able to mimic a meat product. While vegetarian formulations can use animal-based ingredients such as egg white capacity to gel, in a vegan formulation other proteins need to be used and adjuvated by carbohydrate-based hydrocolloids capable of forming strong gels.

In this work, the characteristics of the carrageenans suitable for incorporation in two distinct proteic food formulations, one cooked ham and a meat-free analogue, were studied. A commercially available carrageenan was incorporated into the cooked ham formulation by food industry to increase water holding capacity. By forming a gel, it binds water, prevents shrinkage, and improves yield. It is comprised by 47 % of carbohydrates, 53 mol% galactose and 46 mol% 3,6-anhydrogalactose, where 1 in each 4 residues are sulphated. Texture Profile Analysis of the cooked ham model showed that the incorporation of the carrageenan lead to a significant increase from 83.1 to 97.0 N in hardness and from 2474 to 3239 N in chewiness in comparison with the formulation without carrageenan. The increase in hardness and chewiness are coherent with the formation of the gel making a more sliceable product.

In meat analogues, to form the gel emulsion, a commercial carrageenan-rich ingredient comprising of 64% of carbohydrates (43 mol% galactose, 33 mol% 3,6 anhydrogalactose, 24 mol% glucose) with sulphation accounted for 22 %mol was used. The formulation resulted in a firm product with desired parameters when compared to the vegetarian formulated with egg white as a jellying agent. Carrageenan presents as an interesting gel hydrocolloid in meat products and their analogues formulations.

Acknowledgments: *The authors acknowledge LAQV-REQUIMTE (UID/50006 -Laboratório Associado para a Química Verde – Tecnologias e Processos Limpos) and CICECO-Aveiro Institute of Materials, UIDB/50011/2020 (DOI 10.54499/UIDB/50011/2020), UIDP/50011/2020 (DOI 10.54499/UIDP/50011/2020) & LA/P/0006/2020 (DOI 10.54499/LA/P/0006/2020), funded by FCT/MCTES through national funds. B. A. C. Ferreira and P.A.R.F. acknowledge the FCT grant (ref. 2023.03733.BDANA) and research contract funding (project Agenda VIIAFOOD), respectively. Cláudia Nunes thanks FCT for funding through program DL 57/2016 – Norma transitória (Ref. 049 88 ARH/2018 and DL 57/2016/CP1482/CT0031).*

Funding: *This research was funded by PT national funds (FCT/MCTES, Fundação para a Ciência e Tecnologia and Ministério da Ciência, Tecnologia e Ensino Superior) and the European Union (NextGenerationEU) through the project Agenda VIIAFOOD – Plataforma de Valorização, Industrialização e Inovação 206ommercial para o AgroAlimentar (n.º C644929456-00000040). This work was developed within the scope of project "Missão Interface" funded by the Portuguese Recovery and Resilience Plan (PRR) and the Next Generation EU European Fund.*

PP-In19

Changes in the amino acid and biogenic amine content of oyster mushrooms caused by different pretreatment and fermentation

Albert Gashi[1], Meltem Boylu[2], György Kenesei[2], Zsuzsanna Mednyánszky[1], Livia Simon-Sarkadi[1]
[1]Department of Nutrition, Hungarian University of Agriculture and Life Sciences, Budapest, Hungary; [2]Department of Refrigeration and Livestock Products Technology, Hungarian University of Agriculture and Life Sciences, Budapest, Hungary

Ensuring sustainable food protein sources is a growing challenge. Edible mushrooms offer a promising alternative due to their rich nitrogenous compounds, including amino acids (AA) and biogenic amines (BA), which play important roles in nutrition and food safety.
The aim of the study was to investigate the effect of different pre-treatments on nitrogenous compounds of fermented and non-fermented oyster mushrooms.
Oyster mushrooms (*Pleurotus ostreatus*) were purchased from a local market in Hungary. Different pre-treatments were done, such as: blanching (3 min, 100 °C); steaming (3 min, 100 °C); oven cooking (3 min, 100 °C); microwave (3 min, 85 °C, 100 W); HHP (3 min, 300 MPa, 20 °C); ultraviolet (15 min, 20 °C, 30 W, 312 nm). AA and BA were analysed using an Amino Acid Analyzer.
Amino acid and biogenic amine content of fermented and non-fermented oyster mushrooms showed significant variation due to different pre-treatments. In fermented samples, only steaming caused a significant decrease (-30%) in AA content. In non-fermented samples, all treatments increased AA content. The free amino acid (FAA) content in fermented samples was decreased by all treatments. The biggest decrease was caused by blanching (-51%), steaming (-43%), and microwave (-39%) treatment. While in non-fermented samples, only blanching (-24%) and microwave (-15%) treatment had the same effect. In fermented samples, all treatments decreased BA content except UV treatment, where a 3 times increase was measured. In non-fermented samples, all treatments increased BA content more than 50%. These findings highlight the complex interaction between pre-treatments and fermentation, emphasizing the importance of carefully selecting processing methods to improve the nutritional quality of oyster mushrooms while reducing potential health risks associated with high BA content.

Acknowledgments: *The authors acknowledge MATE University's Doctoral School of Food Science and the Hungaricum Scholarship for support.*

PP-In20

Evaluation of the protein bioaccessibility and bioavailability from a new plant-based protein source: *Jatropha curcas* L.

Mona Grünwald, Tuba Esatbeyoglu
Institute of Food and One Health, Gottfried Wilhelm Leibniz University, Hanover, Germany

The increasing demand for alternative protein sources has intensified research into their accessibility and availability [1]. The kernels of the edible *Jatropha curcas* L. (Xuta) have recently been approved by the European Food Safety Authority (EFSA), and due to their promising amino acid (AA) profile, they are considered a nutritionally interesting protein source [2,3]. However, comprehensive studies of bioavailability and bioaccessibility are still missing.
The present study analyses Xuta varieties from different harvesting seasons in an *in vitro* digestion model according to INFOGEST [4]. Samples were taken at different time points during digestion and visualised using SDS-Page with Coomassie Brilliant Blue staining [5]. The transepithelial transport of the digested samples was simulated *in vitro* using a co-culture model (Caco-2/HT29-MTX, differentiation 21 days). The transport experiment was performed for 4 h, and the Papp index was calculated using sodium fluorescein as a marker. The AA profile was determined using HPLC-FLD after derivatisation with *ortho*-phtaldialdehyd.
The degradation of high molecular weight proteins to peptides and AA was visualised using SDS-Page. An impact on the permeability of the transepithelial membrane is evident from the increasing Papp Index observed during the transport experiment, independent of the Xuta variety [6,7]. The AA profile showed differences for Xuta kernels from different harvesting years, with methionine consistently being the limiting AA.
In summary, the proteins in Xuta kernels are bioaccessible. While the transport experiment provides only limited information about the processes occurring in the human digestive tract, it demonstrates that the AA profile of the digested Xuta varieties is complete with regard to the essential AA, except for methionine, the limiting AA. These results underscore the nutritional relevance of Xuta kernels as a highly digestible protein source, which also represents a high quality in terms of its complete and balanced AA profile.

PP-In21

Chitosan nanoparticles used for protecting labile substances in gelation system

Ondrej Hruška, Kristína Masnicová, František Kreps, Erika Hrašková
Department of Food Technology, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia

Chitosan nanoparticles can encapsulate bioactive molecules during their formation. These molecules are bound to the particles non-covalently and can be released and absorbed under conditions of the digestive tract. Anthocyanins are a group of flavonoids found specifically in dark colored fruit and vegetables. Their bioactive and pharmacological potential is immense, including antioxidative and antimicrobial activities and neurological health improvement. Unfortunately, their stability in food is limited, due to their oxidation and degradation during transportation and storage.
The aim of this work is to evaluate the potential of using chitosan nanoparticles as a protective agent for anthocyanins.
Chitosan nanoparticles were prepared using the ionotropic gelation method. The particles were formed in a solution containing cyanidin-3-glucoside (C-3-glc) and cyanidin-3-galactoside (C-3-gal) and concentrated by centrifugation (2000 RCF). The efficiency and quantity of anthocyanin binding to the nanoparticles was determined by HPLC analysis of the supernatant on Sunshell C18 column (150 mm × 4.5 mm; 5 μm) with gradient elution using acetonitrile and formic acid solution as mobile phases. The prepared nanoparticles were then incorporated into a gel matrix.
Under the experimental conditions, 40 % of anthocyanins in the solution were bound to the chitosan nanoparticles. The gel matrix was enriched with 5 % nanoparticles, where we detected addition of 70,70 mg/kg (of gel) of C-3-gal and 1,79 mg/kg (of gel) of C-3-glc to the formulation.
Binding of anthocyanins into the structure of chitosan nanoparticles was observed. The nanoparticles can be incorporated into the gel matrix. This approach could be used also in stabilizing other unstable bioactive compounds like vitamins.
Acknowledgements: *Research was supported by the Slovak Scientific Grant Agency VEGA based on contracts no. 1/0141/23*

PP-In22

Liquid drawing technology for creating a beverage with 3D design

Ippei Inoue
Novel Business Development Department, Suntory Global Innovation Center Ltd., Kyoto, Japan

While 3D printing technology holds promise for novel food manufacturing, application of the technology to beverages has not been considered. We have developed an advanced 3D printing technologies for creating 3D fluidic patterns in a liquid by combining fluid dynamics and robotics. To form the 3D fluidic pattern, the ink containing colored micro-particles is dispensed at any desired position in the liquid, serving as a canvas solution using a robot-equipped nozzle. The blur caused by ink diffusion is suppressed by a constituent particle size design without resorting to macroscopic plasticity, while sedimentation or floating is prevented by tuning the mass density. Utilizing the Stokes-Einstein equation, the micro-particle behavior within the ink can be predicted, indicating that particles ranging from 0.1 μm to 100 μm in diameter are suitable for liquid pattering. The retainability of the obtained patterns depends on the pseudoplasticity of the canvas solution rather than the viscosity itself. A small amount of xanthan gum added to the canvas solution imparted high pseudoplasticity, resulting in improved retainability of the 3D fluidic patterns. Furthermore, the robotic nozzle motion with a low Reynolds number effectively suppresses distortion of the fluidic patterns. Notably, when the Reynolds number was maintained below 10, we successfully obtained relatively persistent line-shaped liquid patterns through experimentation. This liquid drawing technology result in retainable and visually appealing 3D patterns in beverages. Employing this technology, we achieved successful picture drawings in a canvas beverage containing commercial beverages, with the ink beverage incorporating edible particles. The liquid drawing technology, incorporating the insights gained from the physical models and materials studied, enables the development of beverages with diverse visual designs without compromising the drinking experience.

PP-In23

Dietary fibre with functional properties ameliorates the thwarting effects of copper nanoparticles on the caecal microbial enzymatic activity and SCFA production

Jerzy Juśkiewicz[1], Katarzyna Ognik[2], Anna Stępniowska[2], Ewelina Cholewińska[2], Katarzyna Jaworska[1], Przemysław Sołek[2], Dorota Napiórkowska[1], Bartosz Fotschki[1]

[1]*Division of Food Science, Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Tylińskiego 18, 10-683 Olsztyn, Poland;*

[2]*Department of Biochemistry and Toxicology, Faculty of Animal Sciences and Bioeconomy, University of Life Sciences, 13 Akademicka Street, 20-950 Lublin, Poland*

Nanoparticles are pivotal elements in contemporary science. Their unique properties and applications are shaping the future of nutritional research and health optimization. Our preliminary data showed the pros and cons of dietary Cu nanoparticles (Cu-NP) on the large intestinal microbial processes [1]. The primary objective of this project is to confirm that the effect of Cu-NP in the large intestine significantly depends on the physiological functions of various dietary fibres. There is little information on how these compounds together influence the gut microenvironment. The Wistar rats (Cmdb:Wi) were fed diets supplemented with Cu-NP (6.5 or 13 mg/kg) and combined with different fibre types. The microbial enzymatic activity and fermentation end-products were analysed in the rat's caecum.

The dietary addition of higher Cu-NP dose vs. lower dose resulted in decreased total and extracellular activity of specific microbial enzymes, i.e., α-glucosidase, β-galactosidase, β-glucuronidase, α-arabinopyranosidase, and α-rhamnosidase. Additionally, the release rate of β-glucosidase, α- and β-galactosidase from bacterial cells was enhanced by higher Cu-NP doses. The caecal short-chain fatty acids (SCFA) concentration was dramatically diminished by enhanced Cu-NP dose. The dietary addition of functional fibre to diets containing Cu-NP caused a decrease in the release rate of most bacterial enzymes, except β-mannosidase. However, the extracellular and total activities of most analysed bacterial enzymes were substantially increased by fibres addition. Pectin effectively increased nearly all enzyme activities, while psyllium enhanced α-galactosidase and β-glucuronidase activities, and inulin boosted α-glucosidase activity.

The results show that adding dietary fibre helps protect the caecal environment from the harmful effects of CuNPs on microbial activity. It does this by increasing enzyme activity and the production of SCFAs, which may lead to positive metabolic effects.

Acknowledgments: *This research was supported by the National Science Centre, Poland, Grant No. 2021/41/B/NZ9/01104.*

References:

[1] Cholewińska E, et al. PLoS One. 2018, 13: e0197083.

PP-In24

Effect of pretreatment on microwave drying of celery roots and process optimization

Naciye Kutlu

Department of Food Processing, Bayburt University, Aydintepe, Bayburt, Turkey

Celery (*Apium graveolens*) is one of the most important traditional vegetables in human nutrition and a winter crop. Celery is nutritionally and therapeutically important due to its bioactive compound content. Drying celery roots and extending their shelf life to offer them to consumers is important for sustainability. In this study, celery root was dried with a microwave (M) after osmotic dehydration (OD) pretreatment. Both osmotic dehydration and microwave drying process parameters were optimized to determine the optimum conditions for the shortest drying time and highest phenolic compound amount. For this purpose, a Box-Behnken 4-factor 3-level experimental design was created, and optimization was performed using the response surface method (RSM). Independent variables were OD salt concentration, OD temperature, OD holding time, and microwave power; dependent variables were drying time and total phenolic compound (TPC) amount. As a result, optimum drying conditions were found: OD salt concentration of 15.06%, OD temperature of 42.53, OD holding time of 1.6 h, and microwave power of 490 W. The predicted data obtained under these conditions were close to the experimental data. The results were compared with the values obtained from drying with hot air (with OD pretreatment and without pretreatment) as the control group. The drying time took 11 minutes with the microwave and 210 minutes with hot air after the OD process. The drying process was completed in 240 minutes in the samples without pretreatment. In addition, while the TPC values were obtained as 97.45 mg/100 g with the OD+M process, it was determined that they were 63.36 and 60.86 mg/100 g for the OD pretreatment samples and without pretreatment samples, respectively. As a result, it was determined that both the OD pretreatment and the finish microwave drying process significantly positively affected the drying of food materials.

PP-In25

Can mushrooms' polysaccharides decrease cholesterol absorption?

Helena Laronha[1], Filipe Coreta-Gomes[1,2], Manuel A. Coimbra[1], Elisabete Coelho[1]
[1]*LAQV-REQUIMTE, Chemistry Department, University of Aveiro, 3810-193 Aveiro, Portugal;*
[2]*Coimbra Chemistry Center – Institute of Molecular Sciences (CQC-IMS), Department of Chemistry. University of Coimbra, 3004-535 Coimbra, Portugal*

Mushrooms are part of the Mediterranean diet and have a positive impact on health. They are considered functional foods and several *in vitro* and *in vivo* studies have demonstrated the cholesterol-lowering properties of mushrooms powder and polysaccharides-rich extracts through the bile salts sequestration. While these mechanisms are well-established, the structure-function relationship between polysaccharides and cholesterol-lowering effects remains unclear.
Soluble fibers present in two valuable edible mushroom species – *Lactarius deliciosus* and *Macrolepiota procera* – were extracted with hot water and the aqueous extracts were further fractionated with gradual ethanol precipitation. The polysaccharides-rich fractions, insoluble in 50% and 60% ethanol, are composed of galactose and glucose in both mushroom species, rhamnose (*L. deliciosus*) and fucose (*M. procera*). The glycosidic linkages analysis showed the presence of a glycogen-like structure and a rhamnogalactan in the Et50 fraction from *L. deliciosus* and a fucogalactan in the Et50 and Et60 fractions from *M. procera*. To remove the glycogen-like structure, the Et50 fraction from *L. deliciosus* was hydrolyzed by α-amylase, obtaining a fraction Et50> 12 kDa. The rhamnogalactan present in Et50 and Et50 > 12 kDa fractions have different average polymerization degree of rhamnogalactan, which varies between 7 – 26.
Cholesterol solubility and bile salts sequestration capacity of Et50 and Et50> 12 kDa fractions from *L. deliciosus* were studied using an *in vitro* intestinal simplified model. Cholesterol solubility showed that cholesterol accessibility decreased by 73 – 90% and bile salts sequestration capacity showed a decrease of 38 – 10 % for Et50 fractions.
Soluble fibers present in fraction Et50 and Et50 > 12kDa of *L. deliciosus,* a rhamnogalactan, showed an effect on cholesterol solubility and bile salts sequestration capacity. These properties can be influenced by their polymerization degree. This work demonstrates the structure-function relationship between mushroom polysaccharides and hypocholesterolemic properties.

Acknowledgements: *Project Safe2Taste (MTS/BRB/0056/2020 DOI 10.54499/MTS/BRB/0056/2020) and LAQV-REQUIMTE (UID/50006 -Laboratório Associado para a Química Verde – Tecnologias e Processos Limpos). Helena Laronha thanks FCT/MCTES and ESF through NORTE 2020 (Programa Operacional Região Norte) for her PhD grant (Ref. 2022.13262.BD). Elisabete Coelho thanks Portuguese national funds (OE), through FCT, I.P., in the scope of the framework contract foreseen in the numbers 4, 5 and 6 of the article 23, of the Decree-Law 57/2016, of August 29, changed by Law 57/2017, of July 19 (CDL-CTTRI-88-ARH/2018 – REF. 049-88-ARH/2018). Filipe Coreta-Gomes acknowledge the research contract funding due to LAQV-REQUIMTE (UIDB/50006/2020 DOI 10.54499/UIDB/50006/2020) project.*
Funding: *Supported by Safe2Taste (MTS/BRB/0056/2020 DOI 10.54499/MTS/BRB/0056/2020), FightSterol (PTDC/QUI-OUT/29373/2017) funded by FCT/MCTES through national funds and, where applicable, co-financed by the FEDER, within the PT2020 Partnership Agreement and Compete 2020. The authors also acknowledge the funding through LAQV/REQUIMTE (LA/P/0008/2020 DOI 10.54499/LA/P/0008/2020, UIDB/50006/2020 DOI 10.54499/UIDB/50006/2020, UIDP/50006/2020 DOI 10.54499/UIDP/50006/2020, UID/50006 -Laboratório Associado para a Química Verde – Tecnologias e Processos Limpos).*

PP-In26

Enrichment of legumes by filamentous fungi using solid state fermentation process

Dávid Lörinc[1], Tatiana Klempová[1], Kristína Kukurová[2], Jozef Murín[3], Zuzana Ciesarová[2], Milan Čertík[1]

[1]*Institute of Biotechnology, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia;*

[2]*National Agricultural and Food Centre, Food Research Institute, Bratislava, Slovakia;*

[3]*Celpo, a.s., Očová, Slovakia*

Consumption of legumes as a replacement for cereals has recently increased. This is due to their gluten-free character, higher protein content and the fact that they are rich in lysine or essential sulphur-containing amino acids such as methionine. As they have a lower nutritional value compared to animal protein sources, legumes can be enriched with amino acids and other biologically active compounds that are synthesized by filamentous fungi in the process of solid-state fermentation (SSF). SSF uses solid substrates without the presence of free water, which creates natural conditions for growth of lower filamentous fungi belonging to the Zygomycetes group (such as *Mortierella alpina*, *Umbelopsis 214sabelline* and *Actinomucor elegans*). As a substrate for the filamentous fungi, four different matrices (white beans, green peas, yellow peas and red lentils) have been employed. These substrates were after SSF enriched with polyunsaturated fatty acids (e.g. gamma-linolenic acid, eicosapentaenoic acid and arachidonic acid), sterols (ergosterol and desmosterol) and enzymes (proteases, amylases etc.). An increase in the antioxidant activity of the substrates after the SSF process was also observed.
It is therefore clear that fermented legume-based products containing newly formed metabolites, that do not occur naturally in these plant substrates, are of great importance for human health. This makes it possible to replace simple legumes with fermented ones and thus contribute to improving the human nutrition.

Acknowledgements: *This work was supported by the Slovak Research and Development Agency under the Contract no. APVV-23-0169 and APVV-22-0235.*

PP-In27

Saskatoon berry as an easy-to-grow blueberry substitute

Kristína Masnicová, Ondrej Hruška, František Kreps, Natália Smolárová
Department of Food Technology, Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia

Saskatoon berries are a rarely grown plant in Europe that has a similar appearance to blueberries but contains 7 times more anthocyanins. These compounds are of our interest because of helping to prevent the development of cancer and can be added to food applications without the need for further processing, which reduces production costs. Their great advantage is being easy to grow, with a temperature tolerance of -60°C without the need for special soil composition.
The aim of the study was to highlight the nutritional value of Saskatoon berry, especially the amount of anthocyanins.
Water-ethanolic extracts (1 g/10 ml) of 4 Saskatoon berry varieties (Martin, Smoky, Thiesen, Nortline) were prepared and dried under vacuum. Extracts characterization was performed by a series of spectrophotometric and chromatographic analyses. The analysis of cyanidin-3-glucoside (C-3-glc) and cyanidin-3-galactoside (C-3-gal) was performed on SunShell C18 column, gradient elution with mobile phase A (2% formic acid) and B (acetonitrile), using HPLC-DAD (1260 Infinity II, Agilent, SK) detected at 520 nm.
The analysis of Saskatoon berry revealed an antioxidant activity 50 mg Trolox/g sample in contrast to alpha-tocopherol with 522 mg Trolox/g sample ensured by the presence of polyphenolic compounds. Different cultivars of Saskatoon berries contained 64,24 – 90,70 mg of polyphenols/100 g FWT and 3,39 – 9,14 mg/100 g FWT anthocyanins. The dominant anthocyanin was C-3-gal with 6,1 – 16,3 mg/100 g FWT and C-3-glc with 3,1 -9,1 mg/100 g FWT in the samples detected by HPLC-DAD.
All extracts have suitable properties to be used as health-beneficial ingredients to food applications such as gummy candies, drinks or jams. Their potential in preventing the development of cancer makes them a supportive dietary component.

Acknowledgements: *Research was supported by the Slovak Scientific Grant Agency VEGA based on contracts no. 1/0141/23*

PP-In28

AI-Based peak determination for pesticide analysis

Jan Peter Mayser, Vadim Kraft, Waldemar Weber
Shimadzu Europa GmbH, Albert-Hahn Straße 6-10, 47269 Duisburg, Germany

The global regulation of chemical substances, particularly in environmental and drinking water, is intensifying to safeguard human, animal, and plant health. Among these substances, agricultural chemicals, including pesticides, warrant close monitoring due to their widespread use for controlling weeds and insect pests, and their potential to leach into soil and water resources. Given the diversity of pesticides employed, gas chromatography-mass spectrometry (GC-MS) is increasingly utilized for their detection in water, leveraging its capability for simultaneous multi-component analysis. Concurrently, evolving business environments necessitate enhanced performance and functionality in analytical instruments, particularly in response to operator shortages and the need for reduced training costs. The GCMS-QP2050, a new generation of GC-MS, features an innovative ion optical system that provides high sensitivity, robust quantitative analysis, and durability. It also incorporates support functions to enhance operator efficiency and reliability. This article presents an application example of agricultural chemical analysis in water using the cost-effective GCMS-QP2050 entry model, which integrates advanced AI peak integration for improved analytical performance and robustness.

PP-In29

Impact of chestnut flour processing (boiled, roasted, and dried) on the chemical and sensory properties of fresh pasta

A. B. Guedes[1,2], B. Melgar[1], A. Gonçalves[2], L. Pinto[3,4], J. Moreira[5], T. C. Finimundy[1], L. Barros[1]

[1]*CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;*
[2]*MORE – Collaborative Laboratory Mountains of Research, Brigantia Ecopark, 5300-358 Bragança, Portugal;*
[3]*AquaValor – Centro de Valorização e Transferência de Tecnologia da Água – Associação, Rua Dr. Júlio Martins n.º 1, 5400-342 Chaves, Portugal;*
[4]*LiveWell – Research Centre for Active Living & Wellbeing, Instituto Politécnico de Bragança, Bragança, 5300-253, Portugal;*
[5]*Sortegel, Produtos Congelados, SA, Rua São Mamede Nr 25, 5300-903 Sortes, Bragança, Portugal*

This study aimed to characterize chestnut flour processed by different methods (roasting, boiling, and drying), evaluating its aromatic, nutritional, and functional properties for potential application in the food industry. Carbohydrates, proteins, and lipids were the most abundant macronutrients, with variations depending on the processing method. Drying (50°C) resulted in higher protein, ash, and free sugar (sucrose) content, as well as greater total organic acid concentration, with quinic and citric acids being predominant. Palmitic, oleic, and linoleic acids were the most abundant fatty acids, and boiled flour exhibited the highest proportion of polyunsaturated (46.5 ± 1.0%) and monounsaturated (34.3 ± 0.36%) fatty acids. Volatile compound analysis by HS-SPME/GC-MS identified 66 compounds, primarily aldehydes, alcohols, and hydrocarbons, with distinct profiles for each processing method. Incorporating chestnut flour into fresh pasta formulations enhanced nutritional value, flavor, color, and texture, contributing to good sensory acceptance with over 50% purchase intention. These findings reinforce the potential of chestnut flour as a functional ingredient, supporting its commercial application in gluten-free and alternative food products.

PP-In30

Valorization of hemp flour in wheat-based products: rheological, structural, and optical properties

Andreea – Lavinia Mocanu[1,2], Cătălina – Beatrice Poteraș[1,2], Susman Iulia[2], Gabriela Criveanu-Stamatie[2], Corina Stroe[1,2], Elena Ungureanu[2], Mustățea Gabriel[2]

[1]*National University of Science and Technology POLITEHNICA Bucharest, Faculty of Chemical Engineering and Biotechnology, Bucharest, Romania;*

[2]*National Research & Development Institute for Food Bioresources – IBA, Bucharest, Romania*

The incorporation of *Cannabis sativa L.* (hemp) flour into wheat-based products is a promising approach for developing functional foods with enhanced nutritional and technological properties. This study aimed to evaluate the effects of partially replacing refined wheat flour and whole wheat flour with hemp flour at levels ranging from 5% to 40%, focusing on changes in dough functionality, structural characteristics, and visual quality. Three analytical methods were employed: color analysis, Mixolab rheological testing, and FT-IR spectroscopy. Color parameters (L*, a*, b*) showed a noticeable darkening and shift toward red hues with increasing hemp content. Mixolab analysis indicated a decrease in hydration capacity as the proportion of hemp flour increased. In wheat flour mixtures, hemp addition strengthened the protein network but reduced starch gelatinization and retrogradation. In contrast, whole wheat flour mixtures exhibited weakened protein structure at higher hemp levels, along with a consistent decrease in starch stability. FT-IR spectra confirmed these structural shifts, with increased intensity in the O–H and C–H stretching regions suggesting enhanced water-binding capacity due to hemp's fiber content. A decline in Amide I and II bands indicated disruption of the gluten network, particularly in samples with 15% hemp in wheat flour and 30% in whole wheat flour. Additionally, reduced absorption in the 1200–1000 cm^{-1} carbohydrate fingerprint region reflected altered starch–fiber interactions and a less cohesive dough matrix. Overall, the results highlight hemp flour's potential to improve the nutritional profile of bakery products while emphasizing the importance of optimizing its concentration to maintain desirable textural and structural attributes. These findings support the valorisation of hemp as a sustainable and functional ingredient for bakery applications and contribute to the growing body of research on plant-based flour alternatives in food product development.

PP-In31

Rapid quantification of EPA and DHA in fish oil-based food supplements using mid- and near-infrared spectroscopy combined with partial least squares regression

Chi Mai Nguyenová, Jan Poustka

Department of Food Analysis and Nutrition, University of Chemistry and Technology, Prague, Czech Republic

The great interest in fish oil omega-3 food supplements has driven the development of rapid methods based on vibrational spectroscopy in combination with chemometrics. In this study, Attenuated Total Reflectance – Fourier Transform Infrared Spectroscopy in the mid-infrared region (ATR-FT-MIR) and Fourier Transform Infrared Spectroscopy in the near-infrared region (FT-NIR) combined with Partial Least Squares Regression (PLSR) were applied for the quantification of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in commercially available fish oil omega-3 food supplements (n=33). Reference values were measured by gas chromatography with flame Ionization detector (GC-FID). The results were verified using FAPAS fish oil material obtained within the proficiency testing procedure. The developed PLSR models demonstrated a strong linear correlation of the reference GC-FID and FTIR measurements confirming their potential for rapid and reliable analysis of fish oil omega-3 supplements.

PP-In32

Bioaccessibility and prebiotic effects of phenolic compounds from *Diospyros kaki* extract

Giulia Moretto[1,2], Raffaella Colombo[1], Raquel Rodríguez-Solana[3], Gema Pereira-Caro[4], Adele Papetti[1,2]
[1]*Department of Drug Sciences, University of Pavia, Pavia, Italy;*
[2]*NBFC, National Biodiversity Future Center, Palermo, Italy;*
[3]*Department of Agroindustry and Food Quality, Andalusian Institute of Agricultural and Fisheries Research and Training (IFAPA), Cádiz, Spain;*
[4]*Department of Agroindustry and Food Quality, Andalusian Institute of Agricultural and Fisheries Research and Training (IFAPA), Córdoba, Spain*

Diospyros kaki is an edible plant possessing many healthy properties due to its high content in flavonoids. However, in *vitro* plant extracts' bioactivities may not fully represent the in *vivo* effects since polyphenols are subject to modifications during gastrointestinal digestion that affects their stability and bioavailability. In addition, unabsorbed and incompletely digested polyphenols are transformed by the intestinal microbes to produce potential active metabolites, which can then be absorbed at the colonic level and exert their biological effect.

The aim of this study was to evaluate the bioaccessibility, the antioxidant activity, and the prebiotic effects of *Diospyros kaki* leaf polyphenolic extract after in *vitro* simulated digestion and colonic fermentation.

Diospyros kaki freeze-dried extract was submitted to Infogest 2.0 digestion protocol, followed by an in *vitro* colonic fermentation. The polyphenolic profile of the undigested, digested, and fermented extract was performed by UHPLC-HRAM-MS. Differently, the analysis of short chain fatty acids was performed by GC-FID. The antioxidant activity was evaluated through ORAC, DPPH and ABTS assays.

39 compounds belonging to the flavonoid class (including kaempferol-3-glucoside, kaempferol-3-arabinofuranoside, kaempferol-7-(4')galloyl-pentose, isorhamnetin-3-glucoside and quercetin-3-galactoside) were detected in the extract. The *in vitro* digestion and colonic fermentation markedly affected the polyphenol content, since it decreased after intestinal digestion and, mainly, after 24h of fecal fermentation. A similar trend was also observed for the antioxidant properties, except for the ORAC test indicating increased antioxidant activity after 2h and 4h of colon fermentation. Furthermore, the incubation the *Diospyros kaki* extract with human feces increased the levels of short-chain fatty acids with a parallel pH decrease.

Gastrointestinal and microbial modification of *Diospyros kaki* extract could affect its bioactivity.

Acknowledgements: *The project is funded under NRRP funded by the EU—NextGenerationEU. Project code CN_00000033, CUP F13C22000720007. Project title "National Biodiversity Future Center—NBFC.*

PP-In33

Acorn flour as a new food ingredient: nutritional composition and shelf life

Francesca Vurro, Alexandra-Mihaela Ailoaiei, Davide De Angelis, Giacomo Squeo, Antonella Pasqualone
Department of Soil, Plant and Food Science, University of Bari Aldo Moro, Via Amendola, 165/a, 70126 Bari, Italy

In recent years, scientific interest in acorns as a food source has increased, due to their richness in nutrients and bioactive compounds, including hydrophilic (phenols) and lipophilic (tocopherols) ones, both known for their antioxidant properties. Historical evidence suggests that acorns played a significant role in human nutrition, particularly during times of war and famine. Apulia, a region in southern Italy, hosts a high biodiversity of *Quercus* species.
The aim was to characterize the nutritional composition of flour prepared from acorns of *Q. pubescens* W., *Q. ilex* L., and *Q. trojana* W. collected in Apulia and evaluating the shelf life of a corn flour under four different packaging conditions. The study was supported by the PRIMA project MEDACORNET – Rescuing acorns as a Mediterranean traditional superfood.
Four sampling points in the Apulia region were considered, for two years. The flour was packed in PA/PE 20/70 plastic film under normal atmosphere, vacuum and two different modified atmosphere packaging (MAP) conditions: 50:50 N_2-CO_2 and 80:20 N_2-CO_2. Packaged flour samples were stored at room temperature (20 °C, in the dark) and monitored for lipid oxidation for six months, assessing primary and secondary oxidation markers. AACC and AOCS analytical methods were followed. Data were statistically treated.
Carbohydrates were the main component of acorn flours (~90% d.m.), with dietary fiber contributing significantly (7–24% d.m.). Proteins were low (3–6% d.m.), while lipids (about 7% d.m.) were mainly unsaturated (principally oleic and linoleic acid). The flours showed a relevant antioxidant activity, due to the concentration of phenolic compounds, which varied according to species and year (17–81 mg GAE/g d.m.). Vacuum packaging was the most effective and cost-efficient solution, resulting in lower peroxides and hexanal concentrations over six months.
Acorn flour can be used as a functional ingredient and retains its quality best under vacuum packaging.

PP-In34

Nutritional potential of *Lactarius deliciosus* mycelium for sustainable fungi-based food innovation

Carla Pereira[1], Maria Gabriela Leichtweis[1], Catarina Ribeiro[2], Andreia Afonso[2], Maria InêsDias[1]
[1]*CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;*
[2]*Deifil Technology Lda., Rua do Talho 80, 4839-704 Póvoa de Lanhoso, Portugal*

The increasing demand for sustainable and protein-rich food sources has driven research into innovative alternatives to animal-based products. In this context, fungal mycelium emerges as a promising matrix, recognized for its nutritional profile and low environmental impact. This study focuses on the mycelium of *Lactarius deliciosus*, a species widely valued for its bioactive compounds, exploring its potential as a sustainable food ingredient. By conducting its cultivated and a detailed nutritional (AOAC methods) and chemical characterization, including lipid (GC-FID) and sugar (HPLC-RI) profiling, this research aims to contribute to the development of novel food products aligned with circular economy principles and food innovation.
The cultivated mycelium revealed a moisture content of 85.7 ± 0.3 g/100 g, with protein (1.9 ± 0.2 g/100 g) and carbohydrates (11.0 ± 0.5 g/100 g) as the main macronutrients. Additionally, twelve fatty acids were identified, with capric, palmitic, and linoleic acids being predominant (46 ± 2%, 18,4 ± 0,6%, and 10,7 ± 0,6%, respectively), alongside mannitol and fructose as the main free sugars.
These findings highlight the potential of *L. deliciosus* mycelium as a valuable ingredient for sustainable food innovation, aligning with the growing demand for nutrient-dense and environmentally friendly alternatives.

Acknowledgements: *FCT/MCTES (PIDDAC): CIMO, UIDB/00690/2020 (DOI: 10.54499/UIDB/00690/2020) and UIDP/00690/2020 (DOI: 10.54499/UIDP/00690/2020); and SusTEC, LA/P/0007/2020 (DOI: 10.54499/LA/P/0007/2020); institutional scientific employment program contract with M.I.D. (10.54499/CEECINST/00016/2018/CP1505/CT0004) and C.P. (10. 54499/CEECINST/00016/2018/CP1505/CT0010). To "Myco2Feed – Inovação e sustentabilidade na criação de micélio comestível e de alimentos funcionais à base de micélio" project (COMPETE2030-FEDER-00585700, Nº 14444.*

PP-In35

Isolation and identification of potential starter cultures to obtain bioactive fermented oats

Maylis Renard[1], Elena Peñas[1], Cristina Martínez-Villaluenga[1], Juana Frias[1], José María Landete[2], José Antonio Curiel[2]

[1]*Department of Technological Processes and Biotechnology, Institute of Food Science, Technology and Nutrition (ICTAN-CSIC), Madrid, Spain;*

[2]*Department of Food Technology, National Institute for Agricultural and Food Research and Technology (INIA-CSIC), Madrid, Spain*

Oat fermentation using lactic acid bacteria (LAB) leads to numerous nutritional benefits including a lower glycemic index, reduced antinutrient content, improved macronutrient digestibility, dietary fiber and proteins, enhanced bioavailability of minerals, and better antioxidant properties, contributing to the mitigation of oxidative stress. Although fermentation can be carried out by commercial starter cultures, innovative starters can be isolated from the proper food matrix, which is of greater interest considering their adaptation to the substrate. This work consisted in isolating, characterizing, and identifying starter cultures from wholegrain oat flour for further fermentation of oats and their derived products. A total of 123 LAB isolates were characterized as starter cultures based on their ability to acidify oat sourdoughs (200% dough yield) at 32 °C for 24 h, and identified through amplification of their 16S-23S rDNA internal transcribed spacer. Although the strains of *Lactiplantibacillus plantarum* and *Lactiplantibacillus argentoratensis* species were minorly found in both flour and sourdoughs, they showed the best fermentative capabilities in the oat matrix. Indeed, pH of the single-strain sourdoughs inoculated with the latter species decreased to 4.3, as confirmed by a higher titratable acidity. Besides, a satisfactory growth potential was observed, with strains reaching 10^9 CFU/mL after fermentation at 32 °C for 24 h. Regarding nutritional and bioactive composition of oat sourdoughs, those obtained with both *Lactiplantibacillus* species showed a significant free polyphenol (150 mg GAE/100 g of fresh dough, f.d.) and β-glucan (4–6 g/100 g f.d) contents, and a higher oxygen radical absorbance capacity (250–300 mg TE/100 g f.d) than those obtained by the other isolated LAB strains. Therefore, *L. plantarum* and *L. argentoratensis* are the most promising starter cultures to ferment any type of oat-derived products.

Funds: *PID2022-138978OB-I00 by MCIN/AEI/10.13039/501100011033 and "FEDER A way of making Europe". M. Renard thanks the JAE-intro program (CSIC).*

PP-In36

Oligosaccharide-based investigation of adulteration in fruit juices and fruit juice concentrates

Kai Scholten[1], Angelina Schneider[2], Daniel Wefers[2], Sascha Rohn[1], Clemens Kanzler[1]

[1]*Department of Food Chemistry and Analytics, Technische Universität Berlin, Berlin, Germany;*

[2]*Food Chemistry – Functional Foods, Martin-Luther-Universität Halle-Wittenberg, Halle (Saale), Germany*

The BMWK/DLR/FEI-funded project "JuiceAuthent" aims at developing a HPLC-MS/MS method to detect sugar adulteration in matrices like fruit juices and fruit juice concentrates. This method is intended to address both suspected and novel forms of adulteration. As supply chains are becoming more complex and raw materials are getting scarce, because harvest yields are varying, the risk for adulterated products is increasing, accordingly. Here, sugar syrups are suspected raw materials.

Current detection methods demonstrate limitations in their capacity to identify these adulterants. The stable isotope analysis of syrups from C3-plants like rice, for example, poses difficulties in the identification of foreign sugar sources. The so-called "Low method" for the analysis of silylated carbohydrates using GC-FID is a well-established method to date. However, this method focuses only on two marker substances that are formed during the acid hydrolytic production of inverted sugar syrup. To assess the method's applicability, a range of different sources, including rice, date, agave, fructose-glucose, glucose, and inverted sugar syrups, as well as fruit juices from apple, orange, strawberry, passion fruit, and grape, were characterized using an adapted method. Initial results demonstrated that the "Low method" is inappropriate to detect foreign sugars in fruit juices using the conventional markers, when being enzymatically produced inverted sugar syrup is used. Preliminary findings demonstrated that within model systems, a dispersive activated carbon system in conjunction with subsequent organic elution effectively separated dominant simple sugars from the more promising maltodextrin oligomers. The application of this method as a means of sample preparation for fruit juices and nablees comprehensive analysis of oligosaccharide patterns by employing HPLC-MS/MS. This will allow the identification of novel markers and provide a basis for authentication of fruit juices and concentrates using HPLC-MS/MS, further protect consumers from potential future fraudulent ingredients.

PP-In37

Impact of cricket powder supplementation on gut inflammatory markers and cholesterol levels in a mouse model of diet-induced obesity

Otto Selenius[1], Terhi Kolari[1], Gabriel Vinderola[2], Seppo Salminen[1]
[1]*Faculty of Medicine, University of Turku, Turku, Finland;*
[2]*Faculty of Chemical Engineering, National University of Litoral, Santa Fe, Argentina*

Acheta domesticus powder is safe for human consumption and nutritionally beneficial, containing essential fatty acids and bioactive components. However, research on its metabolic effects, particularly on inflammation and cholesterol, is limited.
This study aimed to investigate the impact of cricket powder consumption on the weight gain, gut inflammation and LDL cholesterol serum levels of mice with diet induced obesity.
5–6-week-old C57bl/6 mice (n=33), were housed individually receiving food and water ad libitum. Mice were randomly divided into three groups receiving either control diet (C), high fat diet (HFD), or high fat diet with 2.5% of *Acheta domesticus* cricket powder (HFD+A) for eight weeks. Mice were weighed weekly, and 24-hour food intake was measured. In the end mice were fasted for 15 hours, anesthetized, and sacrificed. Small intestine samples were collected for cytokine analysis and blood samples were analysed for cholesterol and triglycerides. ANOVA and hierarchical linear mixed models were employed to assess the impact of diet on weight gain, food intake, lipid profiles, and inflammatory markers.
No significant differences in the feed consumption and weight gain between HFD and HFD+A mice. However, HFD+A mice had significantly lower LDL cholesterol levels compared to HFD mice, with a 22.65 % reduction. No significant differences between treatment groups were found in IFN, TNH, or IL-6 levels in small intestine tissue samples, except IL-12 levels were higher in the control group compared to the HFD group.
Substitution of 2.5% cricket powder in a high-fat diet did not significantly impact weight gain, food intake or intestine cytokine levels in obese mice. However, it significantly reduced LDL cholesterol levels, suggesting a potential benefit for cardiovascular health. These findings indicate that cricket powder could help manage LDL cholesterol without adversely affecting weight gain or inflammation. Future research should explore the metabolic outcomes of cricket powder consumption.

PP-In38

Encapsulated flavours: a strategy to reduce sodium in canned tuna

Carmo Serrano[1,2], Beatriz Fernandes[1,3], Gabriel Mota Ribeiro[4], Daniela Araújo[5], Joana Castro[5,6,] Luís F. Baião[7,8], Helga Augusto[9], Ana Cação[9], Helena Oliveira[10,11], Leonor Nunes[10]

[1]*INIAV, National Institute for Agrarian and Veterinary Research, Oeiras, Portugal;*
[2]*LEAF, Linking Landscape, Environment, Agriculture and Food – Research Center, Instituto Superior de Agronomia, University of Lisbon, Lisbon, Portugal;*
[3]*CERENA, DEQ, Instituto Superior Técnico, University of Lisbon, Lisbon, Portugal;*
[4]*FMSI, Lda, Rio de Mouro, Portugal;*
[5]*INIAV, National Institute for Agrarian and Veterinary Research, Vairão, Portugal;*
[6]*Centro de Engenharia Biológica, Universidade do Minho, Braga, Portugal;*
[7]*SenseTest Lda, Vila Nova de Gaia, Portugal;*
[8]*GreenUPorto/INOV4Agro & DGAOT, Faculty of Sciences of the University of Porto, Vairão, Portugal;*
[9]*Cofisa, S.A, Figueira da Foz; 9-REQUIMTE/LAQV, ISEP, Polytechnic of Porto, Porto, Portugal;*
[10]*Interdisciplinary Centre of Marine and Environmental Research, Terminal de Cruzeiros do Porto de Leixões, University of Porto, Matosinhos, Portugal;*
[11]*Division of Aquaculture, Upgrading, and Bioprospecting, Portuguese Institute for the Sea and Atmosphere, Lisbon, Portugal*

Excessive sodium consumption is a global health concern, yet reducing salt in processed foods remains a challenge due to its role in flavour enhancement and food stability. This study explores the use of encapsulated aroma extracts obtained from aromatic plant and spices to offset a 40% sodium reduction in brine for canned tuna, while masking undesirable flavour components and maintaining or improving the flavour profile, texture, stability, and shelf life.

Four encapsulated aromas were tested in canned tuna in oil: (i) lemon and pepper designed to replace the unbalanced factory formulation, which degrades after sterilization; (ii) spicy aroma aimed at enhancing the perception and enabling sodium reduction; and (iii) two additional aromas that mask salt reduction without being explicitly detected by consumers.

The results showed that the new lemon and pepper formulation maintained its balance and stability during the sterilization process, improving the overall sensory profile. The spicy aroma effectively enhanced the flavour intensity, allowing for a significant sodium reduction without compromising taste. Both undetectable flavors subtly modified the perception of taste, demonstrating their potential to reduce sodium without changing the consumer perception.

Encapsulation proved to be an effective technique for preserving the aromatic integrity of natural extracts and ensuring controlled flavour release in canned tuna. These findings highlight an innovative approach to reducing sodium content while maintaining or enhancing sensory qualities, offering a promising solution for healthier and appellative canned seafood products.

PP-In39

Nutritional potential of brown algae extracts: a study on *Bifurcaria bifurcate*, *Fucus spiralis*, and *Ascophyllum nodosum*

Aurora Silva[1,2], Cristina Soares[2], Franklin Chamorro[1], Maria Carpena[1], Rafael Nogueira-Marques[1], M. Fátima Barroso[2] and M.A Prieto[1]

[1]Universidade de Vigo, Nutrition and Food Group (NuFoG), Department of Analytical Chemistry and Food Science, Instituto de Agroecoloxía e Alimentación (IAA) – CITEXVI, 36310 Vigo, Spain;

[2]REQUIMTE/LAQV, Instituto Superior de Engenharia do Porto, Instituto Politécnico do Porto, Rua Dr. António Bernardino de Almeida 431, 4249-015 Porto, Portugal

Macroalgae, especially brown algae, are recognized by the scientific community as being rich in secondary metabolites that give them bioactive properties such as antioxidants, antimicrobial, and cytotoxic properties, among others [1]. There is therefore a great deal of interest in producing and studying extracts to incorporate them into food matrices. However, it is no longer common for scientific studies to focus on the nutritional composition of these extracts. In this work, three edible brown algae: *Bifurcaria bifurcata*, *Fucus spiralis*, and *Ascophyllum nodosum* were subjected to microwave extraction, and the extracts obtained were characterized in terms of their composition in carbohydrates, lipids, minerals, and proteins. In addition, its fatty acid profile (GC-FiD), amino acids (AA) (HPLC-FL), and the phenolic compounds present in the extracts (HPLC-ESI-QqQ-MS/MS) were also studied.

The results indicated the presence of significant quantities of minerals such as sodium (4.4–6.3 g/kg dw) and calcium (0.8–2.0 g/kg dw); however, the element with the highest quantity was potassium (17–31 g/kg dw). Regarding proteins and lipids, the richest extract was obtained from *B. bifurcata*, with 2.6% and 4.9%, respectively. The presence of palmitoleic acid and oleic acid was quantified in all extracts, and the most prevalent amino acids detected were glutamic acid (~20 mg AA/g protein) and aspartic acid (~10 mg AA/g protein). The analyses of the phenolic profile showed the presence of different chemical families, but the most relevant was phlorotannins, which constituted more than 50% of the phenolic compounds detected and reached 70% of the *F. spiralis* and *B. bifurcata* phenolic compounds. The results showed that even after extraction, macroalgae offers nutritional benefits, including proteins, essential amino acids, fatty acids, polysaccharides, and phenolic compounds.

Acknowledgments: *Aurora Silva thanks EU-FORA Fellowship Program (EUBA-EFSA-2023-ENREL-01) and the financial support FCT/MCTES (UIDB/50006/2020 DOI 10.54499/UIDB/50006/2020).*

1. *Crit. Rev. Food Sci. Nutr.* doi:10.1080/10408398.2022.2115004.

PP-In40

Seaweed-derived functional edible coatings to reduce oil uptake in fried fish fillets

Gabriela Sousa[1], Carla Tecelão[2], Suzana Ferreira-Dias[3], Vítor Alves[1]

[1]*Universidade de Lisboa, Instituto Superior de Agronomia, LEAF – Linking Landscape, Environment, Agriculture and Food Research Centre, Associate Laboratory TERRA, 1349-017 Lisboa, Portugal;*

[2]*MARE – Marine and Environmental Sciences Centre/ ARNET – Aquatic Research Network, Politécnico de Leiria, 2520-641 Peniche, Portugal;*

[3]*Universidade de Lisboa, Instituto Superior de Agronomia, LEAF – Linking Landscape, Environment, Agriculture and Food Research Centre, Laboratório de Estudos Técnicos, 1349-017 Lisboa, Portugal*

Portugal has a significant coastal area, being bordered by the Atlantic Ocean in an estimated extension of 987 km. This localization represents opportunities for economic development and put us at the forefront of maritime potential. Oceans, the largest life-support system, are remarkably diverse in underexplored food resources like some fish and seaweed species. The present study aims at producing functional edible coatings from seaweed bioactive compounds and polysaccharides to coat fish fillets, contributing to reduce the oil uptake during frying. As such, two green seaweeds (*Codium tomentosum* Stackhouse and *Ulva* sp.) and one brown seaweed (*Sargassum vulgaris* Grunow) were studied as source of polysaccharides and bioactive compounds. To obtain these compounds, hydrothermal and ultrasound-assisted extraction processes were applied, following a central composite rotatable design. In both cases, besides the polysaccharides yield, the extracts were characterized in terms of total sugars, uronic acid content, total phenolic content, and antioxidant activity. The results show that *Ulva* is the most promising polysaccharides source, with higher extraction yields (11.9 – 34.5%) than *Codium* (7.6 – 14.5 %) and *Sargassum* (3.2 – 10.6 %). Furthermore, hydrothermal treatment allows higher yields (21.5 – 34.5 %) than ultrasound-assisted extraction (11.9 – 20.8 %). In what concerns phenolic content and antioxidant activity, *Sargassum* extracts achieved the most promising results that did not depend on the extraction process applied. The polysaccharides have shown good film forming capacity with excellent barrier to oils. Therefore, the results suggest using *Ulva* polysaccharides together with bioactive compounds from *Sargassum* to produce functional edible coatings that minimize oil uptake in fried food products.

Acknowledgments: *This research was funded by the national funding of FCT–Fundação para a Ciência e a Tecnologia, Portugal, and by LEAF -Linking Landscape, Environment, Agriculture and Food Research Centre (UIDB/04129/2020;UIDP/04129/2020), MARE (UIDB/04292/2020; UIDP/04292/2020). Gabriela Sousa granted with a PhD scholarship from FCT (2022.13225.BD)*

PP-In41

Angiotensin-converting enzyme inhibitory activity of selected phenolic acids, flavonoids and their O-glucosides, and low molecular phenolic metabolites in relation to their oxidation potentials

Danuta Zielińska[1], Małgorzata Starowicz[2], Małgorzata Wronkowska[2], Henryk Zieliński[2]
[1]*Department of Chemistry, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland;*
[2]*Team of Chemistry and Biodynamics of Food, Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Olsztyn, Poland*

In this study, the angiotensin-converting enzyme (ACE) inhibitory activity of selected phenolic acids, flavonoids, their *O*-glucoside derivatives, and low molecular weight phenolic metabolites was investigated to assess their potential roles in the management of hypertension. Furthermore, the relationship between ACE inhibitory potency and the first anodic peak oxidation potential (E_{pa}), as determined by differential pulse voltammetry (DPV), was evaluated to elucidate structure–activity relationships associated with redox behaviour.
Phenolic acids exhibited relatively low ACE inhibitory activity. The observed order of inhibition potency was as follows: chlorogenic acid > *p*-coumaric acid > sinapic acid > gentisic acid > ferulic acid > syringic acid > vanillic acid > protocatechuic acid > caffeic acid. In contrast, low molecular weight phenolic metabolites derived from flavonoids displayed moderate inhibitory effects, whereas flavonoid aglycones demonstrated the most pronounced ACE inhibitory activity. Among these, the inhibitory ranking was: luteolin > quercetin > kaempferol > cyanidin > delphinidin > pelargonidin > naringenin.
A reduced ACE inhibitory activity was observed for selected 3-*O*- and 4'-*O*-glucosides, including quercetin-3-*O*-glucoside, luteolin-4'-*O*-glucoside, cyanidin-3-*O*-glucoside, and pelargonidin-3-*O*-glucoside. In contrast, flavonoid 7-*O*-glucosides, such as those of luteolin, apigenin, and kaempferol, exhibited higher ACE inhibitory potential, suggesting a positional effect of glycosylation on biological activity.
No significant correlation was found between the IC_{50} values of phenolic acids or low molecular weight phenolic metabolites and their E_{pa} values. However, weak positive correlations were observed for flavonoid aglycones ($r = 0.61$), 3-*O*-glucosides ($r = 0.66$), and 7-*O*-glucosides ($r = 0.88$) with their respective E_{pa} values, indicating that oxidation potential may partially influence ACE inhibition in structurally related compounds.
These findings provide further insight into the redox-activity relationships underlying the ACE inhibitory effects of phenolic compounds and highlight the influence of specific structural features—including aglycone *vs*. glycoside form and glycosylation position—on their potential antihypertensive properties.

PP-In42

Multifaceted biological activity of rutin, quercetin, and its glucosides

Danuta Zielińska[1], Małgorzata Starowicz[2], Małgorzata Wronkowska[2], Henryk Zieliński[2]
[1]*Department of Chemistry, University of Warmia and Mazury in Olsztyn, Olsztyn, Poland;*
[2]*Team of Chemistry and Biodynamics of Food, Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Olsztyn, Poland*

In the present study, the multifaceted bioactivities of quercetin (Q), rutin (Ru), and their glucosylated derivatives—quercetin-3-O-glucoside (Q3G), quercetin-4'-O-glucoside (Q4'G), and quercetin-3,4'-O-diglucoside (Q3,4'G)—were systematically evaluated. Antioxidant capacities were quantified via electrochemical approaches, specifically cyclic voltammetry (CV), while the inhibitory effects on angiotensin-converting enzyme (ACE), acetylcholinesterase (AChE), and the formation of advanced glycation end-products (AGEs) were assessed using *in vitro* model systems relevant to hypertension, Alzheimer's disease, and diabetic complications, respectively.
The compounds exhibited differential efficacy across all tested parameters. The ACE inhibitory activity followed the order: Q > Q3,4'G > Ru > Q3G > Q4'G, with a moderate negative correlation observed between ACE inhibition and antioxidant potential ($r = -0.68$), suggesting a structural dependence of ACE inhibition on redox properties. In the case of AchE inhibition, the activity ranking was: Q ≈ Q3G ≈ Q4'G ≈ Ru > Q3,4'G, and a stronger inverse correlation was found between antioxidant potential and AchE inhibition ($r = -0.77$), further supporting the influence of molecular structure on enzymatic interaction.
Regarding anti-glycation effects, all glucosylated quercetin derivatives demonstrated potent inhibitory activity in a BSA/methylglyoxal (MGO) model system. The anti-AGE activity followed the order: Q3,4'G ≈ Q4'G ≈ Q3G > Ru ≈ Q > aminoguanidine (AG). Notably, anti-AGE activity was inversely correlated with both ACE ($r = -0.67$) and AchE ($r = -0.81$) IC_{50} values, indicating potential shared structural features that govern activity across these biological targets. However, no significant correlation was observed between ACE and AchE inhibition profiles, suggesting distinct interaction mechanisms.
These findings highlight the structural and redox-dependent bioactivity profiles of quercetin, rutin, and their glucosides. The demonstrated multifunctionality reinforces their potential as pleiotropic agents of therapeutic interest, particularly in the prevention or management of oxidative stress-related pathologies, cardiovascular diseases, neurodegenerative disorders, and metabolic complications.

PP-In43

Biodiesel production from edible insect oils

Özge Süfer[1], Gülşah Çalışkan Koç[2]

[1]*Food Engineering Department, Osmaniye Korkut Ata University, Osmaniye, 80000, Türkiye;*

[2]*Uşak University, Eşme Vocational School, Food Processing Department, Food Technology Program, Eşme, Uşak, Türkiye*

The concept of insect biorefinery aims to leverage insects' potential to convert biomass waste into valuable energy and other beneficial products while simultaneously processing organic components without harming the environment. Through transesterification processes, lipids derived from mature insects can be transformed into biodiesel, offering a sustainable energy source. For biodiesel production, the deactivated insects are washed, and dried before oil extraction. After removing excess solvents, purification steps are applied, and biodiesel production is carried out using various techniques, including non-catalytic transesterification, direct transesterification, etc. While species such as Termites, Lepidoptera, Hymenoptera, and Odonata are not ideal sources of biodiesel due to their low lipid content, Diptera species are becoming increasingly attractive feedstocks for biodiesel production due to their high lipid content and rapid growth rates. In particular, the black soldier fly larvae (BSFL) is advantageous as animal feed. However, a significant portion of its nutritional value, especially in terms of fat content found in BSF prepupae, makes it a valuable source for biodiesel production. The quality of the biodiesel produced is closely linked to the lipid quality of the insect. Certain insect larvae also hold great potential as feedstock for biodiesel production. This review aims to explore an alternative method by examining insect use for biodiesel production, inspired by the widespread practice of insect consumption in Asian countries.

PP-In44

Optimization of pressurized liquid extraction for efficient recovery of valuable polar antioxidant-rich fractions from *Gnaphalium uliginosum* L.

Marius Užupis, Michail Syrpas, Vaida Kitrytė-Syrpa
Faculty of Chemical Technology, Department of Food Science and Technology, Kaunas University of Technology, Kaunas, Lithuania

Gnaphalium uliginosum L. (marsh cudweed) belongs to the *Asteraceae* family. *G. uliginosum* has been used in ethnomedicine and has a wide range of pharmacological properties, including hypotensive, wound healing, anti-inflammatory, astringent, and antiseptic effects. It is used in the treatment of hypertension, stomach ulcers, and slow healing wounds. The aerial parts of *G. uliginosum* have been shown to contain high levels of caffeoylquinic acids and distinctive flavonoids: jaceosidin, isoquercitrin, apigenin 7-O-β-d-glucopyranoside, and 6-methoxyluteolin, supporting its medicinal potential due to antioxidant and anti-inflammatory properties. However, the extraction process of potential bioactive compounds from *G. uliginosum* remains largely unexplored, with limited information available on the properties and therapeutic potential of its extracts.

In this study, we aimed to optimise the parameters of pressurised liquid extraction using various hydroethanolic (PLE-EtOH/H_2O) mixtures to maximise the extraction yield, total phenolic and flavonoid content (TPC and TFC), and antioxidant activity measured by different *in vitro* assays ($ABTS^{•+}$, CUPRAC, ORAC). To evaluate the impact of selected parameters: temperature (T, 40–100 °C), time (τ, 15–45 min), and ethanol/water ratio (EtOH/H_2O, 20–80 % v/v), a combination of central composite design and a response surface methodology (CCD-RSM) was used. The results show that PLE-EtOH/H_2O under various conditions increases the extract yield from 20.3 to 31.3 g/100 g DW, significantly exceeding the yield obtained through ethanolic Soxhlet extraction (10.8 g/100 g). Furthermore, PLE-EtOH/H_2O produced extracts with higher TPC (64.9–104.6 mg GAE/g E) and *in vitro* antioxidant capacity (473.0–664.0 mg TE/g E) in a significantly shorter extraction time compared to traditional Soxhlet extraction, with SPF measurements supporting the UV-protective potential of the extracts. HPLC-MS/MS analysis confirmed the presence of various phenolic acids and flavonoids in the extracts. this study offers an alternative approach to obtaining high-value fractions from *G. uliginosum*, suitable for diverse pharmaceutical and nutraceutical applications.

PP-In45

Molecular and structural characterization of starch in Breadfruit flours from pulp and peel

Caleb S. Calix-Rivera[1,2], Grazielle Náthia-Neves[3], Raúl Ricardo Mauro[1], Marina Villanueva[1], Felicidad Ronda[1]

[1]PROCEREALtech group, Research Institute on Bioeconomy (BioEcoUVa) and Department of Agriculture and Forestry Engineering, University of Valladolid, Valladolid, Spain;

[2]Department of Agroindustrial Engineering, Campus Choluteca, National Autonomous University of Honduras (UNAH), Tegucigalpa, Honduras;

[3]Research group for Bioactives – Analysis and Application, Technical University of Denmark, Kongens Lyngby, Denmark

Breadfruit (*Artocarpus altilis* (Parkinson) Fosberg) is a high-yielding tropical crop with valuable nutritional properties. Although it presents agronomic, nutritional, and socio-economic benefits in the regions where it is cultivated, it remains underutilized. Breadfruit (BF) flour, rich in starch, represents a promising complement to conventional sources (e.g., corn, wheat, and potato). Furthermore, its lacking gluten offers a valuable alternative for gluten-sensitive populations. Techno-functional properties of flours are intrinsically related to the molecular and structural characteristics of their starch components. Understanding these attributes provides insights for predicting and optimizing the technological performance of breadfruit flour in food applications. This study aimed to: (1) evaluate the chemical composition of breadfruit flours from pulp and peel, and (2) characterize the molecular and structural properties of their starches, using banana flour as reference. The molecular structure was determined by AF4-MALS-dRI, while structural features were assessed using X-ray diffraction and FTIR spectroscopy. The proximal composition showed starch values above 50 g/100g for all the studied flours. BF flours had higher fiber, protein, lipid, and ash than banana. AF4-MALS-dRI analysis revealed that the molecular weight (M_W) and root-mean-square-radius (r_{rms}) of amylopectin were comparable in both BF flours, while peel flour exhibited greater M_W and r_{rms} values for amylose. X-ray diffraction showed a B-type crystalline patterns in BF samples and A-type pattern in banana. The higher short-range order in BF flours supported by FTIR, suggests a more ordered crystalline structure than banana flour, which is consistent with XRD results. These findings highlight the molecular and structural properties of BF flours, relevant for their techno-functional potential in gluten-free food development.

Acknowledgments: *Spanish Ministerio de Ciencia, Innovación y Universidades projects (EQC2021-006985-P, PID2023-153330OB-I00), and doctorate grants of C. Calix (Uva) and R. Mauro (FPI). Junta de Castilla y León CLU 2019-04 – BIOECOUVA Unit of Excellence of the University of Valladolid.*

PP-In46

Valorisation of blackberry seed flour in gluten-free biscuit development: nutritional, technological, and sensory evaluation

Ángela G. Solaesa[1], Marina Villanueva[2], Felicidad Ronda[2], Rodrigo Melgosa[3], M. Teresa Sanz[3], Sagrario Beltrán[3]

[1]*Faculty of Health Sciences, Catholic University of Avila, Avila, Spain;*

[2]*PROCEREALtech group, Research Institute on Bioeconomy (BioEcoUVa) and Department of Agriculture and Forestry Engineering, University of Valladolid, Valladolid, Spain;*

[3]*Department of Biotechnology and Food Science, University of Burgos, Burgos, Spain*

Blackberry seeds (BS) are a valuable by-product of sieved blackberry jam production. Their rich nutritional profile offers significant potential for enhancing the nutritional properties of food products, particularly gluten-free (GF) formulations. This study aimed to incorporate BS flour into GF biscuits to improve their nutritional and sensory characteristics, contributing to this by-product valorisation.

The BS were dried and milled, and the chemical composition of the resulting flour was analysed, including moisture, protein, fat, fibre, sugar, ash, fatty acids, amino acids, and phenolic compounds. Particle size distribution of the flour was also determined. Different levels of substitution of rice flour (control) by BS flour (15, 30 and 45%) were investigated and the resulting GF biscuits were evaluated for colour, spread factor, texture and nutritional composition. Sensory acceptability was assessed by hedonic analysis using a consumer panel.

The BS flour had 45% fibre, 11% fat (90% unsaturated fatty acids, mainly linoleic acid), 6% protein (high composition of essential amino acids, mainly leucine and threonine), 18% sugars and 1% ash. The main polyphenols identified were ellagic, protocatechuic and sinapic acids. Regarding GF biscuits, as the proportion of BS flour increased, biscuits became darker, more reddish and harder. In terms of GF biscuit composition, the fibre content stood out, with 4.5% (15% of substitution) and 7.9% (30% of substitution). For the sensory analysis, the aroma and taste of the 15% of substitution were preferred over 30%, while 45% was not accepted. BS flour showed good nutritional properties and favourable technological performance in GF biscuits production. Although the results were promising, further studies should explore the effect of flour particle size.

Acknowledgements: *Research project "Integral Use of Blackberry Seeds for Superfood Production", funded by the 2021 University-Business Challenge (Foundation Universities/Higher Education of Castilla y León). We thank Agroberry Original from Zamora for providing the seeds.*

SESSION PP-S: SAFETY OF FOODS

PP-S01

Food safety hazards: a comparison of EU data and Slovenian consumers' concerns

Maja Bensa[1], Mojca Jevšnik Podlesnik[2], Irena Vovk[3]

[1]Research Institute of Faculty of Health Sciences, Faculty of Health Sciences, University of Ljubljana, Ljubljana, Slovenia;

[2]Department of Sanitary Engineering, Faculty of Health Sciences, University of Ljubljana, Ljubljana, Slovenia;

[3]Laboratory for Food Chemistry, National Institute of Chemistry, Ljubljana, Slovenia

Consumers' food safety concerns influence consumers' food handling practices and their attitudes towards food safety. Information on food safety irregularities uncovered by regulators and reported in the media can influence consumers' food safety concerns. Information on food safety issues in the European Union is provided by the Rapid Alert System for Food and Feed (RASFF), a system for reporting food safety issues, which is a part of the Alert and Cooperation Network (ACN).

The aim of this study was to evaluate and compare: the most reported food safety hazards in RASFF (between 2017 and 2023) and Slovenian consumers' food safety concerns.

The most reported food safety hazards were determined using annual reports of RASFF and ACN. The Slovenian consumers' food safety concerns were investigated with a mixed methods approach with a questionnaire (1621 participants – question: about the levels of concerns for 14 items) and focus groups (40 participants – question: what is the biggest food safety concern). The top-ranking food hazards / concerns were compared and evaluated.

Consumers' concerns and the most reported food safety hazards in RASFF had some similarities (e.g. pesticide residues, pathogenic microorganisms both ranked high in all). Consumers also had concerns that were not that high ranking in RASFF (e.g. food fraud) or were not covered by RASFF in the same sense as it was mentioned by consumers (e.g. food production practices).

There are similarities and differences between consumers' food safety concerns and the hazards most reported in RASFF. However, consumers are concerned about a variety of food safety issues which highlights the importance of transparent communication with consumers.

Acknowledgements: *The authors acknowledge the financial support from the Slovenian Research and Innovation Agency ("Young Researchers" program – Maja Bensa, research core funding No. P3-0388 and P1-0005).*

PP-S02

Bacterial consortia of ewes´ whey in the production of bryndza cheese in Slovakia

Zuzana Rešková[1], Zuzana Čaplová[1], Janka Koreňová[1], Barbara Brežná[1], Nikola Klištincová[2]

[1]*Department of Microbiology, Molecular Biology and Biotechnology, Food Research Institute, National Agricultural and Food Centre, Priemyselná 4, 82475 Bratislava, Slovakia;*

[2]*Institute of Molecular Biology, Slovak Academy of Sciences, Dúbravská cesta 21, 84551 Bratislava 45, Slovakia*

Whey from the previous productions is often used as a natural starter in the technology of traditional cheeses, including bryndza cheese in Slovakia. Natural whey starters have several advantages over starter cultures composed of defined microbial strains, regarding adaptation to cheese production environment and contribution to fuller flavor.

The composition of bacterial consortia of fresh and fermented whey in the production of raw ewes´ milk-based bryndza cheese was analyzed.

Culture-based microbiological analysis and culture-independent analysis based on 16S rRNA gene fragment amplification followed by Illumina MiSeq and Oxford Nanopore MinION high-throughput sequencing were used. Results showed the dominance of *Lactococcus* or *Streptococcus* genera at 10^{5} – 10^{9} CFU/mL, which likely accelerate the onset of cheese fermentation. The content of various *Lactobacillus* species in all samples suggested additional potential to stimulate aroma development later during cheese ripening. However, coliforms were also present in all samples, with values in fermented whey samples not consistently lower. A fraction of samples contained the genus *Pseudomona*s and/or *Acinetobacter*. Coagulase-positive staphylococci were present at relevant levels in the samples from 4 producers, being lower in fermented whey samples.

The whey from previous production is suitable for use as a natural starter in the technology of bryndza cheese, with a preference for fermented whey when fermented at good hygienic practices. The data presented here provide knowledge about the microbiota of whey in a traditional production of unpasteurized ewes´ milk-based cheese and its suitability as a natural starter.

Acknowledgment: *This research was supported by the Ministry of Agriculture and Rural Development of the Slovak Republic, contract No. 1131/2024/MPRVSR-930, within the project PVV11 and by the Slovak Research and Development Agency under the Contract No. APVV-20-0001 and by the Slovak Research and Development Agency under the Contract No. APVV-20-0001.*

PP-S03

Monitoring of thermal process contaminants in soy-based milk alternatives during storage

Selin Çakmak, İrem Uçaner, Burçe Ataç Mogol

Food Quality and Safety (FoQuS) Research Group, Food Engineering Department, Hacettepe University, Ankara, Turkey

Cow's milk is nutritious due to its unique properties, but sustainability efforts and ethical concerns are driving demand for plant-based alternatives. Soy is a key ingredient in plant-based milk alternatives due to its protein content, similar to cow's milk. During the thermal processing of milk, high-temperature leads to Maillard reaction and glycation forming the thermal process contaminants like fructosyl-lysine, *N*-ε-carboxymethyllysine and *N*-ε-carboxyethyllysine. Similar to cow's milk, the production of soy-based milk alternatives (SBMAs) includes ultra-high temperature (UHT) treatment process that could cause thermal damage. In this study, different SBMAs and one UHT cow's milk samples that were bought from a local market in Turkey was investigated for the formation of glycation products during six months of storage at room temperature. Furosine, an early-stage glycation marker, was found at substantially higher levels in UHT milk (3.07±0.14 – 4.37±0.90 mg/kg protein) compared to SBMAs (0.34±0.01 – 1.78±0.16 mg/kg protein). Over six months of storage, furosine content significantly decreased in all samples, with reductions of 32.1±16.7 – 71.2±6.2% in SBMAs and 29.7±15.7% in UHT milk. As an advanced glycation marker, CML concentration increased significantly after six months of storage, showing a rise of 48.9±10.53 – 96.8±12.9% for SBMAs and 152.7±24.3% for UHT milk. Meanwhile, CEL concentrations in SBMAs approximately doubled within two months. The CEL content in cow's milk (11.43±1.3 – 15.7±1.14 μg/kg protein) was found to be lower than in SBMAs (27.09±7.18 – 89.19±4.49 μg/kg protein). These results indicate that thermal processing of SBMA causes the Maillard reaction, leading to the formation of both early- and advanced-stage glycation products. During six months of storage, glycation reactions continue, resulting in a decrease in furosine and an increase in advanced glycation end products, i.e. CML and CEL.

PP-S04

Effect of air-frier conditions on bioactive properties and formation of harmful Maillard products in potato chips

Elif Apaydın[1], Mustafa Remzi Otağ[2], Ayşegül ÇEBİ[2,3]
[1]Central Research Laboratory, Giresun University, Giresun, Türkiye;
[2]Food Engineering, Faculty of Medicine, Giresun University, Giresun, Türkiye;
[3]Faculty of Health Sciences, Giresun University, Giresun, Türkiye

The objective of this study was to investigate the bioactive properties and presence of Maillard reaction products that are toxic to human health in air-fried potato chips, and to correlate them with the variables of cooking temperature and time. Potato strips were subjected to various temperatures (170–180°C) and durations (10–15 min) in the frying process. The amount of acrylamide and 5-hydroxymethylfurfural (HMF) were detected by HPLC, and colour values were measured. DPPH radical scavenging assay was used to measure antioxidant activity. The data demonstrate a decrease in DPPH radical inhibition with increasing frying time and temperature. The highest recorded level of antioxidant activity (31.19%) was observed at a temperature of 170°C and a duration of 10 min. Conversely, an increase in frying duration resulted in a decrease in antioxidant activity. This phenomenon can be attributed to the degradation of phenolic compounds caused by elevated temperatures or augmented oxidative breakdown. Acrylamide ve HMF values were increased depending on the frying temperature and duration. While the acrylamide and HMF values were 4.005 (±0.014) and 6,253 (±0,103) at 170 C for 10 min of cooking time, they were found to be 4.115 (±0.009) and 6,589 (±0,008) at 180 C for 15 min, respectively.

PP-S05

Sugar composition affects kinds and levels of alpha-dicarbonyl compounds formed in food

Karel Cejpek, Anna Průšová, Zuzana Procházková
Department of Food Analysis and Nutrition, University of Chemistry and Technology, Prague, Czechia

In food rich in saccharides, α-dicarbonyl compounds (α-DCs) are formed mainly by the transformation of sugars *via* caramelization and the Maillard reaction (MR). They easily react, e.g., with proteins, thereby changing technological (in foods) and physiological (in living organisms) protein functionality. Abnormally high levels of α-DCs in blood plasma indicate pathophysiological states of a number of lifestyle diseases and accelerate aging. In foods, α-DCs are the key intermediates of numerous aromagenic, chromogenic and many other reactions that change the properties of foods. The most frequent and well-known α-DCs are 3-deoxyglycosuloses and methylglyoxal. However, in many foods containing prevailing amounts of reducing oligosaccharides possessing a (1→4)-glycosidic bond, such as maltose (malt, maltose syrups, etc.) and lactose (dairy products), the spectrum of α-DCs formed may be completely different. It is because the transformation mechanisms of these sugars are more complicated and different to some extent comparing to common monosaccharides. In this work, we evaluated the formation of α-DCs from different monosaccharides and reducing oligosaccharides in model reaction mixtures and foods. The results confirm that oligosaccharides with (1→4)-glycosidic linkage are largely transformed by specific reactions. Some of the arising α-DCs are probably truly specific for particular oligosaccharides (e.g., deoxylactosuloses and 3,4-dideoxypentosulose), while other α-DCs can be better designated only as typical for oligosaccharides (e.g. 4-deoxyglucosulose and 3-deoxypentosulose). Comparing the extent and rate of the transformation of various sugars to α-DCs, the ketoses and ketosides (e.g., lactulose) are more direct and much better precursors than aldoses and aldosides (e.g., lactose). Experiments with the addition of nucleophilic phenolic compounds lead to a selective lowering of α-DCs. Therefore, the functional ingredients with such nucleophiles may represent one of the potential tools for at least partial control of Maillard and other non-enzymatic browning reactions.

PP-S06

Per- and polyfluoroalkyl substances (PFAS) migration from straws distributed in Korea: An exposure assessment

Siweon Choi, Kwonyong Eom, Minyoung Lee, Dain Bae, Younju Choi
Food Additives and packages Division, Food Safety Evaluation Department, National Institute of Food and Drug Safety Evaluation, Ministry of Food and Drug Safety, Cheongju-si, Chungcheongbuk-do, Republic of Korea

Per- and polyfluoroalkyl substances (PFAS) are organic compounds characterized by strong carbon-fluorine bonds that provide exceptional heat resistance and water/oil repellent properties, leading to their widespread use across various industries. However, due to their environmental persistence and high bioaccumulative potential, these substances are subject to international restrictions through regulatory frameworks such as the Stockholm Convention. In 2023, a research conducted in Belgium identified the presence of various PFAS, including PFOA, in commercially available straws. This study investigated the migration of PFAS from straws distributed in the Korean market into food simulants and conducted a comprehensive exposure assessment. We established an analytical method using LC-MS/MS capable of detecting 27 PFAS compounds with 14 internal standards following method validation. Our investigation encompassed 52 samples, including both synthetic resin and paper straws currently available to Korean consumers. To evaluate PFAS migrations, we exposed the straws to water and 4% acetic acid at 70°C for 30 minutes. Our findings revealed that PFBS was detected in only one straw sample, with migration levels ranging from 0.003 to 0.029 μg/L. The calculated maximum exposure to PFBS was 4.37×10^{-8}%, indicating migration levels well within safe limits.

Acknowledgements: *This research was supported by a grant from Ministry of Food and Drug Safety in 2024.*

PP-S07

Determination of acrylamide content using the LC-MS/MS method in thermally processed food products from the market of Montenegro

Mitar Delević[1,2], Brižita Đorđević[1], Nevena Ivanović[1], Biljana Antonijević[3], Bojan Marković[4]

[1]*University of Belgrade-Faculty of Pharmacy, Department of Bromatology, Belgrade, Serbia;*

[2]*Institute for Public Health of Montenegro, Podgorica, Montenegro;*

[3]*University of Belgrade-Faculty of Pharmacy, Department of Toxicology, Belgrade, Serbia;*

[4]*University of Belgrade-Faculty of Pharmacy, Department of Pharmaceutical Chemistry, Belgrade, Serbia*

When starchy foods are exposed to high temperatures during the technological process of food processing, acrylamide molecules are inevitably synthesized. Acrylamide is a low molecular mass compound that can easily interact with biomolecules and may have significant carcinogenic effect. With this in mind, we investigated the acrylamide content in foods commonly consumed in Montenegro. The aim of this study was to analyze the presence of acrylamide in various foods, especially in thermally processed products rich in starch. A total of 93 samples were taken and analyzed using LC-MS/MS method. The samples were divided into five categories and three subcategories: Potato-based products, coffee and coffee substitutes, bread and bakery products, food for special nutritional needs and confectionery. Of total number of samples tested, 17 samples had acrylamide content above the permitted level specified in Regulation EU 2158/2017. The highest deviation was found in potato-based products ranging from 754.7–1981.5 µg/kg, coffee 450.3 µg/kg, bread 61,4–98,5 µg/kg, confectionery 454,7 µg/kg and in all baby food samples tested 114.4–303.1 µg/kg. The latter finding is of particular concern for public health, as children are the most vulnerable population group. Considering the fact that the tested foods are widely used, it can be concluded that the acrylamide content in certain foods poses a potential health risk to population in Montenegro. Further research should focus on assessing the health risks associated with acrylamide exposure based on the dietary habits of the general population.

Acknowledgements: *Mitar Delević acknowledges receiving a Young Researcher and Innovator Conference grant supported by the COST Action CA21149 "Reducing acrylamide exposure of consumers by a cereals supply-chain approach targeting asparagine (ACRYRED)".*

PP-S08

Effect of extrusion process parameters on acrylamide formation in pea protein-enriched corn snacks

Neslihan Göncüoğlu Taş[1], Dimitris P. Balagiannis[2], Sameer Khalil Ghawi[2], Vural Gökmen[1], Jane K. Parker[2]
[1]Food Quality and Safety (FoQuS) Research Group, Department of Food Engineering, Hacettepe University, 06800 Beytepe, Ankara, Turkiye;
[2]Department of Food and Nutritional Sciences, University of Reading, Whiteknights, Reading RG6 6AP, UK

Extrusion is a rapid process in which cereal-based ingredients are mixed and cooked simultaneously by applying mechanical stress and heat. Under low-moisture conditions, a puffed snack is obtained due to the starch content of the cereal-based ingredients. Corn-based extruded snacks are commonly found in the market, although they typically have a low protein and relatively high acrylamide content. The addition of pea protein isolate (80% protein) can be a strategy to increase the protein content and control acrylamide risk in extruded puffed corn-based snacks.
This study investigated the potential for reducing acrylamide formation in protein-enriched, corn-based snacks by modifying the pea protein isolate content in the feed (0, 15, 30, 50, and 70% of the cornmeal) and adjusting key extrusion process parameters, including moisture content (15–17%), screw speed (400–500 rpm), and temperature profile (up to 160°C). A co-rotating twin-screw extruder was used for processing, and acrylamide levels were analysed.
The formed acrylamide in the pea protein-enriched corn-based extruded snacks ranged from 14 to 35 ng/g, which is lower compared to those obtained through conventional thermal processes. Acrylamide levels changed significantly ($p<0.05$) in response to varying protein contents, but no linear relationship was observed between increasing protein content and acrylamide. The moisture content of the feed, between 15% and 17%, did not affect acrylamide formation. Additionally, neither increasing screw speed using, which enhances mechanical shear, nor higher extrusion temperatures (145 and 160°C at the final zone) increased the acrylamide content of the snacks. Hence, low-moisture extrusion can be considered a promising approach for producing low-acrylamide, protein-enriched corn-based snacks.

Acknowledgements: *This research was partly supported by The Scientific and Technological Research Institution of Turkiye (TUBITAK) in the frame of 2219 – International Postdoctoral Research Fellowship Program for Turkish Citizens*

PP-S09

Mitigating acrylamide formation using food waste materials – a sustainable solution

Mouandhe Imamou Hassani

Kaunas University of Technology, Kaunas, Lithuania

Acrylamide is a toxic compound occurring in thermally processed foods. It is considered as major health hazard in the food industry due to its carcinogenic properties. Food waste valorisation is a common trend that alleviates environmental burden by upcycling agrifood waste into higher value materials in this perspective, this review examined the potential of using agrifood waste for reducing acrylamide in food products, and the eventual challenges. Emphasis was laid on the mechanisms of acrylamide mitigation using agrifood waste materials, recovery of valuable compounds form agrifood waste, practical applications in the food sector, potential challenges, and economic and environmental implications. Agrifood-sourced materials such as antioxidants, dietary fibre, pH modulators, and asparaginase have been widely used to reduce acrylamide in heat processed food products. Citrus waste as predominant material for acrylamide mitigation. Several factors such as concentration, composition of food and extract, and processing technique and conditions affect the efficiency of waste material in minimizing and mitigating acrylamide formation. This approach also reduces the environmental burden of agrifood waste, however, more attention is needed on its effects on sensory properties of foods and its economic viability.

Acknowledgements: *I would like to acknowledge the direct support by COST (European Cooperation in Science and Technology; www.cost.eu), in the framework of COST Action CA21149 (Reducing Acrylamide Exposure of Consumers by a Cereals Supply-chain Approach Targeting Asparagine; https://acryred.eu/).*

PP-S10

Moisture-activated oxygen scavenger based on *Acacia catechu* for active food packaging: A plant-based alternative

Prachi Jain; Kirtiraj K Gaikwad
Indian Institute of Technology Roorkee, India

Many food products on the market shelves are susceptible to oxygen. Their prolonged exposure to atmospheric oxygen may cause undesirable flavor and textural changes. In this study, a plant-based oxygen scavenging system utilizing ball-milled *Acacia catechu* powder and sodium carbonate with moisture activation was developed. Ball milling was done to increase the surface area for the oxygen-scavenging reaction sites, which was confirmed through BET analysis. Among the developed scavenging mixtures, AC1/NC1 exhibited a noteworthy oxygen absorption rate of 2.13 mL O_2/g.day and 0.58 mL O_2/g.day at 25 ℃ and 45 ℃, respectively, at 95% RH conditions. The developed OSM could scavenge almost all oxygen (20.8 v/v) present in the test chambers over different time periods at different temperatures and humidity conditions. Through absorption kinetics it is reported the activation energy is 57.1 kJ/mol. Therefore, the findings of the present study demonstrated that AC-NC-based OSS with moisture activation is a suitable natural alternative to chemical-based oxygen scavengers for long-term stored foods with a moderate to high susceptibility towards oxygen.

PP-S11

From hive to hazard: Overview of honey-related RASFF notifications

Mina Janković[1], Ljilja Torović[2]
[1]*Department of General Education Subjects, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia;* [2]*Department of Pharmacy, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia*

Honey is a natural sweet product, produced through the enzymatic transformation of nectar, pollen, or honeydew, whose composition varies based on botanical, geographical, and entomological factors.
Valued for its rich nutritional and medicinal properties, honey can also be a source of various contaminants, which may pose public health risk. Therefore, the aim of current study was to overview the EU Rapid Alert System for Food and Feed (RASFF) notifications in order to gain insight into „honey and royal jelly" contamination during the period 1999–2024, assessing the perceived risk to public health.
RASFF was used as the data source, serving as a platform that allows European member countries to alert each other about potential health risks in food and feed, including hazards presence.
Primarily as a result of border control (48.7% of cases) and official control on the market (38.2%), a total of 359 cases related to honey were reported, with China being identified as the origin country in the highest number of notifications (22.2%). The major hazard category present in honey was residues of veterinary medicinal products (72.7% of notifications, with almost two-thirds belonging to the sulfonamides class), followed by pesticide residues (4.3%), adulteration/fraud (4.0%), foreign bodies (3.5%), and documentation issues (2.7%). Additional hazards, present in a few consignments (fewer than five), included allergens (milk, lactoprotein), novel food (cannabidiol, epimedium), biological contaminants (tetrahydrocannabinol), composition (sildenafil, tadalafil), natural toxins (pyrrolizidine alkaloids, grayanotoxins), and non-pathogenic microorganisms. In the absence of other risk decisions, the "undecided" was the only during the first 13 years, accounting for 85.0% of all reported notifications. Consequently, two-thirds of notifications were classified as information (65.7%), followed by alerts (20.0%) and border rejections (14.2%).
Understanding main hazards in honey not only guides monitoring activities, but also suggests appropriate measures from the hive to consumption, contributing to public health protection.

PP-S12

From hive to risk: Overview of honey-related EU monitoring and risk assessment data

Ljilja Torović[1], Mina Janković[2]
[1]*Department of Pharmacy, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia;*
[2]*Department of General Education Subjects, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia*

Consumer demand for natural foods places honey high on the list of sweeteners. Nevertheless, honey is a potential source of contaminants posing a risk to public health.
The aim of the study is to overview honey safety and identify the primary hazards.
Honey contamination data were extracted from the reports on EU monitoring and risk assessment activities, retrieved from the websites of competent authorities.
According to the report on monitoring of veterinary medicinal product residues in animal products, among 3422 honey samples analysed within national risk-based controls in 2023, 0.41% were non-compliant: 0.12% for prohibited/unauthorised pharmacologically active substances in food-producing animals and 0.47% for authorised ones. Third-country import monitoring and suspect sampling revealed additional non-compliant samples. The report on pesticide residues in food included 1272 honey samples analyzed in 2022. In 84.7% of samples, residues were not quantified, 11.6% contained residues within the maximum limits, while 2.2% were non-compliant. In total, 32 pesticides were reported, most frequently acetamiprid, thiacloprid and amitraz. Scientific reports on risk to public health revealed the rate of lead detection in honey around 50%, while arsenic and mercury were less frequently detected, with variable mean concentrations. Contribution of honey to the overall dietary exposure to toxic metal(loid)s was negligible (e.g. in case of cadmium, less than 1% for all children and adolescents). Regarding pyrrolizidine alkaloids (PA), in a set of 1,966 honey samples the number of Pas per sample varied between 8 and 19, with mean total PA concentrations of 14.5–27.5 µg/kg (main contributors were echimidine (44%) and lycopsamine (37%)). Despite the relatively high PA levels determined, honey was not an important contributor to the overall dietary exposure since it is not regularly consumed in population.
Historic data give risk managers information necessary for designing future monitoring schemes (risk-based sampling, targeted food-hazard pairs) and decision-making.

PP-S13

A combined sample preparation and multi-technique strategy employing GC- and LC-MS/MS for the determination of 60 plasticizers and other selected additives in Germany´s first total diet study "BfR MEAL"

Elisabeth Koch[1], Andriy Kuklya[1], Klaudia Michna[1], Saskia Lehmann[1], Oliver Kappenstein[2], Irmela Sarvan[3], Andreas Luch[1], Alexander Roloff[1], Torsten Bruhn[1]
[1]Department of Chemical and Product Safety, German Federal Institute for Risk Assessment, Berlin, Germany; [2]Department of Safety in the Food Chain, German Federal Institute for Risk Assessment, Berlin, Germany; [3]Department of Exposure, German Federal Institute for Risk Assessment, Berlin, Germany

Plasticizers such as phthalates are used as additives in many synthetic polymers used for e.g. food contact materials, from which they can migrate into food. Some phthalates are classified as toxic to reproduction (category 1B) according to Regulation (EC) No 1272/2008 and identified as endocrine disruptors. Due to regulatory requirements and a growing environmental awareness, phthalate-based plasticizers are increasingly being replaced by non-phthalate alternatives.
The aim was to enable monitoring of plasticizer contaminations in foods, validated methods are needed that allow the simultaneous quantification of a large number of phthalates along with alternative plasticizers and additives at low concentration levels in various matrices including those with e.g. high starch, fat and/or protein contents.
We developed a combined sample preparation strategy for seven different food classes and a multi-technique approach for the quantification of 28 phthalates together with 32 alternative plasticizers and additives. The method comprises matrix-specific sample preparation steps including liquid-liquid or solid-phase extraction and subsequent quantification by GC- and LC-MS/MS. The performance criteria of the methods are characterized by high recoveries (80–120%) and low intra-day precisions (< 10%) for most investigated analytes. The limits of quantification (LOQ) range mainly between 10–50 $\mu g/kg_{food}$.
This multi-technique approach has been applied to analyze 226 pooled food and beverage samples from the BfR MEAL study, Germany's first full-scale total diet study. In most samples the *ortho*-phthalates were below the limit of detection (e.g. LOD for di(2-ethylhexyl) phthalate, DEHP: 5 $\mu g/kg_{food}$). However, DEHP was quantifiable in 15% of the samples in a range from 17–720 $\mu g/kg_{food}$ with a median value of 45 $\mu g/kg_{food}$. Of the alternative plasticizers, mainly acetyl tributyl citrate was found (~46% of the samples, 0.01–20 mg/kg_{food}) while others such as acetyl triethyl citrate were not detected in any food group.

PP-S14

The application of cyclodextrins for the elimination of aflatoxin M1 from aqueous solution and milk

Lukáš Kolarič, Peter Šimko
Slovak University of Technology, Faculty of Chemical and Food Technology, Institute of Food Science and Nutrition, Department of Food Technology, Bratislava, Slovakia

Aflatoxins are among the major contaminants of food and feed, with serious impacts on health, agricultural and livestock productivity, and food safety. One of the most dangerous aflatoxins is aflatoxin B1 (AFB1), while after the consumption of contaminated feed/food, AFB1 is metabolized in the body to form aflatoxin M1 (AFM1), which is then excreted in the milk of lactating animals. AFM1 is the cause of acute and chronic toxicosis, and long-term studies have confirmed its hepatotoxicity and carcinogenic effect. There are several ways to eliminate this toxin in milk, however, no official method is established by health authorities. Cyclodextrins (CDs), enzyme-modified starch derivatives, are used as a suitable adsorbent of many compounds, as well as contaminants, such as mycotoxins. In a recently published study, around 39% of AFM1 was removed from milk by native β-CD. In this study, the optimal conditions were evaluated for the elimination of AFM1 from aqueous solution using native β-CD and its derivatives. It was noticed that β-CD bead polymer (BBP) was found to decrease the AFM1 content by 52.2% from the model system. These optimal conditions were then applied for the removal of AFM1 from raw milk, and it was found that 22.0% and 58.6% AFM1 were removed using 2% (w/w) native β-CD and BBP, respectively. Other β-CD derivatives, such as β-CD crosslinked with adipic or tartaric acid, methylated β-CD or triacetyl-β-CD removed the lower amounts of AFM1 from milk. Due to increasing problems with global warming, the contamination of feed/food with aflatoxins is becoming more serious, therefore the results of this work describe a promising new approach to improving the food safety of milk and milk products.

Acknowledgements: *This work was supported by the Slovak Republic Research and Development Agency under the Contract no. APPV-22-0102*

PP-S15

Comparison of infrared and conventional baking and study of their effect on acrylamide content and quality characteristics of rye crispbread

Maria Kopsacheili[1], Kali Kotsiou[2], Maria Papageorgiou[2], Adamantini Paraskevopoulou[1]

[1]*Laboratory of Food Chemistry and Technology, School of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece;*

[2]*Department of Food Science and Technology, International Hellenic University, Alexandrian Campus, Thessaloniki, Greece*

Baking involves various physical and chemical changes due to heat application, such as water evaporation arising from simultaneous mass and heat transfer. These high-temperature and low-moisture conditions favor the Maillard reaction, which results in the formation of color- and flavor-related compounds but also heat-generated contaminants, such as acrylamide. Rye crispbread is a widely consumed product with several nutritional benefits; however, it is at high risk of acrylamide formation, because of its formulation and the thermal process applied during baking. Lowering baking temperature, as a way to mitigate acrylamide formation, requires extended baking times, which could affect its quality characteristics. Infrared radiation has been suggested as an alternative due to its ability to rapidly heat the product with lower energy consumption, potentially reducing acrylamide levels without compromising product quality.

The main objective of this study was to compare the effect of infrared and conventional baking on acrylamide content and some quality characteristics, such as texture, color and baking loss, in rye crispbreads.

Rye crispbreads were baked using both an infrared and a conventional oven at 120, 160, and 220 ºC. Baking times were adjusted to achieve the desired final moisture content. For each condition, acrylamide levels (LC-MS/MS), texture (three-point bending test), colour and baking loss were assessed.

The results indicated that both heat-transfer methods promoted an increase in acrylamide levels during baking at higher temperatures. However, crispbreads baked under infrared conditions exhibited significantly lower acrylamide content, and similar texture and colour attributes compared to those baked in a conventional oven under the same conditions.

The use of infrared baking may offer a promising way to reduce acrylamide content in rye crispbread and concurrently shorten baking time and energy consumption, while maintaining the desired quality characteristics of the product.

Acknowledgements: *I would like to acknowledge the direct support by COST (European Cooperation in Science and Technology; www.cost.eu), in the framework of COST Action CA21149 (Reducing Acrylamide Exposure of Consumers by a Cereals Supply-chain Approach Targeting Asparagine; https://acryred.eu/).*

PP-S16

Hemp seed breads – profiles, contents and thermal stability of cannabinoids like Δ9-THC

Niklas Lindekamp[1], Nadja Triesch[1], Michael Weiss[1], Tim Rautenberg[2], Alexander Voß[3], Sascha Rohn[2,3], Stefan Weigel[1]

[1]*Department Safety in the Food Chain, German Federal Institute for Risk Assessment, Berlin, Germany;* [2]*Department of Food Chemistry and Analysis, Institute of Food Technology and Food Chemistry, Technische Universität Berlin, Berlin, Germany;*

[3]*Institute for Food and Environmental Research (ILU) e.V., Bad Belzig, Germany*

Hemp seeds can be incorporated into bread dough or sprinkled on the surface to modify the taste, colour or nutritional profile of bread. The psychoactive Δ^9-THC (Δ^9-tetrahydrocannabinol) is a natural component of hemp. As hemp seeds might be contaminated with Δ^9-THC during harvest, they are regulated by Regulation (EU) 2023/915 with maximum levels for Δ^9-THC equivalents (Δ^9-THC+0.877*THC-acid) of 3.0 mg/kg. With regards to toxicological aspects, Δ^9-THC contents in food are relevant in relation to the Acute Reference Dose (ARfD) of 1 µg/kg body weight set by EFSA in 2015. Thermal decarboxylation of THCA (THC-acid) to Δ^9-THC is a reaction that has been shown to occur during food processing. This is relevant because neutral cannabinoids are usually the biologically active forms and decarboxylation of acids affects cannabinoid profiles and thus risk assessment of foods.

In this study, two aspects related to hemp breads were investigated using a validated HPLC-MS/MS method. First, the content of 19 cannabinoids in commercial hemp seed breads and bakery products from Germany, Austria and Lithuania (n = 31) was analysed. Δ^9-THC equivalents of 1 to 66 µg/kg fresh bread were determined. Although the regulated levels do not apply to bakery products, relating the Δ^9-THC equivalents to the regulated ingredients (21–919 µg/kg) showed no exceedance of the regulated levels. The ArfD would be expected to be exceeded after consumption of 1.8–64 kg of bread. Secondly, hemp seed breads (n = 72) were baked at temperatures of 180–260 °C for 40–60 min to investigate the effects of baking parameters on cannabinoids. Significant effects ($p<0.05$) of both baking temperature and time on acidic and neutral cannabinoid content were found in a linear model. During baking, Δ^9-THC equivalents decreased by 7–44%. Depending on the baking parameters, Δ^9-THC contents either decreased by up to 53% or increased by up to 25%.

PP-S17

Influence of thermal processing on cannabinoids contents and profiles in hemp seed oil

Niklas Lindekamp[1], Nadja Triesch[1], Sascha Rohn[2], Stefan Weigel[1]

[1]Department Safety in the Food Chain, German Federal Institute for Risk Assessment, Berlin, Germany; [2]Department of Food Chemistry and Analysis, Institute of Food Technology and Food Chemistry, Technische Universität Berlin, Berlin, Germany

The thermal decarboxylation of tetrahydrocannabinolic acid (THCA) to Δ^9-tetrahydrocannabinol (Δ^9-THC), the psychoactive component of *Cannabis sativa* L., could be relevant for food safety. Little is known about the extent to which this and other reactions occur during thermal food processing such as frying. Maximum levels for Δ9-THC equivalents (Δ^9-THC+0.877*THC-acid) of 7.5 mg/kg have been regulated for hemp seed oils in the EU. Hemp seeds themselves are practically free of cannabinoids, but can be contaminated with cannabinoids during harvest through contact with other parts of the plant. Subsequent pressing of the seeds releases the cannabinoids into the oil.

In this study, 16 cannabinoids were quantified in commercial hemp seed oils (n = 30) using an HPLC-MS/MS method. The Δ^9-THC equivalents ranged from 0.3 to 7.7 mg/kg. Three samples exceeded the EU maximum levels for Δ^9-THC equivalents of 7.5 mg/kg. Specific product features declared on the packaging of hemp seed oils (e.g., use of roasted seeds) can be recognised by the cannabinoid profiles (e.g., high ratio of neutral to acidic cannabinoids). Two oils showed deviating profiles with high levels of THCA/Δ^9-THC, indicating a possible origin, at least in part, from medicinal hemp. In another part of this study, hemp seed oils were processed at 130–200 °C for 10–60 min. At maximum temperature stress (200 °C/60 min) a 38% decrease in total cannabinoid content and an almost complete decarboxylation of cannabinoid acids (-99%) was observed. Besides decarboxylation, volatilisation and other transformation reactions could be the cause. In terms of transformation, the oxidation of Δ^9-THC to cannabinol (CBN) was observed. The Δ^9-THC equivalents decreased by 28% under maximum temperature stress. However, the decarboxylation of THCA led to a 22% increase in Δ^9-THC itself.

PP-S18

Expanding the asparaginase toolbox: New sources, promising properties and industrial potential

Karolína Loužecká, Max Štětina, Jan Beránek, Tomáš Podzimek, Eva Benešová
Department of Biochemistry and Microbiology, University of Chemistry and Technology, Prague, Czech Republic

Asparaginases (ASNases), a diverse group of enzymes catalyzing the hydrolytic deamination of asparagine (Asn), have found indispensable applications in food biotechnology. They mitigate the formation of toxic acrylamide by reducing the availability of its precursor, Asn. Acrylamide, a product of the Maillard reaction, is formed during the processing of various foods, including French fries, coffee, chocolate, and cereal-based products. Furthermore, the fact that ASNases do not affect taste, or texture increases their significance, especially in the light of increasingly stringent legislation. Therefore, in view of the increasingly stringent regulatory requirements under discussion, manufacturers will need to implement new strategies to reduce acrylamide and detect levels of Asn in raw materials, e.g., using ASNase-based biosensors. Building on the potential of ASNases highlighted above, this study focuses on the less studied group, previously known as *Rhizobium etli*-type ASNases and explores their industrial potential. Recognizing the limitations of the current official nomenclature of ASNases, this study is based on our team's bioinformatics analysis reflecting their abundance and diversity. The target ASNases (from *Paenibacillus thiaminolyticus* and *Arthrobacter polaris*) were expressed in *E. coli* with His-tag. The pH optimum, K_M in the millimolar range and relatively high thermal stability were then determined using enzymological methods. Pilot experiments demonstrated that the immobilised ASNases retained their activity. Some unique characteristics of these ASNases, and of their mutated forms were confirmed. They lack glutaminase activity, retain activity after immobilization, and their stability is conducive to biosensor development, offering a promising approach for cost-effective and simple monitoring of Asn levels.

Acknowledgements: *This work was supported by the grant of Specific university research – grant No A1_FPBT_2025_001, A2_FPBT_2025_014, MEYS (grant No LUC23140), and TA CR under the Sigma Programme (grant No TQ03000738).*

PP-S19

Microplastics and nanoplastics contamination in food and beverages: a global review

Carolina Mota[1], Zita E. Martins[1,2], Helena Ramos[1], Isabel M.P.L.V.O. Ferreira[1], Márcia Carvalho[1,3], Ana Margarida Araújo[1]

[1]*LAQV/REQUIMTE, Bromatology and Hydrology Laboratory, Faculty of Pharmacy of the University of Porto, Portugal;*

[2]*Faculty of Nutrition and Food Sciences of the University of Porto, Portugal;*

[3]*FP-I3ID, FP-BHS, Faculty of Health Sciences, Fernando Pessoa University, Porto, Portugal*

Plastics have become an integral part of modern life, offering numerous benefits but at a significant cost to environmental and human health. Their widespread use and inadequate disposal practices have led to the accumulation of microplastics (MPs) and nanoplastics (NPs) in the environment. These particles can adsorb environmental pollutants and enter the food chain, thereby posing potential human health risks.

This study reviews the extent of MPs/NPs contamination in different food/beverages groups, highlighting the urgent need for mitigation strategies and future research directions.

A systematic literature search was performed across PubMed, Scopus, and Web of Science until August 15, 2023. From an initial pool of 4078 studies, 229 relevant articles focused on MPs/NPs in edible products/beverages were selected, yielding 1630 data points. Extracted data included food type, detection methods, particle characteristics, and MPs/NPs concentrations.

Over 95% of analyzed food items contained MPs/NPs. Predominant detection methods included FTIR spectroscopy and microscopy, identifying mainly blue, black, red, transparent, and white fragments and fibers. The primary polymers found were polypropylene, polyethylene, and polyethylene terephthalate. Fruits and vegetables presented the highest contamination levels (126150 items/g), followed by sauces, beverages and dairy products (ranging from 8 to 45 items/L). Lower contamination was found in seafood, sweeteners, canned foods, salts, and meat (0.014 up to 0.7 items/g), along with rice (56 µg/g) and soy-based products (0 µg/g). Variations in contamination were linked to food processing, packaging, and environmental exposure.

This review highlights critical gaps in understanding the prevalence of MPs/NPs in our diet and their health impacts. Further research is essential, particularly in under- or unexplored categories such as fruits and vegetables, dairy products, meat, bakery products, baby foods, and non-water beverages. Comprehensive studies evaluating long-term health risks and policy interventions are urgently needed to address this environmental and health challenge.

PP-S20

Innovative radiofrequency application for effective pest control in infested chestnuts

B. Melgar[1], C. Ribeiro[1], Â. Fernandes[1], T. Finimundy[1], T.C.S.P. Pires[1], J. Moreira[3], E. Alexandre[4], C. Freire[4], T. Vila Franca[2], N.C.P. Fernandes[2], A. Gonçalves[1,2], L. Barros[1]

[1]*CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;*
[2]*MORE – Collaborative Laboratory Mountains of Research, Brigantia Ecopark, 5300-358 Bragança, Portugal;*
[3]*Sortegel, Produtos Congelados, SA, Rua São Mamede Nr 25, 5300-903 Sortes, Bragança, Portugal;*
[4]*PERFINOX – Indústrias Metalúrgicas AS, Zona Industrial Lameiradas Lt 1 Mansores, 4540-423 Arouca, Portugal*

Infestations by *Curculio elephas* and *Cydia splendana* in chestnuts pose a significant challenge to the food industry, affecting product quality and causing economic losses. Conventional disinfestation methods, such as prolonged thermal treatments, involve high water and energy consumption, driving the search for more efficient alternatives.

In this study, we evaluated the efficacy of a radiofrequency system specifically designed for pest elimination in chestnuts, developed in collaboration with our project partners.

Based on a preliminary screening analysis, an augmented central composite design (augmented CCD) was applied, considering two factors: power (793–2500 W) and conveyor speed (190–281kg/h), with 18 experimental runs, including eight central points. Temperature increases in the fruit, larval survival rate after treatment, and cooking percentage were measured.

Numerical optimization (Nelder-Mead algorithm) was performed to minimize larval survival rate and cooking rate, identifying optimal conditions at 1500 W and 190 kg/h conveyor speed. Under these parameters, the observed mean values were $\Delta T = 34.7°C$, survival rate = 11.6%, and cooking rate = 3.4%, all falling within the 90% confidence interval of the predicted values. Further refinements of the model are planned, incorporating more realistic environmental factors beyond the controlled experimental conditions, aiming to adapt the model to real-world chestnut processing and storage conditions. Results suggest that increasing power and conveyor speed significantly influence the temperature reached by chestnuts, affecting treatment efficacy, making it essential to determine the optimum operating point of the process.

Radiofrequency could represent an efficient and sustainable solution for improving the disinfestation of chestnuts and become an innovative strategy for pest control in the food industry.

Acknowledgments: *This work was carried out under Agenda VIIAFOOD – Plataforma de Valorização, Industrialização e Inovação Comercial para o Agro-Alimentar (n.º C644929456-00000040), a project supported under the PRR (www.recuperarportugal.gov.pt), and financed by the European Union/Next Generation EU.*

PP-S21

Acrylamide formation in roasted almonds: impact of roasting conditions

Marta Mesías, Francisca Holgado, Francisco J Morales
Institute of Food Science, Technology and Nutrition (ICTAN), Spanish National Research Council (CSIC), José Antonio Novais 6, Madrid, Spain

Roasting is a common practice used to improve the flavour, aroma, colour, and texture of almonds (Prunus dulcis). However, this process can also promote the formation of chemical contaminants, such as acrylamide. While acrylamide regulations were established in 2017 for potatoes, cereals, and coffee, the European Commission extended its recommendations in 2019 to include the monitoring of acrylamide levels in additional food items, such as roasted nuts. This study aimed to thoroughly examine how roasting temperature and duration influence acrylamide formation in almonds. Peeled raw (untreated) almonds were tested in two different formats (whole and ground) and subjected to various roasting conditions, with temperatures ranging from 120–195°C and times from 10–30 minutes. Samples were analysed for acrylamide precursors, including reducing sugars (ion chromatography) and asparagine (AccQ-Tag method), as well as for colour (CIELAB space) and acrylamide concentration (LC-ESI-MS/MS). During roasting, the levels of both reducing sugars and free asparagine in whole and ground almonds decreased over time and with increasing temperature, directly influencing acrylamide formation. Acrylamide concentrations ranged between 24–480 µg/kg in whole roasted almonds and from 20 to 414 µg/kg in ground roasted almonds. Levels increased progressively from light to medium roasting, peaking before declining in the dark roast stage. The structure of the almonds affected acrylamide levels only in the dark roast category, where ground almonds exhibited higher concentrations than whole almonds. In contrast, changes in colour, free asparagine, and reducing sugar content were similar for both almond formats. The results clearly indicate that temperature has a greater impact on acrylamide formation than roasting time. Therefore, careful control of these parameters is recommended to minimize the formation of high acrylamide concentrations during almond roasting.

Acknowledgements: *Research partly supported by the Community of Madrid and European funding from FSE and FEDER programs (project S2018/BAA-4393, AVANSECAL-II-CM) and CSIC (project 202070E193).*

PP-S22

Effect of free asparagine content on acrylamide formation and texture in crispbreads made from wheat flour

Sofia Keramari[1], Kali Kotsiou[2], Maria Kopsacheili[1], Nigel G. Halford[3], Maria Papageorgiou[2], Adamantini Paraskevopoulou[1]

[1]*Laboratory of Food Chemistry and Technology, School of Chemistry, Aristotle University of Thessaloniki, Thessaloniki, Greece;*

[2]*Department of Food Science and Technology, International Hellenic University, Alexandrian Campus, Thessaloniki, Greece;*

[3]*Rothamsted Research, Harpenden AL5 2JQ, UK*

Acrylamide is a chemical compound that can form at high levels in heat-treated, highcarbohydrate foods, such as baked cereal products. It is considered a processing contaminant and classified as a Group 2A carcinogen. Factors affecting acrylamide formation include the presence of acrylamide precursors, such as free asparagine and reducing sugars, as well as processing conditions (i.e., temperature, baking time). The main objective of this study was to examine the effect of using wheat flours with varying asparagine content on acrylamide levels and the key quality characteristic, texture, in crispbreads.

Wheat flours were prepared from cv Cadenza grain and grain from lines in which asparagine synthetase-2 or asparagine synthetase-1 and -2 had been 'knocked out' using CRISPR. The approximate free asparagine concentrations were 2.75 mmol/kg, 0.71 mmol/kg, and 0.11 mmol/kg. These flours were used for crispbread formulation, adjusting the baking conditions to achieve the desired final moisture content. Acrylamide levels were measured by LCMS/MS), and texture was assessed using the three-point bending test.

The results showed that the varying content of free asparagine in the flours significantly affected acrylamide formation. A reduction in free asparagine concentration led to a decrease in acrylamide levels in the final product. Regarding texture, differences were observed in fracturability as well as hardness

The results indicated that lowering the asparagine content in wheat flour led to a concomitant decrease in acrylamide formation during the baking of crispbread, while the texture was slightly affected.

Acknowledgements: *I would like to acknowledge the direct support by COST (European Cooperation in Science and Technology; www.cost.eu), in the framework of COST Action CA21149 (Reducing Acrylamide Exposure of Consumers by a Cereals Supply-chain Approach Targeting Asparagine; https://acryred.eu/).*

PP-S23

Mitigation of 5-hydroxymethylfurfural formation in muffins by an optimized polyphenolic antioxidant extract from tara pods (*Caesalpinia spinosa*) obtained via high hydrostatic pressure

Franco Pedreschi[1], Jessami Marín[2], Andrea Bunger[2]
[1]*Faculty of Engineering; Pontificia Universidad Católica de Chile, Chile;*
[2]*Faculty of Chemical and Pharmaceutical Sciences, Universidad de Chile, Chile*

Heat-treated foods, including bakery products such as crackers, cookies, cakes, and muffins, are widely consumed worldwide. However, the combination of heat processing and the natural composition of these foods can lead to the unavoidable formation of neo-contaminants, such as acrylamide (AA) and 5-hydroxymethylfurfural (5-HMF). In some cases, polyphenols have been shown to mitigate the formation of these harmful compounds in starchy food matrices subjected to high temperatures.
This study aimed to optimize the extraction of a polyphenol-rich antioxidant extract from tara pods (Caesalpinia spinosa) using high hydrostatic pressure (HHP) and to chemically characterize it. Additionally, the study assessed the effectiveness of incorporating this polyphenolic extract into muffins to reduce 5-HMF formation.
Polyphenol extraction from tara pods using HHP was optimized through a Box-Behnken experimental design, consisting of 27 runs and four independent variables: pressure (MPa), extraction time (min), ethanol concentration in hydroalcoholic solutions (%), and tara pod mass-to-solvent volume ratio (g/mL). Optimization was based on four response variables: extraction yield, total polyphenol content, antioxidant capacity, and tannin concentration.
The optimal extract was obtained under conditions of 349.97 MPa and 57.83% ethanol concentration, yielding the following maximized responses: (i) extraction yield (80.77 ± 0.38%), (ii) total polyphenol content (765.26 ± 15.03 mg GAE/g), (iii) antioxidant capacity (6656.39 ± 209.17 µmol Trolox Eq/g), and (iv) hydrolyzable tannin concentration (47.19 ± 0.78%). When incorporated into muffins baked at 190°C for 30 minutes at a concentration of 500 mg/kg, the optimized extract significantly reduced 5-HMF formation by 41%.
These findings underscore the potential of using polyphenols extracted from tara pods via HHP to reduce consumers' dietary exposure to 5-HMF.
Acknowledgements: *This research was funded by Fondecyt Projects 1190080 and 1240031.*

PP-S24

Analytical approaches to follow process-induced compounds, AGEs and key adducts formed during in vitro digestion of a pea-based cake

Federica Secco, Even Le Roux, Véronique Bosc, Barbara Rega
Paris-Saclay University, INRAE, AgroParisTech, UMR SayFood, 91120 Palaiseau, France

Using legumes as a protein source raises the concern of their reactivity during food processing (Krause et al., 2022). Among others, pea ingredients contain high concentrations of Maillard precursors which, after processing, generate reactive furanic and dicarbonyl newly formed compounds (NFCs), potentially hazardous for human health. Little is known about the occurrence of these NFCs in legume-based processed products and about their fate during digestion and in presence of constituents of digested food.

This study investigates the fate of 8 NFCs (glyoxal, methylglyoxal, dimethylglyoxal, glucosone, 1-deoxyglucosone, 3-deoxyglucosone, 5-HMF, furfural) during the *in vitro* digestion of a pea-based cake and explores possible in situ reactivity through adducts formation with lysine and arginine, abundant in pea protein ingredients.

A pea-based cake was baked and submitted to the INFOGEST static digestion. UHPLC-DAD and UHPLC-ESI-QToF were used to quantify NFCs (Secco et al., 2025). A fit for purpose analysis based on UHPLC-ESI-QToF-MS/MS method was developed to detect putative adducts, based on the matching with the theoretical HR mass of all the main target analytes and their fragments.

Imine and Michael products between NFCs and Lys and Arg were designed, leading to an a priori list of around 100 target adducts. Among all the adducts and AGEs considered, a selection was made based on their polarity, intrinsic reactivity and characteristics of the chromatographic signals. Frequently, several isomers were identified. The molecular ion of several a priori adduct was detected. The poster discusses how further MS/MS fragmentation allowed to identify some key adducts in both gastric and intestinal stages of *in vitro* digestion.

AGEs and adducts with Arg and Lys were identified for the majority of the selected 8 NFCs demonstrating that NFCs could react with amino acids under digestion conditions.

Acknowledgement: *The authors wish to thank Isabelle Billault for her advice for mass spectra interpretation.*

PP-S25

New European regulation for bisphenols in food contact materials posing analytical challenges

Lara Skef, Erich Leitner
Institute of Analytical Chemistry and Food Chemistry, Graz University of Technology, Stremayrgasse 9, 8010 Graz, Austria

Bisphenols are widely used in plastic food packaging, cookware, and non-food applications as epoxy-based paints, printing inks, etc. These materials introduce bisphenols into other consumer products as paper materials that come into contact with food. Bisphenol A (BPA) is the most studied due to its endocrine-disrupting properties. Due to increasing health concerns, in 2023, the EU significantly reduced the tolerable daily intake to 0.2 ng/kg body weight/day. In 2024, "Regulation (EU) 2024/3190 on the use of bisphenol A (BPA) and other bisphenols and bisphenol derivatives with harmonised classification for specific hazardous properties in certain materials and articles intended to come into contact with food, amending Regulation (EU) No 10/2011 and repealing Regulation (EU) 2018/213" prohibits the use of BPA and other bisphenols with similar endocrine-disrupting properties such as bisphenol S (BPS).
This regulation mandates a detection limit of 1 µg/kg of material. Therefore, this study aims to develop a more sensitive and selective method for the simultaneous determination of bisphenols in FCMs to reach the desired limits of quantification.
Also, the new regulation demands an analytical procedure based on extraction rather than migration. Therefore, a sample preparation, including extraction and derivatization, needed to be established and optimized to enhance analysis of 10 selected bisphenols using gas chromatography-tandem mass spectrometry (GC-MS/MS).
Preliminary analysis of paper samples obtained from the market demonstrated the effectiveness of the sample preparation method. Data analysis confirmed the presence of at least 9 out of the 10 bisphenols included in the study.
While the new regulatory limits enhance consumer safety, they also pose analytical challenges. Existing validated methods lack the required sensitivity. While GC-MS/MS is widely used for bisphenol analysis, achieving accurate and reproducible quantification at such low levels requires methodological refinements. This study provides a framework for improving analytical techniques to ensure compliance with new regulations.

PP-S26

Importance of FHB resistant wheat genotypes in reduction of acrylamide

Valentina Spanic, Jurica Duvnjak, Katarina Sunic Budimir
Department of Small Cereal Crops Breeding and Genetics, Agricultural Institute Osijek, Osijek, Croatia

Due to the fact that a significant portion of wheat grain yield losses result from different diseases, wheat plants are constantly threatened. One of the main diseases is Fusarium head blight (FHB), and is causing substantial damage to wheat and cereals. Besides quality and grain yield losses, even more concerning is the accumulation of toxic secondary metabolites during the *Fusarium* infestation. The most abundant mycotoxin is deoxynivalenol (DON, a type B trichothecene) that can occur with acrylamide in thermally processed cereal-based products with both having negative health implications in humans and animals. Effective FHB management requires a combination of cultural, biological, chemical, and host plant resistance strategies, where genetic control accomplished by breeding gains, when combined with other methods, can be a sustainable solution for FHB control. To secure world's food demand very important role is given to plant breeders to increase genetic potential of wheat genotypes with better resistance to FHB stress and therefore to accomplish the future requirements of agricultural production. DON produced by the pathogen was found in higher concentrations with a stronger decrease of wheat quality in more FHB susceptible genotypes. It is suggested that amino acids can be used to reduce acrylamide level in processed foods and mitigate its hazardous effects after intake. In the present research it was shown that glycylproline was mostly reduced in wheat genotypes highly infected with *Fusarium* spp.

PP-S27

Analysis of the occurrence of selected persistent organic pollutants (POPs) and perfluoroalkyl substances (PFAS) in Polish traditional cheeses

Magdalena Surma[1], Anna Sadowska-Rociek[1], Władysław Migdał[2], Magda Filipczak-Fiutak[2], Jacek Domagała[2], Tomasz Sawicki[3]

[1]Department of Plant Products Technology and Nutrition Hygiene, Faculty of Food Technology, University of Agriculture in Krakow, 122, Balicka Street, 30-149 Kraków, Poland;

[2]Department of Animal Products Processing, Faculty of Food Technology, University of Agriculture in Krakow, 122, Balicka Street, 30-149 Kraków, Poland;

[3]Department of Human Nutrition, Faculty of Food Sciences, University of Warmia and Mazury in Olsztyn, 45F, Słoneczna Street, 10-718 Olsztyn, Poland

Traditional cheeses, including smoked products, are one of the most recognizable foodstuffs among consumers, due to their taste and relation to the history of a particular region. However, the smoking process can be a source of contamination for cheeses, due to the presence of some toxic compounds in the smoke. In addition, they can become contaminated due to the presence of xenobiotics in the environment and the packaging used to store and transport them.

The objective of the present study was to analyze the content of selected persistent organic pollutants (POPs) and perfluoroalkyl substances (PFAS) in traditional cheeses.

The content of all xenobiotics was determined using the modified QuEChERS method with final detection by gas chromatography coupled to mass spectrometry for POPs and liquid chromatography coupled to mass spectrometry for PFAS.

The analysis of the samples revealed the presence of only light polycyclic aromatic hydrocarbons (PAHs). Among the compounds belonging to this group, acenaphthene, fluorene and phenanthrene exhibited the highest concentrations. The mean content of total PAHs in the samples ranged from 48 to 1853 µg/kg. Residues of organochlorine pesticides, the presence of chlorobenzenes and polychlorinated biphenyls were not detected in any of the samples that were analysed. The majority of the perfluoroalkyl substances were detected in all of the analysed samples, with perfluoroalkyl carboxylic acids being identified at a higher frequency than perfluorooalkane sulfonates. The total contents of these substances in the samples ranged from 2.28 to 16.24 ng/g and 7.28 to 348.65 ng/g, respectively.

Acknowledgements: *Financial Support from the Ministry of Science and Higher Education, on the basis of agreement no. MEiN/2023/DPI/2872 of 4 October 2023. The task entitled "Research network of natural science universities for the development of the Polish dairy sector – a research project" – SUP-RIM.*

PP-S28

Influence of traditional versus industrial processing on the trans-fatty acids content of foods

Beatrice Poteras[1], Fulvia Manolache[2], Cristina Todasca[1]

[1]*Faculty of Chemical Engineering and Biotechnology, National University of Science and Technology Politehnica Bucharest, Bucharest, Romania;*

[2]*National Research & Development Institute for Food Bioresources – IBA, Bucharest, Romania*

Trans fatty acids (TFAs) are known for their negative impact on cardiovascular health and are commonly found in industrially processed foods. In response to growing health concerns, the European Union has introduced regulatory limits for TFA content in food products placed on the market. This study aims to evaluate the TFA content in a selection of traditional foods prepared either by conventional household methods or through industrial processing. Given the strong cultural attachment to traditional cooking practices, reducing TFA levels in these products presents specific challenges. The analytical data collected will contribute to estimating the total TFA intake within the Romanian population, based on current dietary habits and the preference for home-cooked meals versus commercially available alternatives. The collected information will be used in an attempt to establish what is the total intake of TFA for Romanian populations based on the culinary preferences and habits of the current society (if they prefer home cooking vs commercially available products). The results are intended to inform both national health strategies and food reformulation policies adapted to local culinary traditions.

The average TFA content in the Panettone samples was 0.3190 g/100 g of product, compared to 0.2751 g/100 g in the Cozonac samples. The higher trans fat content in Panettone is primarily attributed to the use of specific raw materials intended to provide the product with a light and airy texture. The Cozonac control sample has a TFA content closer to the average value for the analyzed industrially obtained Cozonac samples, since homemade products typically contain a higher amount of butter and egg yolk to enhance sensory properties, as well as a greater quantity of fat-containing raw materials used in the filling, being more susceptible for TFA formation.

PP-S29

Further decoding of degradation pathways of *N*-ε-carboxymethyllysine (CML) in *Escherichia coli*

Patroklos Vougioukas[1], Erica Aveta[2], Judith Mehler[2], Nicola Gericke[2], Vincent Hoffmann[1], Jürgen Lassak[2], Michael Hellwig[1]
[1]*Chair of Special Food Chemistry, Technische Universität Dresden, Dresden, Germany;*
[2]*Microbiology, Ludwig-Maximilian Universität München, Planegg-Martinsried, Germany*

In the diet, N_ε-carboxymethyllysine (CML) is among the advanced glycation endproducts (AGEs) frequently found in thermally processed foods and is prevalent with an estimated daily intake of up to 24.6 mg. During digestion, a high amount of this AGE encounters the microbiota in the large intestine and can be utilized by representatives such as *Cloacibacillus evryensis*, *Oscillibacter* and *Escherichia coli*. For the latter, aerobic *in vivo* experiments of various *E. Coli* strains with CML revealed alongside other metabolites *N*-carboxymethyl cadaverine (CM-CAD) as one of the main degradation products, which can be formed by the ornithine decarboxylase SpeC.
As further investigations had shown, CML can be utilised by *E. coli* as a nitrogen source, reactions beyond decarboxylation would have to be necessary. Transamination reactions would therefore be reasonable. Accordingly, the first step is to determine the extent to which promiscuity of selected transaminases can convert CML to provide information about the degradation pathway to already known or even additional metabolites. As biogenic amines, those resulting degradation products could influence the intestinal flora and thus ultimately the host even at low concentrations.
To identify the relevant enzymes, various *E. coli* mutants with specific transaminases were incubated with CML. After potential candidates were isolated, *in vitro* incubations of those enzymes were performed with CML and other possible substrates. These include both the quantification of substrate degradation via precolumn derivatization by RP-HPLC-UV and the identification of resulting degradation products by HPLC-ESI-MS/MS.
Initial results such as a higher growth rate of the overexpression mutant for 4-aminobutyrate aminotransferase GabT and a visible CML degradation during an incubation with this enzyme indicate a higher importance of this aminotransferase in the metabolism of CML in *E. coli*. However, further results and the corresponding conclusion are still pending.

PP-S30

Development of nanoformulations from lavender waste for the sustainable control of *Botrytis cinerea*

María P. Fattobene, Renata Bence, Camila T. Vélez, Natalia S. Podio, Daniel Wunderlin, Natividad Herrera Cano.

ICYTAC Institute for Food Science and Technology, CONICET- Universidad Nacional de Córdoba, Córdoba, Argentina

Botrytis cinerea (BC) is a phytopathogenic fungus that causes gray mold in over 1,400 plant species, significantly impacting economically valuable crops. While synthetic pesticides remain the primary control strategy, their environmental impact has driven interest in sustainable alternatives such as biopesticides. Particularly, lavender essential oil (LEO), have demonstrated antifungal properties, making them promising candidates for pest management. Some bioactive compounds with potential antifungal activity, can still in the residue after extraction of essential oil, so can be interesting its utilization.
This study aimed to develop and evaluate formulations derived from LEO extraction residues for BC control.
Active compounds were extracted from *Lavandula angustifolia* waste using the ultrasound extraction technique with a mixture of ethanol and water (60:40). The extract was then partitioned with ethyl acetate (EA). Extracts were characterized using UPLC-MS/MS, and formulations were synthesized via ionic gelation, using chitosan as a biopolymer and sodium tripolyphosphate to cross-link and encapsulate the active compounds. The formulations were then characterized by Dynamic Light Scattering and Scanning Electron Microscopy. Antifungal activity was evaluated *in vitro* using microdilution assay and was performed for both non-encapsulated and encapsulated extracts. Phytotoxicity was assessed using *Chichorium intybus* as a biological model.
The Ultrasound-assisted extraction demonstrated a good performance to extract bioactive compounds. Using UPLC-MS/MS, rosmarinic and caffeic acids seem to be the principal bioactive compounds. Chitosan nanoparticle (CSNP) formulations were successfully synthesized, maintaining stability for 30 days. The antifungal activity was higher in the formulation with the encapsulated compounds (CSNP-EA) than in the non-encapsulated counterparts (ethyl acetate extract). Notably, CSNP-EA formulation exhibited stronger inhibitory effects against BC than the synthetic fungicide cyproconazole, highlighting their potential as eco-friendly biopesticides derived from agro-industrial waste. Germination assays confirmed the absence of phytotoxicity in root, stem and leaf of the biological model to study.

PP-S31

From manure to crops: assessing enrofloxacin contamination in agricultural systems using chicory as case study

Camilla Di Marcantonio[1], Camila T. Vélez[2], Daniel A. Wunderlin[2], and Natalia S. Podio[2]
[1]*Sapienza University of Rome, Department of Civil, Building and Environmental Engineering (DICEA), Rome, Italy;*
[2]*ICYTAC Institute for Food Science and Technology Córdoba, CONICET and Universidad Nacional de Córdoba, Córdoba, Argentina*

Using livestock manure as fertilizer is a widespread practice in Argentina, where livestock farming is a cornerstone of the national economy. Particularly, Poultry Litter (PL) is valued for its nutrient content and ability to enhance soil fertility. However, PL introduces veterinary antibiotics into soils and plants, given the use of these drugs in industrial livestock operations. The uptake of antibiotics by plants depends on various factors, including soil properties, plant species, and the chemical characteristics of the antibiotic. Understanding these processes is crucial for assessing the environmental risks associated with using antibiotic-laden fertilizers.
This study investigates the uptake of enrofloxacin (ENR), a fluoroquinolone antibiotic, by chicory plants (*Cichorium intybus*) from three contamination sources: 1) Standard Solution: irrigation water containing 50 µg/L or 200 µg/L ENR in tap water; 2) Drug Solution: irrigation water prepared by dissolving a commercial ENR tablet in tap water to achieve 50 µg/L or 200 µg/L ENR; 3) Poultry Litter: fertilizer application with treated PL corresponding to 6 and 24 tons/ha under field conditions (8.5 g or 34.2 g per pot, respectively) to achieve 50 µg/L or 200 µg/L ENR.
Control tests included plants irrigated with tap water and pots containing soil only. All treatments were performed with at least three replicates. Greenhouse experiments were conducted to evaluate ENR bioavailability, phytotoxic effects, and the potential transfer to plants. Plants were exposed to treatments for 21 days, with measurements including chlorophyll content, biomass, and antibiotic concentration in plant tissues. Soil pH, temperature, and moisture were also monitored weekly, along with plant health indicators such as leaf colour.
Results revealed phytotoxic effects and differences in ENR uptake across the tested contamination sources, being higher in PL treatments. These findings underline the importance of understanding the environmental implications of using antibiotic-laden fertilizers in agriculture.

SESSION PP-A: ATTRACTIVENESS OF FOODS

PP-A01

METROFOOD-IT – The Italian research infrastructure for metrology and open access data in support to the agrifood

Paola Adamo[1], Maria Careri[2], Cesare Manetti[3], Remo Pareschi[4], Angelo Riccaboni[5], Andrea Mario Rossi[6], Sabina Tangaro[7], Claudia Zoani[8]

[1]*University of Naples Federico II, Dept. of Agricultural Sciences, Piazza Carlo di Borbone 1, 80055 Portici (Napoli), Italy;*

[2]*University of Parma, Department of Chemistry, Life Sciences and Environmental Sustainability, Parco Area delle Scienze 17/A, 43124 Parma, Italy;*

[3]*Sapienza University of Rome, Department of Environmental Biology, Piazzale Aldo Moro 5, 00185 Roma, Italy;*

[4]*University of Molise, Department of Biosciences and Territory, Contrada di Forte Lappone, Pesche (Isernia), Italy;*

[5]*University of Siena, Santa Chiara Lab., Via Valdimontone 1, 53100 Siena, Italy;*

[6]*Italian National Institute of Metrology Research (INRiM), Chemical Physical and Nanotechnologies Unit, Strada delle Cacce 91, 10135 Torino, Italy;*

[7]*University of Bari, Department of Soil, Plant and Food Sciences, Piazza Giulio Cesare 11, 70124 Bari, Italy;*

[8]*Italian National Agency for new Technology, Energy and Sustainable Economic Development (ENEA), Department for Sustainability – Biotechnologies and Agroindustry Division (SSPT-BIOAG), C.R. Casaccia Via Anguillarese 301, 00123 Roma, Italy*

In the frame of Mission 4 "Education and Research" of the Italian National Recovery Resilience Plan (NRRP), the METROFOOD-IT project aims at strengthening the Italian Research Infrastructure (RI) for Metrology and Open Access Data in support to the Agrifood. It is related to the Italian Node of the EU Infrastructure METROFOOD-RI (www.metrofood.eu – ESFRI Roadmap, domain Health and Food).

The project focuses on the RI's electronic component and its integration with the physical one, to provide services in support to the digitalization of the agrifood system for food quality & safety, traceability, food transparency, sustainability, and resilience of agrifood systems, and circular economy. It aims at developing the organizational and operational framework of the RI and structuring the strategy, procedures and supporting system for the service provision via TransNational Access and Virtual Access, thus making the Italian infrastructure fully implemented, operational and sustainable in the long run. RI services are addressed to different users categories with access to physical facilities (laboratories and plants) and e-resources (e.g., apps, software, models) and will allow the RI to act as an interface between research and innovation, industrial players and consumers, defining and testing processes and scenarios for the development of sustainable and innovative agrifood systems, food safety, healthy diets, and solutions for a circular bioeconomy. METROFOOD-IT is characterised by the application of ICT solutions with an integrated supply chain approach. The innovation potential relies on the state-of-the art services, tools and concepts deployed, along with FAIR data management, data quality and open data, crossing the 4th digital evolution applied to the agrifood. Computational modelling and laboratory-based solutions will be integrated via upcoming approaches such as smart and remote sensing systems, IoT, blockchain, and Artificial Intelligence. An open science-based approach will be followed, sharing, and making open data and access to resources.

PP-A02

Advanced green microextraction techniques for eco-friendly monitoring of pesticide residues in grapes

Mereke Alimzhanova, Yerkanat Syrgabek
[1]*Center of Physical Chemical Methods of Research and Analysis, Al-Farabi Kazakh National University, Almaty, Kazakhstan;*
[2]*Faculty of Physics and Technology, Al-Farabi Kazakh National University, Almaty, Kazakhstan;* [3]*Faculty of Medicine and Healthcare, Al-Farabi Kazakh National University, Almaty, Kazakhstan*

As a reply to the increasing global demands for green analytical techniques, this study introduces and optimizes two new, eco-friendly extraction techniques – vacuum headspace solid-phase microextraction (Vac-HS-SPME) and miniaturized headspace solid-phase microextraction (mini-HS-SPME) for the green determination of pesticide residues in grapes. Both techniques are ideally coupled with gas chromatography–mass spectrometry (GC-MS), a highly sensitive technique that greatly reduces solvent consumption and sample handling.
Vac-HS-SPME utilizes vacuum-assisted headspace conditions to enhance the migration of analytes to the SPME fiber for the convenient determination of six pesticides, boscalid, oxyfluorfen, and epoxiconazole. The method parameters – extraction temperature (30–70°C), extraction time (1–40 min), fiber type, desorption time, and vacuum equilibration time – were optimized for best performance.
Mini-HS-SPME, due to its reduced size and flexibility, achieved reliable detection of ten pesticides with enhanced sensitivity and even lower detection limits. Extraction temperature (30–110°C), time (1–120 min), micro-sample volume (100–300 µL), pH, and salt concentration were also optimized for maximum analyte recovery under minimum resource utilization.
Both techniques' environmental acceptability was relatively evaluated using the green analytical procedure index (GAPI), AGREE, AGREEprep, blue applicability grade index (BAGI) evaluation tools. Mini-HS-SPME was found to be more environmentally friendly and eco-efficient and is particularly suitable for routine pesticide determination in sustainable food quality control systems.
In conclusion, both microextraction methods embody a contemporary trend towards green analytical chemistry. Vac-HS-SPME is most amenable to targeted, ultra-sensitive determinations necessitating vacuum enrichment, whereas mini-HS-SPME emerges as a greener, highly versatile option for large-scale pesticide screening. Both novel methods provide a green way forward in safeguarding public health by cleaner, safer grape cultivation and processing.

PP-A03

Extraction of functional components from *Lycium ruthenicum* Murray and *Lycium barbarum* Lam. Fruits using deep eutectic solvents and antimicrobial effect

Yusuf Can Gerçek[1], Naciye Kutlu[2], Sinan Bayram[3], Saffet Çelik[4], Fatma Nur Baştürk[1], Bahar Özmener[1], Nesrin Ecem Bayram[2]

[1]*Faculty of Science, Istanbul University, Istanbul, Türkiye;*

[2]*Aydıntepe Vocational College, Bayburt University, Bayburt, Türkiye;*

[3]*Vocational School of Health Services, Bayburt University, Bayburt, Türkiye;*

[4]*Technology Research and Development Application and Research Center, Trakya University, Edirne, Türkiye*

High amounts of organic solvents are used during the extraction processes in the analysis of foods, food additives, and nutraceuticals. However, in recent years, deep eutectic solvents, a new class of green solvents, have been preferred as alternatives to these organic solvents in extraction processes. In this study, ultrasonic-assisted extraction, which is an innovative (green) extraction technique, and deep eutectic solvents, which are also considered innovative (green) extraction solvents, were used to extract functional components from *Lycium ruthenicum* and *Lycium barbarum* fruits and to optimize the extraction conditions. As a result of the 12 different DESs, it was determined that proline:citric acid monohydrate for *Lycium ruthenicum* and choline chloride:acetic acid for *Lycium barbarum* were the most suitable DES combinations for bioactive compound extraction. However, the highest total phenolic content values were 33.59±2.98 and 9.73±0.34 mg GAE/g and the highest antioxidant activity values were 36.26±3.94 and 16.41±0.28 mg TE/g for *Lycium ruthenicum* and *Lycium barbarum*, respectively. Additionally, the antimicrobial activities of the extracts against *Bacillus cereus* ATCC 14579, *Enterococcus faecalis* ATCC 49452, *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC BAA 25922, *Pseudomonas aeruginosa* ATCC 9070, *Yersinia enterocolitica* ATCC 27729, *Candida albicans* ATCC 10231, and *Candida glabrata* ATCC 90030 were determined. The results showed that the DESs could be successfully used for the extraction of bioactive components from these fruits.

Acknowledgment: *This study was supported by the Istanbul University Scientific Research Projects Coordination Unit (Project No. FAB-2023-40231).*

PP-A04

Biochemical properties and antibacterial activity of Armenian honeys

Viktoriia Chirkova[1], Marcela Bucekova[1], Jana Godocikova[1], Juraj Majtan[1,2]

[1]*Department of Microbial Genetics, Institute of Molecular Biology, Slovak Academy of Sciences, Bratislava, Slovakia;*

[2]*Deparment of Microbiology, Faculty of Medicine, Slovak Medical University, Bratislava, Slovakia*

Honey is a natural product with diverse bioactive properties, including antimicrobial and antioxidant activities, making it a valuable functional food and therapeutic agent. This study investigates the biochemical parameters and antibacterial activity of Armenian honeys, which have not been described previously.

Ten honey samples collected from various regions of Armenia at altitudes ranging from 1,000 to 2,300 meters above sea level were analyzed. Protein analysis was performed using SDS-PAGE analysis and the Bradford assay, while the enzyme GOX was detected by immunoblotting and its enzymatic activity was evaluated by a Megazyme assay kit as well as H_2O_2 concentration after 24 h incubation at 37˚C. To investigate the impact of low-molecular-weight components, honey samples underwent dialysis with a molecular weight cut-off of 3.5 kDa, followed by GOX activity assay. Antibacterial activity was evaluated by broth microdilution assay and expressed as minimal inhibitory concentration (MIC) of honey solution. Additionally, electrical conductivity and crystallization studies were performed.

Enzymatic activity of honey samples ranged from 0 to 11.4 mU/ml, and H_2O_2 concentration varied from 53 to 1570 µM. Removing low-molecular-weight components by dialysis reduced GOX enzymatic activity 4 to over 10-fold. MIC values ranged from 4–35% (*Staphylococcus aureus*) and 8–25% (*Pseudomonas aeruginosa*). Low antimicrobial activity correlated with reduced crystallization, possibly indicating producer manipulation.

This study represents the first comprehensive investigation into the antibacterial activity of Armenian honey, shedding light on importance of low-molecular-weight components in maintaining enzyme functionality. Future research will focus on detailed characterization of Armenian honey samples and investigating the reason of the low antimicrobial activity of certain samples.

Acknowledgements: *This study was supported by the Scientific Grant Agency of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences VEGA 2/0022/22 and the Slovak Research and Development Agency under Contract No. APVV-21-0262.*

PP-A05

AQUASERV: Research services for sustainable aquaculture, fisheries and blue economy

Nidhi Dalal, Antonio G. Caporale, Diana Agrelli, Paola Adamo

Department of Agricultural Sciences, University of Naples Federico II, Piazza Carlo di Borbone I – Portici, Naples, Italy

AQUASERV is an international consortium of 32 scientific institutions with 82 scientific installations across 15 countries in the EU. Its main goal is to sustainably transform the blue economy. AQUASERV is guided by principles of the European Common Fisheries Policy, the Farm to Fork Strategy, the Sustainable Blue Economy, and the European Green Deal. The consortium aims to create a sustainable research infrastructure network by offering customized and efficient transnational services to stakeholders in the blue economy, promote open science policies, and encourage knowledge transfer. To achieve this, AQUASERV will provide scientists with on-site transnational access (TA) and virtual access (VA) to research infrastructure focused on marine and freshwater resources, food traceability and quality, and biotechnology.

The Food Authenticity, Safety and Quality (FASQ) laboratory at the University of Naples Federico II is the WP28 leader for AQUASERV. We're providing traceability and authenticity services for seafood with near-infrared spectroscopy, multielement fingerprinting, and stable isotopic ratios. IR spectrometer, ICP-MS/ICP-OES/TQ-ICP-MS, and IRMS, respectively, will be employed to analyze solid and liquid samples. Additionally, FASQ will also assist the users in sampling plan and methodology, analysis standardization, data pre-treatment, and data analysis/modelling.

TAs entail free on-site or remote access to services offered in the project, while VAs include free access to databases remotely. The TAs and VAs are accessible to researchers from academia and industry within and beyond Europe, with possibility of on-site training for users. However, researchers can only apply for services in institutions outside their home country. A website dedicated to services provided by all partners has been created where interested researchers can apply for the service of their choice.

Acknowledgements: *AQUASERV is funded by the European Union (HORIZON-INFRA-2023-SERV-01) from 1 April 2024 to 31 March 2029. Coordinator: Prof. Adelino Canario – Centro De Ciencias Do Mar Do Algarve (CCMAR).*

PP-A06

Effects of innovative non-thermal techniques on individual polyphenols in Sicilian table olives

Jasmin Djahandideh[1], Edwin Januschewski[2], Andreas Juadjur[2], Kemal Aganovic[2,3], Tuba Esatbeyoglu[1]
[1]*Institute of Food and One Health, Leibniz University Hannover, Hannover, Germany;*
[2]*German Institute of Food Technologies, Quakenbrück, Germany;*
[3]*Institute of Food Quality and Food Safety, University of Veterinary Medicine Hannover, Hannover, Germany*

Table olives (*Olea europaea* L.) are an important component of the Mediterranean diet due to the high content of bioactive compounds associated with health benefits [1]. However, high temperature can lead to a reduction of bioactives. Therefore, non-thermal techniques such as high-pressure processing (HPP), pulsed electric field (PEF), and cold plasma (CP) should be considered, to preserve or enhance the bioactives after processing [2]. Previous studies focused on the entire polyphenol spectrum as sum parameters, therefore, the focus of this study is to evaluate the influence on individual polyphenols.
For the analysis, an ultrasonic extraction and a liquid chromatography method coupled with PDA and MS detection were developed to qualify and quantify table olive polyphenols. Subsequently, the Sicilian variety *Nocellara del Belice* was treated with HPP, PEF, and CP using various parameters, and the content of characteristic polyphenols was quantified. Furthermore, LC-MS measurements were performed to obtain information on possible degradation products with regard to structural characteristics.
The results showed that treatment of table olives with non-thermal methods can lead to a preservation or increase in the concentration of individual polyphenols. However, not all techniques show the same effect; the cold plasma technique is the only one in which no degradation of polyphenols was observed, whereas treatment with HPP and PEF led to a degradation of glycosidic polyphenols. Contrary to expectations, the thermal control treatment showed that not all of the polyphenols examined are degraded compared to untreated olives.
In summary, the effects on polyphenols depend on the type of the technique. The CP method increases the content of all bioactives. If the focus is on specific bioactives such as hydroxytyrosol, tyrosol or luteolin — aglycones of other polyphenols — HPP and PEF are preferable.

PP-A07

Valorization of the nutraceutical potential of sumac (*Rhus coriaria* L.)

Laura Dugo[1], Elisa Pannucci[1], Katia Arena[2], Paola Dugo[2], Luca Santi[3]

[1]Department of Science and Technology for Sustainable Development and One Health, University Campus Bio-Medico di Roma, Via Alvaro del Portillo 21, 00128 Rome, Italy;

[2]Department of Chemical, Biological, Pharmaceutical and Environmental Sciences, University of Messina, 98168 Messina, Italy;

[3]Department of Environmental Biology, Sapienza University of Rome, Piazzale Aldo Moro 5, 00185 Rome, Italy

Rhus coriaria L. (Anacardiaceae), known as sumac, has been used since ancient times for many different applications, and nowadays mainly as a spice obtained from its ground drupes, mostly in Mediterranean and Middle Eastern regions. Sumac drupes are rich in various classes of phytochemicals, including organic acids, flavonoids, tannins, responsible of their powerful antioxidant capacity, from which treatment of many common diseases could benefit.

The aim of this study is to investigate the nutraceutical potential of sumac phenolic extract.

Phenolic compounds were extracted from sumac fruits and characterized by HILICxRP-LC-PDA-ESI/MS. Antioxidant activity of the extract was assessed via DPPH and ABTS assays. The extract's ability to inhibit α-amylase and α-glucosidase, enzymes involved in glucose metabolism, was tested. A cell model of human hepatocytes (HepG2) was used to investigate its capacity to inhibit reactive oxygen species (ROS).

Gallic acids and its derivates were identified as the main phenolic molecules sumac extract (2,215 mg/100 g) representing 89% of bioactive molecules. The extract exhibited strong antioxidant potential (DPPH: 1,02 mmolTE/g; ABTS: 1,76 mmolTE/g) and effectively inhibited α-amylase (IC50: 2,28 mg/ml) and α-glucosidase (IC50: 18,5 μg/ml), the latter showing a stronger capacity of inhibition compared to the pharmaceutical inhibitor acarbose. Extract also protected HepG2 cells against oxidative damage.

Our results indicate that sumac represents a rich source of bioactive phenolic compounds with potential application in the nutraceutical industry. Further studies are needed to investigate the mechanism of action.

Acknowledgements: *We acknowledge financial support under the National Recovery and Resilience Plan (NRRP), Mission 4, Component 2, Investment 1.1, Call for tender No. 1409 published on 14-9-2022 by the Italian Ministry of University and Research (MUR), funded by the European Union, NextGenerationEU. Project Title: "Sumac nutraceutical Potential through Innovative and Comprehensive invEstigation (SPICE)", CUP J53D23014460001, project ID: P20224B5BE.*

PP-A08

Sweetness perception in biscuits: The effects of Maillard and caramelisation reactions

Naz Erdem, Neslihan Göncüoğlu Taş, Tolgahan Kocadağlı, Vural Gökmen

Food Quality and Safety (FoQuS) Research Group, Department of Food Engineering, Hacettepe University, 06800 Beytepe, Ankara, Turkey

Reducing sugar content in biscuits remains a challenge due to its impact on consumer perception. Flavouring substances are one of the promising approaches to reduce sugar in bakery products, and Maillard and caramelisation reactions are the primary ways to form flavour compounds in heat-treated foods. This study investigated the differences in sweetness perception by adding caramel and enhancing the Maillard reaction in biscuits, as well as their relationship with aroma compounds.

The caramel added, and Maillard reaction-boosted biscuits were baked with minor modifications on the AACC 10.54 biscuit recipe. For caramel-added biscuits, 5 g of the icing sugar was replaced with caramel and Maillard reaction-boosted biscuits were prepared by replacing 5 g of refined wheat flour with calcium caseinate. Each type of biscuit was baked for 7, 11, and 13 min. Sensory analysis was conducted using a line scale and untrained panellists to observe the changes in sweetness perception of different recipes at varying baking times. Volatile compounds were analysed to explain differences in perceived sweetness resulting from the formulation changes by SPME-GC-MS.

As a result, Maillard reaction and caramel were found to increase the perceived sweetness of biscuits for all baking times; however, this effect is more distinct in Maillard reaction-boosted biscuits. Moreover, an increase in sweetness scores for all types of biscuits was observed when the baking time was extended from 7 minutes to 11 minutes due to the enhanced flavour profile. Despite this, extending the baking time from 11 min to 13 min decreased the sweetness perception, which may be caused by the formation of bitter taste molecules in the advanced stages of MR and caramelization. In conclusion, the Maillard and caramelization reaction products, as they promote the increase of aromas associated with sweetness, might be added to the biscuit recipe to reduce sugar.

PP-A09

Chemometric analysis of fatty acid profiles of 30 Portuguese corn samples

Lais Freitas[1,2,3], Maria Eugénia Tornadijoa[1], Pedro Mendes Moreira[4,5], Isabel Dinis[4,5], André Pereira[4], Ana Sofia Bagulho[6,7], Nuno Pinheiro[6,7], Fernanda Simões[6], Ângela Lopes[6], Diogo Mendonça[6], Letícia M. Estevinho[2,3], Luís G. Dias[2,3]

[1]*Doctoral School, University of León, Campus de Vegazana, 24007 León, Spain;*

[2]*Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus Santa Apolónia, 5300-253 Bragança, Portugal;*

[3]*Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;*

[4]*Instituto Politécnico de Coimbra, Escola Superior Agrária, Bencanta, 3045-601 Coimbra, Portugal;*

[5]*Centro de Estudos em Recursos Naturais, Ambiente e Sociedade (CERNAS), Instituto Politécnico de Coimbra, Bencanta, 3045-601 Coimbra, Portugal;*

[6]*Instituto Nacional de Investigação Agrária e Veterinária (INIAV, I.P.), Unidade de Biotecnologia e Recursos Genéticos, Polos de Elvas e Oeiras, Portugal;*

[7]*GeoBioTec – Universidade Nova de Lisboa, Campus da Caparica, Costa da Caparica, Portugal*

Corn (*Zea mays* L.) is one of the most widely cultivated and consumed cereals worldwide, playing a crucial role in both human and animal nutrition. The lipid composition of corn, particularly its fatty acid profile, plays a fundamental role in its nutritional and technological quality. Within the CERTRA project (Development of Traditional Cereal Value Chains for Sustainable Nutrition in Portugal), which aims to enhance the value of traditional cereal production, 30 samples were analyzed to assess differences in their lipid composition.

In addition to fatty acid profiling, genetic and technological analyses were conducted to provide a more comprehensive characterization of the samples. Fatty acids underwent base-catalyzed derivatization to obtain methyl esters, and their analysis was performed using a DANI GC1000 gas chromatograph equipped with a split/splitless injector and a flame ionization detector (FID). The Supelco 37-component FAME Mix was used as the standard solution.

Multivariate statistical analysis showed that the results revealed significant variations in fatty acid content among the samples, allowing the identification of groups with similar lipid profiles. These variations may be related to the genetic characteristics of the studied varieties and cultivation conditions, providing valuable insights for the valorization and selection of Portuguese corn varieties with distinct lipid profiles.

Acknowledgments: *CERTRA – Desenvolvimento de Cadeias de Valor de Cereais Tradicionais para uma Alimentação Sustentável em Portugal, Investimento RE-C05-i03 – Agenda de investigação e inovação para a sustentabilidade da agricultura, alimentação e agroindústria, N.º 12/C05-i03/2021 – PRR-C05-i03-I-000161, Projetos I&D+I Projetos de Investigação e Inovação – Alimentação Sustentável. Linha de ação 1.2 – Produtos.*

PP-A10

Fermentation-derived bioactives from fruit juices: a natural dietary strategy against metabolic disorders

Ana R. Monteiro[1,2,3], Ana Faria[2,4], Maria João Almeida[2,4], Shámila Ismael[2,4], João Araújo[2,4], Nuno Mateus[1], Victor Freitas[1], Iva Fernandes[1*]

[1]*LAQV-REQUIMTE, Department of Chemistry and Biochemistry, Faculty of Sciences, University of Porto, Rua do Campo Alegre, s/n, 4169-007 Porto, Portugal;*

[2]*NOVA Medical School, Universidade NOVA de Lisboa, Lisboa, Portugal;*

[3]*Sumol+Compal Marcas, SA, Rua Dr. António João Eusébio, 24, Carnaxide, Portugal;*

[4] *Comprehensive Health Research Centre (CHRC), NOVA Medical School, Universidade NOVA de Lisboa, Lisboa, Portugal*

Dysregulated adipogenesis is a key contributor to obesity and its associated metabolic disorders, including type 2 diabetes, cardiovascular disease, and non-alcoholic fatty liver disease. As the global prevalence of obesity continues to rise, growing evidence highlights the potential of food-derived bioactives as promising agents to prevent or modulate the underlying pathophysiological mechanisms [1,2]. Among food-based strategies, fermentation has emerged as a valuable tool to enhance the bioactivity and bioavailability of fruit juice constituents, leading to the formation of novel metabolites with potential health-promoting effects [3].

This study investigates the biological impact of fermented fruit juices on early adipogenesis. Increased levels of pyruvic and succinic acids were detected in these juices, through a derivatization-based analytical method. Using the human SGBS preadipocyte model, the effects of these compounds were evaluated during the differentiation process, simulating early adipogenesis. A comprehensive set of molecular and functional markers was assessed, including adipogenesis- and lipogenesis-related genes (e.g., *PPARγ*, *C/EBPα*), pro- and anti-inflammatory cytokines, ATP and ROS levels, glucose uptake, and lipid accumulation. Results revealed that exposure to pyruvate and succinate modulated key adipogenic markers, improved glucose metabolism, and influenced cellular oxidative balance, suggesting a potential role in supporting healthier adipocyte development and function. These findings highlight the potential of fermented functional beverages as a nutritional strategy for modulation of obesity-related mechanisms.

Acknowledgements: *This work was financially supported by FCT project FERMEN.TO (2023.00164.RESTART) and PT national funds (FCT/MECI, Fundação para a Ciência e Tecnologia and Ministério da Educação, Ciência e Inovação) through the project UID/50006 -Laboratório Associado para a Química Verde – Tecnologias e Processos Limpos. Ana R. Monteiro acknowledges FCT for her PhD grant (2024.03649.BDANA).*

References

[1]Ghaben & Scherer (2019) *Nat. Rev. Mol. Cell Biol.*, 20(4), 242–258.

[2]Jakab et al.(2021) *Diabetes Metab. Syndr. Obes.*, 14, 67–83.

[3]Shah et al.(2023) *Fermentation*, 9(2), 1–23.

PP-A11

Cultivation and processing of buckwheat under the aspect of climate protection

Martin Almendinger, Lara Mathew, Sandra Grebenteuch, Alexander Voss, Maxie Grüter
Institute for Food and Environmental Research e.V., Bad Belzig, Germany

Due to its dry, sandy and nutrient-poor soils, the state of Brandenburg, Germany is limited in its choice of arable crops. Climate change is exacerbating these conditions with periods of heat and heavy rainfall. In addition to measures to improve the soil, the choice of climate-adapted crops plays a central role for Brandenburg's agriculture. Buckwheat (*Fagopyrum esculentum*) is robust in the face of adverse climatic conditions and thrives on sandy soils. It is rich in nutrients and ideal for the production of gluten-free foods. However, the cultivation of buckwheat in Germany has been almost completely replaced by high-yielding cereals such as wheat and rye over the last hundred years.

The aim of the "Buckwheat" project, funded by the Brandenburg Ministry of Agriculture, Environment and Climate, is to increase the cultivation and processing of buckwheat and the sale of buckwheat products. Knowledge will be gathered and information shared with the help of a network of stakeholders from the entire value chain. Farmers will be accompanied and supported in the cultivation and harvesting of buckwheat. Together with food processing and manufacturing companies, products such as baked goods, extrudates and breakfast cereals based on buckwheat are improved from a sensory and nutritional point of view and innovative products are developed. The long-term aim is to boost sales of such products and increase the demand for buckwheat.

In the first year of the project, various buckwheat fractions (nuts, groats, flours) and commercial foods made from or with buckwheat were characterized and a network of stakeholders was established. Farmers, hulling mills, beekeepers, bakeries and retailers in the form of organic and farm stores and possibly supermarkets are involved. The current focus is on developing innovative gluten-free foods made from buckwheat and bringing them to the attention of food manufacturers.

PP-A12

Characterization of artisanal and industrial Maroilles cheeses quality by targeted and untargeted techniques

Romdhane Karoui
Université d'Artois, 9 Rue du Temples, 62000, Arras, France

Food adulteration corresponds to intentional action to gain an undue economic advantage. In this context, cheese, an ancient and globally appreciated food product, with protected land- and tradition-related labels is among the most impacted, because consumers are ready to pay a premium price for traditional and typical products. In this context, Mid-infrared (MIR) and front-face fluorescence spectroscopies as well as rheology and physico-chemical methods coupled with chemometric tools were investigated for their potential to differentiate industrial and artisanal Maroilles cheeses at the external and central zones. A significant difference in their physico-chemical parameters namely pH, ash, fat, color and moisture contents were noted. This difference impacted the rheological properties of the investigated cheeses, since artisanal and industrial Maroilles cheeses had an elastic-like behavior, with the central zones exhibiting the greatest viscoelastic modules (G' and G"). The MIR spectra highlighted the presence of lipids, proteins and sugars. A significant modification of α-helix and β-sheet levels at the central zones was noted between artisanal and industrial Maroilles cheeses. These findings were supported by the tryptophan and vitamin A spectra obtained by fluorescence spectroscopy. It is suggested that the difference between artisanal and industrial Maroilles cheeses observed at the macroscopic level due to cheese making procedure and ripening stage affect the secondary and tertiary structure determined by MIR and fluorescence spectroscopy, respectively. This trend was confirmed by the factorial discriminant analysis (FDA) applied in the MIR and fluorescence spectra since more than 90% of correct classification was noted between artisanal and industrial cheeses. In addition, a clear discrimination between the central and external zones was observed for each cheese brand (artisanal and industrial). It was concluded that spectroscopic techniques such as MIR and fluorescence spectroscopy could be used as rapid tools to authenticate Maroilles cheese samples belonging to different brands.

PP-A13

Production of Maillard reaction flavouring from sprouted wholewheat flour for use in low acrylamide biscuits

Tolgahan Kocadağlı, Dilara Başbozkurt, Neslihan Taş, Aytül Hamzalıoğlu, Vural Gökmen

Food Quality and Safety (FoQuS) Research Group, Department of Food Engineering, Hacettepe University, 06800 Beytepe, Ankara, Türkiye

The sprouting of wheat leads to an increase in free amino acids and reducing sugars. The objective was to utilise this amino acid- and sugar-rich system to create a Maillard reaction flavouring reminiscent of baked notes. A mixture of sprouted wholewheat flour, water, sodium bicarbonate, ammonium bicarbonate, pentanedione, and asparaginase was prepared to form a dough, which was then baked into thin layered disks and ground into a fine powder to obtain the reaction flavouring. Control biscuits were baked at 200 °C for 8 to 9 minutes, while low acrylamide biscuits underwent a lower thermal treatment (200 °C for 5 minutes followed by drying at 110 °C for 15 minutes). Reaction flavouring was incorporated into the low acrylamide biscuit dough at 5% and 10% by substituting an equivalent amount of flour, and these biscuits were baked under the same low thermal conditions. The addition of reaction flavouring significantly increased the content of Strecker aldehydes to a level comparable to that of the control biscuits, being 3 to 6 times higher than in low thermal load biscuits that lacked the flavouring. Low odour threshold pyrazines increased by 2 to 6 times, although they remained below control biscuit levels. Strecker aldehydes and pyrazines contribute to baked flavours. Maltol, furaneol, and cyclotene (which add sweet and biscuity notes) were not detected in the low thermal load biscuits. The addition of the reaction flavouring partially restored their levels with respect to control. The reduction in acrylamide content was 60%. In conclusion, the use of Maillard reaction flavouring in low thermal load biscuits effectively enhances desirable flavours while maintaining low acrylamide content. This highlights that heated sprouted wheat flour is a promising ingredient for creating low acrylamide baked products with enhanced sweet and baked notes.

PP-A14

Quantitative analysis of isomeric tocols in oils using RPLC-MS/MS

Jesse Namo Ombugadu[1], Katarzyna Pawlak[1], Kamil Wojciechowski[2]
[1]*Chair of Analytical Chemistry, Faculty of Chemistry, Warsaw University of Technology, Noakowskiego 3, 00-664 Warsaw, Poland;*
[2]*Chair of Medical Biotechnology, Faculty of Chemistry, Warsaw University of Technology, Noakowskiego 3, 00-664 Warsaw, Poland*

Vitamin E is composed of two subcategories of compounds: tocopherols and tocotrienols, classified as Tocols. These compounds are found naturally in a variety of foods including seeds, nuts, vegetables and palm oils, grains and leafy green vegetables. Vitamin E functions as an antioxidant, boosts the immune system, promotes healthy skin, helps to maintain eye health, aids in the production of red blood cells, inhibits blood clot formation, and prevents neurodegenerative disorders. The daily recommended intake for adults is set at 15 mg. Various seed oils are a significant source of tocols, containing them between 10 to 40 mg per 100 g. The stability of vitamin E in oil can be affected by several factors, including exposure to oxygen, light, and heat; its degradation can also be accelerated by other plant-derived components or additives. Careful control of tocopherol's concentration can be used as an indicator for oil antioxidant activity and to illustrate the impact of pressing methods, refining steps, and storage conditions. Due to variations in stability, each isomer should be evaluated separately.
Beta- and gamma-tocols are separated due to their isomeric structure by employing normal-phase liquid chromatography, coupled with mass spectrometry and atmospheric-pressure chemical ionisation, which is particularly recommended for hydrophobic compounds (NPLC-APCI-MS/MS). Although method provides good selectivity, it necessitates the use of substantial quantities of non-polar solvents. The objective of this study was to suggest a novel method for identifying tocols in plant-based oils via reversed-phase liquid chromatography in combination with electrospray ionisation mass spectrometry (RPLC-ESI-MS/MS). All tocopherol isomers were quantified, with a detection limit of less than 1 ng/mL, including coeluting beta- and gamma-isomers, following their specific fragmentation MS/MS pattern and calculation of the mole fraction of each isomer. This method was utilized to examine the stability of tocopherols in various types of oils.

PP-A15

Quantitative analysis of saponins in beverages via LC-MS/MS

Jesse Namo Ombugadu[1], Katarzyna Pawlak[1], Ewa Kobylska[2], Kamil Wojciechowski[2]

[1]*Chair of Analytical Chemistry, Faculty of Chemistry, Warsaw University of Technology, Noakowskiego 3, 00-664 Warsaw, Poland;*

[2] *Chair of Medical Biotechnology, Faculty of Chemistry, Warsaw University of Technology, Noakowskiego 3, 00-664 Warsaw, Poland*

Saponins are naturally occurring amphiphilic low-molecular-weight compounds synthesized by numerous plants as secondary metabolites. Synthesized to protect plants from pests and pathogens, they also have a positive impact on human health when present in human diet. These compounds exhibit antioxidant, anti-inflammatory, and cholesterol-lowering effects. They can help improve heart health, boost the immune system, inhibit dental decays and the aggregation of platelets. In food products, saponins serve as natural emulsifiers, foaming agents, and stabilizers that contribute to food texture and stability. It is crucial to consume them in moderation to prevent digestive problems and impede nutrient absorption. The European Food Safety Authority has established an acceptable daily intake of 3 mg of saponins per kg of body weight per day for quillaia extract (E 999). Quillaia extract is approved as additive in specific food categories such as flavoured beverages. It is also used as a feed additive for poultry.

Saponins can be detected using a variety of methods using chemical tests with spectrophotometry, which cannot distinguish between complex mixtures of saponins containing different aglycones and sugar domains. A more targeted approach is needed, employing techniques like liquid chromatography paired with an evaporative light scattering detector, charged aerosol detector, or mass spectrometer, as saponins do not contain chromophore groups.

A novel reversed-phase liquid chromatography coupled with tandem mass spectrometry (RPLC-MS/MS) approach has been developed for identifying and quantifying quillaia saponins through scanning precursor ions with a detection threshold of below 2 µg/mL, as well as multiple reaction monitoring with detection limits below 100 ng/mL. The method was utilised to quantify the saponins present in plant extracts and beverages.

Acknowledgements: *This work was financially supported by the Chemical Sciences Discipline Council grant "NChem3-IDUB" (K.P.) and by Warsaw University of Technology within the Excellence Initiative: Research University (IDUB) programme "Postdoc PW-III" (K.W.).*

PP-A16

Influence of heat treatment and ethanol washing on sensory characteristics of pea protein concentrates

Diana Owsienko, Greta van Huyssteen, Leyla Dahl, Evelina Höglund

Department of Food Research and Innovation, RISE Research Institutes of Sweden, Gothenburg, Sweden

The shift from animal-based to plant-based proteins is crucial for promoting sustainability in food production and consumption. Peas are a favourable plant protein source, with pea protein concentrate (PPC) offering a more sustainable option compared to pea protein isolate. However, PPC is often associated with stronger off-flavours, thus, treatments are necessary to improve the flavour. In this study, the effect of different treatments of PPC on the sensory characteristics was evaluated by sensory and instrumental analysis. The following treatments were applied: dry-heating at 150 °C for 1 h (DH), steam-heating at 130 °C for 1 h (SH), and washing with 50% ethanol (EW). A trained panel performed a sensory profiling (rate-all-that-apply) on the untreated PPC control and treated samples by rating the total intensity and intensity of aroma/flavour attributes on a 5-point-intensity scale. For the untreated PPC, the attributes pea-like and sprouts-like were rated as most intense. The intensity of these green notes was significantly reduced for all treatments (DH, SH, EW). For the heat-treated samples (PPC-DH, PPC-SH), nutty and peanut-like characteristics emerged as most prominent. The sample PPC-EW was rated with the lowest total intensity and perceived as most neutral. A gas chromatography-mass spectrometry/olfactometry (GC-MS/O) screening was performed to identify relevant aroma compounds potentially contributing to the green and nutty notes described by the panel. Among the green notes, hexanal, 3-isopropyl-2-methoxypyrazine, and 3-isobutyl-2-methoxypyrazine were detected. Heat treatment of the PPC led to the formation of several new aromas, including nutty-smelling alkyl pyrazines. For the sample PPC-EW, the number of aroma compounds perceived during GC-O was notably reduced in comparison to the control. In conclusion, it was shown that that heat treatment and ethanol washing changed the overall aroma/flavour profile towards nutty characteristics or a more neutral impression, respectively, making PPC suitable for the use in meat analogues.

PP-A17

Harnessing *Brassica oleracea* biodiversity for health-promoting plant-based foods

Vanda Púčiková[1], Franziska S. Hanschen[2,3], Andreas Dunkel[4], Andreas Börner[5], Katja Witzel[1]
[1]Biotic Interactions, Leibniz Institute of Vegetable and Ornamental Crops (IGZ), Großbeeren, Germany;
[2]Plant Quality and Food Security, Leibniz Institute of Vegetable and Ornamental Crops (IGZ), Großbeeren, Germany;
[3]Institute of Food Technology and Food Chemistry, Technische Universität Berlin, Berlin, Germany;
[4]Leibniz Institute for Food Systems Biology at the Technical University of Munich, Freising, Germany;
[5]Leibniz Institute of Plant Genetics and Crop Plant Research (IPK), Gatersleben, Germany

Brassica oleracea includes a large number of nutritionally important vegetables. Their sulfur-containing compounds, particularly metabolites derived from glucosinolates (GLS) and *S*-methyl-l-cysteine sulfoxide (SMCSO), have been linked to various health benefits. To address the ongoing biodiversity loss in agricultural land, selecting *B. oleracea* genotypes with enhanced nutritional value and highlighting their health benefits could promote cabbage diversity in the market.
317 genotypes representing seven *B. oleracea* varieties, including gene bank (IPK) and commercial genotypes mainly from Europe, but also from the Middle East, China, or the USA, were grown under field conditions. GLS were analyzed by UHPLC-DAD-ToF-MS, SMCSO by UHPLC-FLD, and GC-MS was performed to analyze GLS and SMCSO metabolites. To deepen the understanding of the regulation of GLS and SMCSO degradation, proteome analysis was carried out by nano-LC-MS/MS. Multivariate data analysis methods were applied to integrate the analytical datasets.
In general, Chinese broccoli genotypes showed the lowest GLS as well as SMCSO levels, whereas savoy cabbage accumulated the highest levels. The profiles and levels of GLS and their metabolites were homogeneous in kohlrabi and cauliflower genotypes. In contrast, a strong heterogeneity was found between the white cabbages. The highest potential to form health-promoting isothiocyanates upon GLS degradation was found in kohlrabi genotypes. Furthermore, most of the commercial genotypes had average to low GLS levels and showed a low isothiocyanate formation. *S*-methyl methanethiosulfinate, showing antimicrobial and chemopreventive properties, was the most common metabolite of SMCSO. Relevance networks and functional enrichment analysis support further elucidation of the regulatory mechanisms of the formation of health-promoting metabolites in cabbages.
Our findings highlight that the health-promoting potential of different cabbage genotypes may differ greatly due to their varying degradation patterns. By elucidating the regulatory mechanisms of those processes, we will contribute to the optimizing of the health value of *Brassica* vegetables.

PP-A18

Maturation study of *Sorbus aucuparia* fruit

Natália L. Seixas[1,2,3], José Fresno Baro[1], Miguel Sousa Dias[2,3], Nuno Sousa Dias[2,3], Letícia M. Estevinho[2,3], Luís G. Dias[2,3]

[1]Doctoral School, University of Léon (ULE), Campus de Vegazana, 24007, Léon, Spain;

[2]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Bragança, Portugal;

[3]Laboratório para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

The *Sorbus aucuparia*, commonly known as rowan or wild rowan in Portugal, is a species of the *Rosaceae* family widely distributed in temperate regions. Its fruits, characterized by an intense red-orange coloration, are rich in bioactive compounds, including polyphenols, flavonoids, and organic acids, which confer antioxidant properties and potential health benefits.

This study is part of the Tramonte project – Valorization of Biological Resources from Northern Inland Regions: The Transmontane Rowan as a Case Study. The objective was to monitor the maturation of *S. aucuparia* fruits by evaluating changes in their chemical composition over time. For this purpose, sugars (glucose, fructose, sucrose, and sorbitol) were quantified by HPLC Varian (manual injector with a loop, column temperature of 45°C, C18 column, RI detector; sulfuric acid aqueous solution was used as the mobile phase). Additionally, phenolic compounds were analyzed using the Folin-Ciocalteu and $AlCl_3$ methods, while antioxidant activity was assessed using the DPPH and FRAP assays. To enable a rapid assessment of fruit maturation, cyclic voltammetry and an electronic nose (E-nose) were employed. Cyclic voltammetry detected variations in electroactive compounds, providing a fast evaluation of maturation status. The e-nose analyzed the volatile profiles of the fruits to establish correlations between changes in aroma composition and the developmental stage.

The overall results allowed for the determination of the optimal harvest time, ensuring a balance between sugar content and bioactive compounds. Furthermore, the data suggests that the fruit pulp has potential applications in food product development. This study highlights the potential of *S. aucuparia* as a bioactive ingredient of interest to the food industry, promoting its sustainable use and adding value to this wild species.

Acknowledgments: *TRAMONTE – Valorização dos recursos biológicos do interior norte: a Tramazeira transmontana como case-study. FCT e "la Caixa" – Promove 2022. Program "promove": Mobilization of R&D Projects.*

PP-A19

Flavour chemistry as a valuable tool for the evaluation of new apple varieties

Niklas Pontesegger[1], Thomas Rühmer[2], Barbara Siegmund[1]

[1]*Graz University of Technology, Institute of Analytical Chemistry and Food Chemistry, Graz, Austria;*

[2]*Haidegg Experimental Station for Fruit Growing and Viticulture, Ragnitzstraße 193, Graz, Austria*

Apples belong to the most important fruits worldwide. The consequences of climate change do not stop in apple cultivation. The altered conditions impact the properties of the fruits or shift the harvest windows. Furthermore, new pests and diseases are detected in the orchards which require modified measures in plant protection. Infection of apples with scab, caused by the fungus *Venturia inaequlis*, results in dark, irregularly shaped lesions of leaves and fruits and also premature leaf and fruit drop.

One measure to fight against scab is the cultivation of scab-resistant varieties. These varieties are also suitable for organic cultivation which is of particular importance for organic agriculture in Austria's humid climate. Little is known about the maturation and ripening behaviour of new apple varieties. In this study, we investigated the maturation, ripening and long-term storage behaviour of the scab resistant apple variety Crimson Crisp in order to evaluate the harvest recommendations which are usually based on parameters such as starch content, texture and °Brix (Streif index).

Crimson Crisp apples were harvested beginning at an unripe stage mid of August until a very ripe stage in October. The formation of primary and secondary flavour compounds and also the sensory properties were followed alongside starch, texture, sugar content, pH and total acidity. The analysis of flavour compounds was performed using HS SPME GC-MS, for sensory evaluation trained panelists were used applying the Check-All-That-Apply method. The obtained results from flavour analysis were set into relation with the 'traditional' analytical parameters.

This study allows a deep insight into the properties and flavour formation of Crimson Crisp apples. The investigation of the flavour properties demonstrates that a prolonged on-tree ripening time of the fruits significantly improves the flavour of the fruits while other desired properties such as crisp texture can be maintained during storage.

PP-A20

The flavour of coffee substitutes – a comparative investigation

Müge Dogan, Niklas Pontesegger, Barbara Siegmund
Graz University of Technology, Institute of Analytical Chemistry and Food Chemistry, Graz Austria

Coffee belongs to the most popular hot drinks worldwide. However, climate change shows significant impact on coffee cultivation leading to a steady coffee price increase. This – together with an increasing awareness for sustainable foods – leads to an increased market share of coffee substitutes produced from domestic raw materials. In this study, we investigated the flavour properties of common coffee substitutes with respect to their volatile compounds and flavour properties.

Coffee substitutes produced from lupin seed, figs, chicoree and dandelion were investigated with instrumental as well as sensory methods. The volatilome of the ground products was analysed by HS-SPME GC-MS. Analysis of the sensory properties of French press infusions was performed by trained panellists and the use of Check-All-That-Apply (CATA). Multivariate statistical data treatment was applied to correlate the data and to compare the products with respect to their volatiles and the sensory properties.

The results of this study revealed significant differences between the investigated coffee substitutes in their sensory properties, but also in the composition of the volatiles. High similarities were found for dandelion and chicoree 'coffee' – both of them were dominated by ashy, dusty and also fermented, vegetable-like aroma, while flavour reminding of dried fruits and honey play an important role in fig 'coffee'. Lupin 'coffee' shows highest similarities to coffee, which is also reflected by a high number of alkylated pyrazines being responsible for the roasted, coffee-like notes of this product.

These results show that new and innovative products such as lupin 'coffee' are interesting alternatives to coffee, while the traditionally used coffee substitutes neither remind of coffee flavour nor show similarities to coffee in the composition of the volatilome.

PP-A21

Health-promoting properties of young barley (*Hordeum vulgare* L.)-based supplements

Anna Sadowska-Rociek[1], Magdalena Surma[1], Adam Florkiewicz[2]

[1]*Department of Plant Products Technology and Nutrition Hygiene, Faculty of Food Technology, University of Agriculture in Krakow, 122, Balicka Street, 30-149 Kraków, Poland;*

[2]*Department of Food Analysis and Quality Assessment, Faculty of Food Technology, University of Agriculture in Krakow, 122, Balicka Street, 30-149 Kraków, Poland*

The term "green barley", "young barley" or "barley grass" is used in the literature to describe barley (Hordeum vulgare L.) seedlings that grow up to 200 hours after germination and reach a height of approximately 20–30 cm. Cereal grasses are perceived as superfoods, and as a result, their popularity is constantly increasing.

In light of these facts, the content of bioactive ingredients (polyphenols, micro and macro elements, antioxidants activity) in dietary supplements containing green barley was examined.

The research material consisted of dietary supplements containing young barley, which were present on the Polish market (pharmacies and online stores) between 2021 and 2023. The material comprised 14 samples in the form of tablets or capsules, 13 powdered barley grass and 4 juices. The total polyphenols content (TPC) and the antioxidant activity (AO) were determined by standard spectrophotometric methods and phenolic acids concentration were analyzed by high-performance liquid chromatography–diode array detection (HPLC-DAD).

Overall, the research findings indicated that young barley products were rich in antioxidant compounds; however, their content was not as significant when compared to that of commonly consumed vegetables and fruits. Similarly, although young barley powders exhibited a substantial amount of macro and microelements, in particular iron and manganese, they were also most contaminated with heavy metals which may be harmful to the human organism. Dietary supplements in the form of tablets or capsules frequently contained additional bioactive ingredients that may enhance their beneficial health properties. Young barley is undoubtedly a rich source of valuable nutrients. Ultimately, the results suggest that caution may be warranted when considering the purchase of dietary supplements based on plant extracts.

Acknowledgements: *Financial Support from the Ministry of Science and Higher Education of Republic of Poland within the scope of statutory R & D activities (SUB/2023-70014-D015).*

PP-A22

Effect of ascorbic acid on the quality of caviar substitute from eggs of the small brown snail (*Cornu aspersum aspersum*)

Krzysztof Surówka[1], Maciej Ligaszewski[2], Barbara Anthony[3], Ireneusz Maciejaszek[1], Iwona Tesarowicz[1], Jagoda Majcherczyk[1], Wiesław Łasocha[4], Ladislav Staruch[5].
[1]*Faculty of Food Technology, University of Agriculture in Krakow, Krakow, Poland;*
[2]*Department of Small Livestock Breeding, National Research Institute of Animal Production, Balice n. Krakow, Poland;*
[3]*Faculty of Veterinary Medicine, University of Life Sciences in Lublin, Lublin, Poland;*
[4]*Faculty of Chemistry, Jagiellonian University, Krakow, Poland;*
[5]*Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia*

A caviar substitute with an earthy-nutty taste and white color was produced from the eggs of the small brown snail. The aim of the study was to determine the effect of ascorbic acid addition (0.1%) during salting (in a 6% NaCl brine) on the quality of the product. Salting caused a decrease in water content from 85.1% to 82.7% and reduced water activity to 0.97. Gel electrophoresis showed that the proteins distribution in the eggs does not change as a result of salting and does not depend on the presence of ascorbic acid. The X-ray diffraction showed that the calcium carbonate crystals visible in SEM images in the walls of the eggs occur as calcite. Structural changes caused by salting eggs affect their texture. Samples treated with NaCl were characterized by slightly lower firmness. Fresh eggs, apart from a small amount of spermine and spermidine, do not contain biogenic amines. They appear only in finished products, after their two-month storage, but even then the biogenic amine index (BAI), calculated as a sum of histamine, putrescine, cadaverine and tyramine, was only 26.1 mg/kg and 38.3 mg/kg for products obtained with and without vitamin C, respectively. During storage of the caviar substitute, changes in its color occur, because salted eggs darken and turn pink. However, the presence of ascorbic acid very effectively counteracts this process and contributes to maintaining very high quality even after 2 months of storage at 2°C. In summary, the salting of the eggs partially changes their microstructure, resulting in a slight decrease in firmness. In turn, the addition of ascorbic acid at a level of only 0.1% to the brine significantly improves the quality of the obtained caviar substitute, which is manifested by the reduction of biogenic amines accumulation and better preservation of attractive color during refrigerated storage.

PP-A23

Effects of infrared radiation at 850 nm and 940 nm on the synthesis of bioactive phytochemicals in radish sprouts

Grzegorz Fiutak, Krzysztof Surówka
Faculty of Food Technology, University of Agriculture in Krakow, Krakow, Poland

The aim of the study was to evaluate the impact of infrared (IR) light (850 nm and 940 nm) on the morphology, bioactive phytochemical content, and fiber composition of radish sprouts. The experiment included three lighting conditions: IR light at 850 nm, 940 nm, and a control group grown in complete darkness. The study analyzed chlorophyll, carotenoids, anthocyanins, polyphenols, protein, vitamin C, and the amino acid profile. The results showed that sprouts grown in darkness did not synthesize chlorophyll, leading to etiolation of the shoots. IR light did not increase chlorophyll production but significantly influenced the biochemical composition of the plants. Sprouts grown under 850 nm light exhibited higher anthocyanin and polyphenol content, including pelargonidin and sinapic acid derivatives. In contrast, 940 nm irradiation increased protein content by over 25% compared to the control group. Additionally, 850 nm IR light promoted the accumulation of vitamin C and carotenoids, while 940 nm light resulted in increased sprout mass and height. These findings suggest that infrared light can stimulate the synthesis of certain bioactive compounds in plants, even though it does not enhance chlorophyll production. This could be significant for optimizing plant cultivation conditions in controlled environments such as greenhouses and vertical farms.

PP-A24

Water stress-induced metabolic shifts and bioactivity in broccoli sprouts

Ivana Šola[1], Daria Gmižić[1], Karlo Miškec[1], Jutta Ludwig-Müller[2]
[1]Department of Biology, Faculty of Science, University of Zagreb, Horvatovac 102a, 10000 Zagreb, Croatia; [2]Faculty of Biology, Technische Universität Dresden, Zellescher Weg 20b, 01217 Dresden, Germany

Drought and flooding alter broccoli sprout metabolism, affecting phytochemical profiles and biological activity. In this study, we examined how these conditions affect broccoli sprouts (*Brassica oleracea* L. convar. *botrytis* (L.) Alef. var. *cymosa* Duch.) using spectrophotometric, HPLC, and electrophoretic techniques. Drought and flood had distinct effects on pigment profiles: drought more strongly suppressed chlorophyll *a*, total chlorophyll, and porphyrins compared to flooding. Conversely, drought led to an accumulation of carotenoids and glucosinolates, while these compounds declined under flooding, pointing to their role in drought tolerance mechanisms. Nitrate levels increased significantly under drought (from 13.11 ± 1.05 to 22.41 ± 1.20 mg/g dry weight) but fell sharply during flooding (to 5.17 ± 1.03 mg/g dry weight). Drought also slightly reduced oxalic acid (from 48.94 ± 1.30 to 46.43 ± 0.64 mg/g dry weight). Flooding caused notable decreases in proteins (29%), total phenolics (15%), flavonoids (10%), flavonols (11%), tannins (36%), and proanthocyanidins (19%). In contrast, drought primarily reduced flavonoids (by 23%) but increased total phenolics and proanthocyanidins by 29% and 7%, respectively. Flooding also lowered hydroxycinnamic acids by 13%. Individual polyphenol responses varied by stress type: drought reduced ferulic acid by 17% and raised sinapic acid by 30%, while flooding reversed these trends and increased kaempferol content by 22%. Proline, which rose by 139% under drought, along with these metabolites, emerged as key indicators of water stress. Antioxidant capacity was more negatively affected by flooding, yet drought-exposed broccoli extracts provided better protection of plasmid DNA from oxidative damage. Overall, these results highlight the dynamic metabolic responses of broccoli sprouts to water stress and underscore their value in developing water-resilient crop strategies.

PP-A25

Influence of red and blue-dominant light spectra on the biosynthesis of secondary metabolites in *Mentha*

Saskia Tsiaparas, Annika Walpert, Kai Kehle, Maike Passon, Andreas Schieber, and Matthias Wüst
Faculty of Agricultural, Nutritional and Engineering Sciences, Institute of Nutritional and Food Science, University of Bonn, Bonn, Germany

Mint (*Mentha sp.*), which belongs to the Lamiaceae family, is a widely used medicinal and aromatic plant. The perennial herb has great economic importance in the food, beverage, pharmaceutical, confectionery, and cosmetics industries. A number of biological activities such as antimicrobial, antiallergic, anticancer, antidiabetic and neuroprotective properties have been ascribed to *Mentha.* Polyphenols, carotenoids and chlorophylls are among the biologically active compounds. Furthermore, they play an essential role in plant protection, signaling, photoprotection and pigmentation. Polyphenols are the primary source of natural antioxidants and include flavonoids and phenolic acids. As the demand for naturally derived antioxidants increases, farmers are challenged to ensure consistent product quality while meeting consumer expectations of untreated products. With the climate changing, cultivation of herbs and medicinal plants in greenhouse is on the rise. This is challenging because greenhouse mint has five to fifty times lower levels of phytochemicals than field-grown mint. Light quality is crucial for the biosynthesis and accumulation of plant secondary metabolites. The potential of light in closed systems has not yet been fully exploited. Unlike high-pressure sodium lamps, LED (light-emitting diode) technology provides a high level of spectral tuning.

Five genotypes of different mint varieties were grown in a red- (660 nm) and blue-dominated spectrum to investigate the influence of spectral adaptation on the biosynthesis of secondary metabolites. A full spectrum served as control. Phenolic compounds were identified and quantified using a UHPLC-MS system. The climate chamber experiment showed light-dependent differences in levels and the composition of flavones, flavanones as well as phenolic acids. Within the variety of peppermint, quantities of phenolic acids or flavones were significantly increased in the red dominated spectrum. Additionally, the effect of spectral tuning on the qualitative and quantitative profile of chlorophylls and carotenoids was investigated.

PP-A26

Effect of coffee roasting degree on bioactive compounds and acrylamide based on processing methods in specialty coffee

Matúš Várady[1], Jan Tauchen[2], Adéla Fraňková[2], Pavel Klouček[2], Miriam Vlčáková[3], Anna Reitznerová[1], Slavomír Marcinčák[1], Peter Popelka[1]

[1]*Department of Food Hygiene, Technology and Safety, University of Veterinary Medicine and Pharmacy, Komenského 73, 041 81 Košice, Slovakia;*

[2]*Department of Food Science, Czech University of Life Sciences Prague, Kamýcká 129, 165 00 Praha – Suchdol, Czech Republic;*

[3]*State Veterinary and Food Institute Dolný Kubin, Jánošková 1611, 026 01 Dolný Kubín, Slovakia*

Coffee beverages are one of the most popular commodities and their antioxidant properties play an important role in human health. The antioxidant activity of coffee beans depends on the properties of phenolic compounds, particularly chlorogenic acids (5-O-CQA) and caffeine (CAF). Coffee roasting and processing result in the elimination of damaged beans and an increase in bean quality, including the adjustment of flavour and aroma. We investigated the effect of roasting degree on bioactive compounds and acrylamide in specialty coffees (100% *Coffea arabica*) originating from Java (JAV) and Rwanda (RWA) and processed by natural and anaerobic fermentation methods. Light roasting was carried out at a final temperature of 203 °C for 5 minutes and dark roasting was carried out at a final temperature of 207 °C for 6 minutes. CAF and 5-O-CQA were measured by HPLC-UV/Vis and acrylamide was measured by LC-MS/MS. The highest level of acrylamide was found in the darker roast of naturally processed RWA, which was significantly higher than the darker roast of RWA processed by anaerobic fermentation. 5-O-CQA was significantly higher ($P < 0.001$) in light-roasted RWA coffee beans than in dark-roasted ones. JAV had the highest CAF content, with the highest values for light roasting of naturally processed beans. In conclusion, the type of processing and degree of roasting affected the content of acrylamide and bioactive compounds in specialty coffee, and anaerobic fermentation was able to maintain bioactive compounds at high levels and significantly reduce the amount of acrylamide in coffee.

Acknowledgment: *This study was supported by funds from the Scientific Grant Agency of the Ministry of Education of the Slovak Republic and the Slovak Academy of Sciences (VEGA 1/0038/25) and by Early stage grant – UVLF, 09I03-03-V05-00017, IGA – ESGV/01/2024.*

PP-A27

Kernel type variability in maize: Insights into mineral element content

Jelena Vukadinović, Violeta Anđelković, Vojka Babić, Snežana Mladenović Drinić, Jelena Srdić, Nikola Grčić, Natalija Kravić

Maize Research Institute Zemun Polje, Belgrade, Serbia

Maize (*Zea mays* L.) is one of the most extensively cultivated and consumed crops globally. Within its diverse spectrum of kernel types, dent kernels are primarily used for industrial products and livestock feed, while flint and popcorn varieties are favored for making polenta, maize tortillas, and chips. Maize is also rich in phytonutrients, including essential macro- and microelements important for human health. These nutrients play a significant role in supporting various physiological functions, enhancing immune system efficacy, and ensuring the proper functioning of organs. This study aimed to assess whether different types of maize kernels exhibit varying levels of mineral element accumulation. Accordingly, the macro- and microelement content of 32 maize accessions, representative of diverse kernel types—flint, semi-flint, dent, semi-dent, and popcorn—was analyzed. These accessions were obtained from the Maize Research Institute Zemun Polje gene bank. The content of potassium (K), magnesium (Mg), phosphorus (P), zinc (Zn), copper (Cu), iron (Fe), and manganese (Mn) was quantified using ICP-OES. The average mineral element content for the observed kernel types was as follows: flint (970.44 μg/g dw), dent (921.62 μg/g dw), popcorn (912.90 μg/g dw), semi-dent (899.56 μg/g dw), and semi-flint (849.68 μg/g dw). Hierarchical cluster analysis demonstrated that all four popcorn accessions clustered together, alongside three accessions from the semi-dent and dent types, as well as two accessions from the semi-flint and flint types. Although a limited number of accessions were evaluated, the results indicate a distinct relationship between different maize kernel types and their mineral element content. These findings underscore the importance of screening a broader range of gene bank accessions to further explore the potential of genetic resources related to mineral element content, i.e., improved nutritional profiles.

Acknowledgements: *This work was supported by the Project TWINNING GREEN-EDITING VIBES FOR FѳѳD (CREDIT Vibes) (Grant No: 101059942).*

SESSION PP-F: FOOD PRODUCTION AND ITS SUSTAINABILITY

PP-F01

Botanical origin of pollen mixtures and honey: comparison of two ITS2 primer sets for DNA-metabarcoding

Mónica Honrado [1,2], Andreia Quaresma[1], Joana Santos[1], M. Alice Pinto[1], Joana S. Amaral[1]

[1]CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal; [2]LAQV-REQUIMTE – Department of Chemistry, University of Aveiro, Campus Universitário de Santiago, Aveiro, Portugal

Honey's botanical origin plays a critical role in determining its flavor, color, and medicinal properties. Due to the high value and consumer preference for monofloral honeys, mislabelling of botanical origin has become a widespread adulteration. Traditionally, microscopic analysis of pollen grains is used to verify the floral source of the honey. However, this method is labour-intensive, requires specialised expertise, and often achieves low taxonomic resolution. More recently, ITS2 metabarcoding has emerged as a promising alternative for honey botanical identification. Despite its advantages, several challenges remain, particularly regarding the use of sequence read counts to estimate relative pollen abundance and the overall reliability of the method for honey authenticity testing.

In this work, a recently proposed primer set (ITS-3p62pIF1/ ITS-4unR1) for ITS2 amplification was compared with the mostly used for pollen analysis, ITS-S2F/ITS-S4R. For this purpose, six mixed-pollen and ten honey samples were analysed using both primer sets. Moreover, mock-mixtures of pollen grains from known species were prepared to contain an equal mass of each species or a similar amount of pollen grains. Each mock-mixture was individually prepared and added to agave syrup (naturally pollen-free) to simulate the honey matrix. Independent triplicates were subjected to DNA extraction, PCR amplification, ITS2 metabarcoding, and parallelly to microscopy.

Although qualitative differences were observed between primer sets, overall, ITS-S2F/ITS-S4R primers resulted in a higher number of detected plant species, both on pollen and honey samples. This primer set enabled the identification of all species in the mock-mixtures containing five different pollens, however it failed to detect *Zea mays* in the mixture containing 13 pollens. Quantitatively, some species were either overrepresented (*Olea europaea*) or underrepresented (*Tilia cordata*). Thus, further studies are required to improve the accuracy of the method.

Acknowledgments: *to project "Mel I.D" financed by PNASA 2023-2027, PRIMA project "MEDIBEES" and FCT PhD scholarships (2021.08119.BD, 2020.05155.BD)*

PP-F02

3D printing of protein-based ink: Multivariate analysis of printing conditions on physicochemical properties

Diana Vicente-Jurado[1,2], Tania Doménech[1], Purificación García-Segovia[1], Marta Igual[1], José-Manuel Catalá-Civera[2], Javier Martínez-Monzó[1]

[1]i-Food Group, Instituto Universitario de Ingeniería de Alimentos-FoodUPV, Universitat Politècnica de València, Valencia, Spain;

[2]Institute of Information and Communication Technologies (ITACA), Universitat Politècnica de València, Valencia, Spain

Food 3D printing faces challenges in formulating and evaluating inks for continuous, controlled, and reproducible extrusion. Parameters like printing speed and nozzle diameter influence material behavior, affecting system pressure and the ink's structural and rheological properties.

This study conducts a multivariate evaluation of the effects of printing parameters on the rheological and structural properties of a rice protein-based ink.

A randomized block design was employed, incorporating printing speed (20, 35, 50 mm/s) and nozzle diameter (0.85, 1.2, 1.55 mm) as variables, with each condition replicated three times. For each combination of these factor levels, the pressure curves of the printing system, rheological parameter curves (G', G", and η*), and the spectral characteristics of the protein ink were assessed. These data were subjected to multivariate analysis, including principal component analysis (PCA) and heat map visualization.

Utilizing PCA and heat maps, the influence of printing parameters on system pressure was discerned. It was observed that under low-intermediate printing conditions ([50 mm/s and 0.85 mm], [35 mm/s and 0.85 mm], [20 mm/s and 1.2 mm]), there is a diminished impact on pressure. Furthermore, the printing process alters the rheological properties, sometimes increasing or decreasing stiffness. These parameters also affect the structural network of food inks, as identified by FTIR, particularly in the amine functional group regions (1500–1700 cm^{-1}). The conditions that exhibited a lesser effect on pressure also demonstrated minimal structural alteration.

The relationship between pressure behavior and the changes observed in rheology and FTIR is only partial. As revealed by FTIR, the molecular structure was strongly influenced by the printing conditions, which is also reflected in the pressure variations. In contrast, rheological properties exhibit greater internal variability, with similar pressure profiles sometimes corresponding to different rheological responses, suggesting the involvement of additional underlying factors.

PP-F03

Properties of pectin extracted under different conditions from infrared dried orange peels

Arzu Başman, Melis Akdeniz
Hacettepe University, Food Engineering Department, Beytepe, Ankara, Türkiye

In recent years, utilization of infrared drying in food industry has been increasing, due to its advantages (direct heat penetration, short processing time, low cost) over conventional heating. Infrared has been used for drying, cooking, roasting, and enzyme inactivation. Infrared also enhances extraction of many compounds by disrupting structure.

Pectin, found in plant cell walls, is commonly extracted from fruit juice industry waste, such as citrus peel and apple pomace. Its gelation, emulsification, and biodegradability make it valuable as a stabilizer, thickener, and edible coating in food applications.

This study investigated the effects of drying methods and extraction conditions on pectin yield, galacturonic acid content, esterification degree, FTIR spectra, color. Orange peels were dried using infrared (600W, 700W, 800W for 30min.) or oven drying (60°C for 235min.,70°C for 197min.). Pectin was extracted from dried peels at 90°C under varying pH (1-1.5-2) and extraction time (60-90-120min.).

Multiple comparison test results of main factors (drying method, extraction pH, extraction time) showed that infrared drying of orange peels significantly increased pectin yield compared to oven drying. Higher infrared power enhanced disruption of cellular structures, resulting in higher pectin yields at pH 1.5 compared to those from oven-dried samples. Pectin yield from oven-dried orange peels was high only at pH 1 but lower pH generally decreased pectin lightness. Some pectin samples produced in this study had higher galacturonic acid content and esterification degree, compared to commercial pectin. Infrared drying of orange peels, compared to oven drying, resulted in pectin with higher esterification degree, indicating less structural damage. FTIR spectra confirmed structural similarity to commercial pectin. These results indicated that infrared drying, with a shorter drying time for orange peels, shows great promise for producing pectin with high yield and quality.

Acknowledgements: *The authors wish to thank Hacettepe University, Scientific Research Projects Coordination Unit for financial support (Project No:FHD- 2022-19978).*

PP-F04

A green biorefinery approach for *Butia catarinensis* supply chain

Eduardo Macedo de Melo[1,5], Juan David Marmolejo Tascón[2,5] , Sandra Regina Salvador Ferreira[2,3,5], Jane Mara Block[1,4,5]

[1]*Graduate Program in Food Science — Department of Food Science and Technology;*
[2]*Graduate Program in Food Engineering — Chemical and Food Engineering Department;*
[3]*Department of Chemical and Food Engineering;*
[4]*Department of Food Science and Tecnology;*
[5]*Federal University of Santa Catarina, Florianópolis, SC, 88034-001, Brazil*

Butia catarinensis (butiá) is a fruit from the Brazilian Atlantic Forest that is currently at risk of extinction. Butiá is locally processed to produce pulp, which also generates a waste mostly composed of seeds. Although butiá seeds are rich in oil and other nutrients it has been neglected as a potential resource of bioactive compounds. In this work, we used green technologies (supercritical fluid extraction — SFE; pressurized liquid extraction — PLE; microwave assisted extraction — MAE) to create a biorefinery process for the recovery of different nutrient fractions from this residue. Seed shells were separated from kernels, and the latter was used as feedstock for the three-step biorefinery based on sequential extractions (SFE-CO_2, PLE-EtOH 80% and MAE-water, respectively). Product yield, bioactive compound content (phenolic compounds, flavonoids, carotenoids, sugars and proteins), antioxidant activities (DPPH and ABTS) of each recovered fraction and the accumulated product yield of the biorefinery was evaluated. The process applied allowed for the selective extraction of three fractions of different chemical composition (oil, a phenolic-rich fraction and a protein-rich fraction) in good yields (6.47–31.14%). Antioxidant activities were higher in the phenolic-rich extract obtained by PLE-EtOH 80% (DPPH = 160 µmol TE g^{-1} and ABTS = 124 µmol TE g^{-1}). The accumulated product yield of the biorefinery was 50%. Overall, the chosen biorefinery approach was a selective and efficient strategy for the recovery and added value of nutrients from butiá kernels.

PP-F05

Antioxidant activity of *Butia catarinensis* kernel extracts

Eduardo Macedo de Melo[1,5]; Juan David Marmolejo Tascón[2,5]; Sandra Regina Salvador Ferreira[2,3,5]; Jane Mara Block[1,4,5]

[1]*Graduate Program in Food Science;*

[2]*Graduate Program in Food Engineering;*

[3]*Department of Chemical Engineering and Food Engineering;*

[4]*Department of Food Science and Technology;*

[5]*Federal University of Santa Catarina, Florianópolis, SC, 88034-001, Brazil*

The kernels of *Butia catarinensis* (butiá) is a major residue derived from the fruit processing to produce pulp. Besides being rich in oil, this residue is also rich in antioxidant ingredients, such as phenolic compounds, which can be recovered as a valuable bioproduct. In this work we evaluated the total phenolic content (TPC), total flavonoid content (TFC), total carotenoid content (TCC) and antioxidant activities (DPPH and ABTS) in the butia kernel oil (obtained by cold-press, supercritical fluid extraction-CO_2 and Goldfisch extraction-hexane) and in the hydroethanolic extracts (obtained by pressurized liquid extraction — PLE, and Goldfisch). TPC, TFC and TCC were higher in the hydroethanolic extracts, especially in those obtained by Goldfisch (22.54 mg GAE g^{-1}, 0.26 mg QE g^{-1} and 69.70 μg βCE g^{-1}, respectively). Accordingly, antioxidant activities were higher in the hydroethanolic extracts in relation to the oil samples. When comparing both hydroethanolic extracts, the activities were higher in PLE extracts (DPPH = 160 μmol TE g^{-1} and ABTS = 124 μmol TE g^{-1}), which was an unexpected result. In conclusion, antioxidant compounds could be selectively extracted from butiá kernel cake using 80% ethanol as solvent. Although Goldfisch provided an extract with higher content of antioxidants, its activity was lower than the extract obtained with PLE, suggesting that PLE provides a better-quality antioxidant extract. Owning to its antioxidant properties, the produced extracts could be applied as natural food additives to enhance processed food quality and nutrition.

PP-F06

Next-generation non-alcoholic beer fermented with potential probiotic yeasts

Ján Brunner, Tatiana Klempová, Peter Vaštík

Faculty of Chemical and Food Technology, Slovak University of Technology, Bratislava, Slovakia

The traditional beer markets worldwide are thriving, which motivates brewers to broaden their focus towards emerging consumer trends. As consumers increasingly seek innovative beer styles that align with a healthier lifestyle, one promising approach is the use of potential probiotic yeasts.

Non-*Saccharomyces* yeasts *Pichia manshurica* (CCY 039-063-001 and CCY 039-063-004), *Kluyveromyces lactis* (CCY 026-012-002), and *Kluyveromyces marxianus* (CCY 029-008-010) were investigated alongside the commercial probiotic yeast *Saccharomyces boulardii* (HANSEN CBS 5926) as a control for functional non-alcoholic beer (NAB) production.

Growth and viability of the studied yeasts were assessed under beer matrix and human digestive tract conditions (temperature, pH, NaCl and iso-α-bitter acids concentrations). *β*-glucosidase activity of the studied yeasts and their ability to ferment glucose, maltose, sucrose and lactose were determined. Non-volatile and volatile organic compounds (VOCs) in beer samples were determined using HPLC-RID and HS-SPME-GC-MS, along with the basic beer parameters (ethanol concentration and pH value).

Yeast strains demonstrated resilience under beer matrix and human digestive tract conditions. *Kluyveromyces* and *Pichia* strains were unable to ferment maltose, making them suitable for NAB production. *K. lactis* and *K. marxianus* exhibited strong *β*-glucosidase activity, which may enhance the beverage aromatic complexity. Tested non-*Saccharomyces* yeasts were suitable to produce NABs with ethanol concentration below 0.5% (v/v) and further VOC analysis indicated contribution of the tested yeasts to produce higher alcohols and esters, making them noteworthy for brewers.

Yeast characterisation showed high probability of survival in beer matrix and digestive tract conditions. The yeasts successfully fermented beer as sole cultures, producing NABs, while *K. marxianus*, *K. lactis*, and *P. manshurica* enhanced the sensory profile with higher alcohols and esters, offering potential for future functional beer production.

Acknowledgments: *This work was supported by Slovak Academy of Sciences VEGA 1/0063/18, by Slovak Research and Development Agency APVV-22–0235.*

PP-F07

In-depth LC-IMS-MS profiling of avocados from different Iberian regions: utilizing ion mobility as a crucial descriptor in non-targeted metabolomics

Irene Serrano-García[1], María Gemma Beiro-Valenzuela[1], Romina Pedreschi[2], José Jorge González-Fernández[3], José Ignacio Hormaza[3], Lucía Olmo-García[1], Alegría Carrasco-Pancorbo[1]

[1]*Department of Analytical Chemistry, Faculty of Sciences, University of Granada, Granada, Spain;*

[2]*Escuela de Agronomía, Facultad de Ciencias Agronómicas y de los Alimentos, Pontificia Universidad Católica de Valparaíso, Quillota, Chile;*

[3]*Institute for Mediterranean and Subtropical Horticulture (La Mayora-CSIC), Málaga, Spain*

Spain remains Europe's leading avocado producer, with Andalusia as the primary growing region. However, rising global demand has prompted the expansion of avocado cultivation into the Valencian Community, northern coastal regions of Spain, and southern Portugal. This study aimed to provide a comprehensive characterization of the metabolic profiles of *Hass* avocados grown in different regions of the Iberian Peninsula and explore the role of ion mobility spectrometry (IMS) in non-targeted metabolomics for geographical origin tracing.

480 *Hass* avocado fruits from eight different Iberian regions, including areas from northern (Galicia and Asturias), eastern (Valencia), and southern Spain (Granada, Cadiz, Malaga), as well as the Algarve in Portugal were considered. Utilizing UHPLC-TimsTOF MS/MS, over 100 primary and secondary metabolites were identified in avocado mesocarp. Among these, phenolic compounds emerged as the most abundant chemical family. The addition of ion mobility spectrometry (IMS) enhanced metabolite annotation by incorporating the Collision Cross Section (CCS) value, which serves as a key descriptor to further differentiate metabolites.

The results revealed distinct metabolic profiles that allowed for clear differentiation between avocados from various regions, such as Asturias and Galicia, which exhibited similar profiles, and those from Malaga, Granada, Valencia, Cadiz, and Algarve, which displayed unique metabolic patterns. Chemometrics-assisted non-targeted metabolomics was employed to assess the data, identifying regional-specific biomarkers and compositional patterns. Supervised OPLS-DA models enabled clear differentiation of the avocados based on their regional origins and provided excellent cross-validation results.

This research has important implications for the avocado industry. By understanding the impact of environmental factors like soil and climate on fruit composition, producers can optimize agricultural practices, enhance post-harvest management and improve product quality. Additionally, the findings provide a scientific basis for differentiating Spanish avocados—particularly those from distinct regions—from imported varieties, which could be valuable for marketing and consumer recognition.

PP-F08

Advances in sustainable and functional mycelium-based foods

Maria Inês Dias[1], Maria Gabriela Leichtweis[1], Catarina Ribeiro[2], Andreia Afonso[2], Carla Pereira[1]
[1]*CIMO, LA SusTEC, Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal;*
[2]*2Deifil Technology Lda., Rua do Talho 80, 4839-704 Póvoa de Lanhoso, Portugal*

As the global population expands and environmental challenges intensifies, the need for innovative food production systems becomes more urgent. Simultaneously, consumers are increasingly seeking healthier, more sustainable dietary options. Mushrooms, long valued for their nutritional properties and sensory qualities comparable to animal-based foods, present a promising alternative. Within this, mycelium emerges as a particularly compelling solution due to its rapid growth, excellent digestibility, complete amino acid composition, and minimal ecological footprint. Unlike mushroom fruiting bodies, mycelium naturally develops a fibrous consistency that closely resembles meat, making it an appealing candidate for alternative protein sources. Despite the well-established practice of mushroom farming, mycelium cultivation is still gaining traction in the food industry, mainly for its efficiency and reduced resource requirements. Of the approximately 12,000 known mushroom species, only 2,000 is recognized as edible, with an even smaller subset cultivated for consumption. Mycelium-based foods remain underdeveloped, particularly in their raw, unprocessed form. A key obstacle in expanding their availability lies in the challenge of isolating viable mycelium strains, particularly from wild mushrooms, where environmental variables impact their growth. Furthermore, scaling up production necessitates fine-tuning factors such as nutrient balance, pH levels, temperature control, aeration, and agitation. Liquid culture techniques have demonstrated potential for producing uniform mycelium, yet large-scale implementation remains an underexplored frontier. The Myco2Feed project is dedicated to advancing scientific and technological breakthroughs in mycelium-based food production. By enhancing efficiency, scaling production, and advancing research, this initiative accelerates mycelium-based food development to meet consumers' demand and drive sustainable solutions.

Acknowledgements: *FCT/MCTES (PIDDAC): CIMO, UIDB/00690/2020 (DOI: 10.54499/UIDB/00690/2020) and UIDP/00690/2020 (DOI: 10.54499/UIDP/00690/2020); and SusTEC, LA/P/0007/2020 (DOI: 10.54499/LA/P/0007/2020); institutional scientific employment program contract with M.I.D. 10.54499/CEECINST/00016/2018/CP1505/CT0004) and C.P. (10. 54499/CEECINST/00016/2018/CP1505/CT0010). To "Myco2Feed – Inovação e sustentabilidade na criação de micélio comestível e de alimentos funcionais à base de micélio" project (COMPETE2030-FEDER-00585700, Nº 14444.*

PP-F09

3D printing extrusion flow optimisation with simultaneous microwave processing

Tania Doménech[1], Diana Vicente-Jurado[1,2], Purificación García-Segovia[1], Marta Igual[1], José-Manuel Catalá-Civera[2], Javier Martínez-Monzó[1]

[1] i-Food Group, Instituto Universitario de Ingeniería de Alimentos-FoodUPV, Universitat Politècnica de València, Valencia, Spain;

[2]Institute of Information and Communication Technologies (ITACA), Universitat Politècnica de València, Valencia, Spain

3D printing is revolutionising food processing by enabling more efficient work with various food inks compared to other techniques. The integration of microwaves via an evanescent wave antenna is currently being investigated in order to apply a heat treatment that cooks the food inks while preserving the consistency of the three-dimensional figures created layer by layer. Among extrusion printing methods, auger extrusion stands out as one of the most common. However, this technology faces difficulties during stops in the printing flow, a situation that is aggravated by the use of microwaves.

The aim of the project is to improve the extrusion technique to obtain a controlled flow during printing and simultaneous application of microwaves.

Initially, a single piston was used, but pauses in the microwave treatment caused a loss of pressure and flow in the following layers. To solve this, a screw second extruder and an external controller were added to adjust the speed of the system. The piston pushes the mass from the syringe, while the second extruder, located in the nozzle, pushes it outwards. A laser meter was used to measure the height of the printed dough and quantify the flow in the tests.

Flow accuracy was improved with the new extruder and external controller, keeping it uniforms in multilayer shapes with microwaves. The laser meter detected an average height difference of only 0.02 mm in the printed masses.

The results show that the use of a second extruder and the external controller allowed to maintain a constant flow during the printing process with a better control of the pressure in the printing system.

PP-F10

Ohmic heating-assisted extraction of bioactive compounds from goji berry

Harun Kantar[1], Yusuf Can Gerçek[2], Nesrin Ecem Bayram[3]
[1]*Institute of Graduate Education, Bayburt University, Bayburt, Türkiye;*
[2]*Faculty of Science, Istanbul University, Istanbul, Türkiye;*
[3]*Aydıntepe Vocational College, Bayburt University, Bayburt, Türkiye*

Goji berry fruits are one of the remarkable food/functional foods with rich bioactive content and therefore many health protective properties. In recent years, with the increase in demand for functional foods, the fruits of this plant have been intensively consumed. In this study, we aimed to optimize the extraction of phenolic compounds from goji berry fruit by ohmic heating-assisted extraction, an advanced extraction technique, using the response surface method. Within the scope of the study, different temperature (40, 50 and 60 °C), holding time (20, 40 and 60 min) and electric field strength (15, 30 and 45 V/cm) parameters were selected as independent variables while total phenolic compound, total flavonoid compound and antioxidant activity parameters were selected as dependent variables. According to the results obtained, the optimum extraction parameters for temperature, holding time, and electric field strength were determined to be 60 °C, 60 min, and 45 V/cm, respectively. Maximum total phenolic content, total flavonoid content and antioxidant activity values were found as 23.83 mg GAE/g, 7.33 mg QE/g and 24.53 mg TE/g, respectively. In addition, when the individual phenolic contents of the extracts were evaluated, it was found that this fruit contained a high content of rutin phenolic. However, the ohmic heating-assisted extraction yielded extracts with higher bioactive substance content in a shorter time than the maceration as a control. As a result, it can be said that ohmic heating-assisted extraction can be preferred in the preparation of goji berry fruit extracts. In addition, in future studies, it can be suggested to investigate and develop the potential of using this method in the processing processes of different functional foods.

PP-F11

Aerogels in Food: Innovation for Sustainability and Functionality

Tuğba Elbir Abca

Food Engineering Department, Faculty of Engineering, Bayburt University, Bayburt, Türkiye

Aerogels, characterized by their highly porous structure and low density, have emerged as promising materials in the food industry due to their exceptional physicochemical properties. These lightweight, nanostructured materials provide high surface area, low thermal conductivity, and superior adsorption capabilities, making them suitable for various applications in food systems. Among them, biopolymer-based aerogels, derived from natural polysaccharides or proteins, are being explored as sustainable alternatives to conventional synthetic food packaging due to their biodegradable and environmentally friendly nature. Their ability to act as oxygen and moisture barriers further enhances their potential in extending the shelf life of perishable food products.

Beyond packaging, aerogels have gained attention as carriers for bioactive compounds, including vitamins, probiotics, antioxidants, and enzymes. Their porous architecture allows for the encapsulation and controlled release of these functional ingredients, improving their stability and bioavailability in food matrices. Additionally, in response to the growing demand for healthier food options, cellulose-based aerogels have been investigated as fat replacers in low-calorie food formulations. Their ability to mimic the texture and mouthfeel of lipids without compromising the sensory attributes of food products makes them an attractive alternative in fat-reduced formulations.

Despite their promising applications, the incorporation of aerogels in food systems poses challenges related to sensory modifications, rheological behavior, regulatory approvals, and large-scale production feasibility. Further research is needed to optimize their formulation, ensure food safety compliance, and develop cost-effective manufacturing processes to facilitate their commercial adoption in the food industry.

PP-F12

Impact of dehydration on the nutritional and bioactive properties of *Anisophyllea quangensis* Engl. ex Henriq.

Luísa Dovala[1,2], Maria Manuel Romeiras[1], Vitor Alves[1].and Margarida Moldão[1]

[1]*Linking Landscape, Environment, Agriculture and Food Research Center (LEAF), Associated Laboratory TERRA, Instituto Superior de Agronomia (ISA), Universidade de Lisboa, Tapada da Ajuda, 1340-017 Lisboa, Portugal;* [2]*Instituto Politécnico, Universidade 11 de Novembro, Rua das Mangueiras, Bairro 4 de Fevereiro, Cabinda, Angola*

Cabinda, a province of Angola, is characterized by diverse physiography, climate, and biology, which give rise to a wide variety of wild fruits with unique sensory qualities. These fruits play a crucial role in the local population's diet and traditional medicine.

However, many of these fruits are seasonal and have a very short shelf-life. Dehydration emerges as a simple and cost-effective preservation method, yet sun drying proves challenging due to the region's high relative humidity.

This study investigates the effect of a more controlled drying process on the nutritional and functional composition of *Annisophyllea quangensis*. The effects of air-drying conditions (55–65ºC, 24–46h) on the chemical composition (proteins, minerals, solid soluble sugars, lipids and antioxidant capacity (FRAP, DPPH, ABTS) of *Annisophyllea quangensis* fruits were studied.

The results demonstrate that *A. quangensis* fruits exhibit high antioxidant capacity and high mineral content, with calcium (Ca), magnesium (Mg), and zinc (Zn) being the most significant. Additionally, the dehydration conditions studied did not significantly affect ($p > 0.05$) most of the evaluated parameters.

Based on the obtained results, dehydration presents itself as an effective methodology to extend the shelf life of *A. quangensis* fruits.

PP-F13

Adherence to the Mediterranean diet in older adults with metabolic syndrome: PERTE_AGRO pilot study

Rosario Pastor[1,2], Ángela García-Solaesa[1], Carolina García-Barroso[1,] Paula Jiménez[3], Elena Álvarez-Olmedo[4], Marina Villanueva[4], Felicidad Ronda[4], Pedro A. Caballero[4]

[1]*Faculty of Health Sciences, Catholic University of Avila,05005 Avila, Spain;*

[2]*Research Group on Community Nutrition and Oxidative Stress, University of Balearic Islands, 07122 Palma de Mallorca, Spain;*

[3]*PhD student, doctoral school Catholic University of Avila,05005 Avila, Spain;*

[4]*PROCEREALtech group, Research Institute on Bioeconomy (BioEcoUVa) and Department of Agriculture and Forestry Engineering, University of Valladolid, Valladolid, Spain*

Nuts, a key food in the Mediterranean diet (MD), have been shown to exert beneficial effects on cardiometabolic health.

The aim of this study is to evaluate adherence to the MD in older adults with metabolic syndrome (MetS), participants in the PERTE_AGRO pilot study.

A 7-week, parallel-group randomized pilot trial of cardiovascular prevention in older adults with MetS has been designed.

Participants will be randomly assigned to one of two groups: the intervention group (IG), which will receive pistachio flour biscuits, and the control group (CG), which will consume Maria-type cookies.

The pistachio biscuits were produced following the optimization of formulation and processing conditions, through the following stages: Weighing and mixing the ingredients > Kneading > Resting > Rolling > Docking the dough and sealing (Maria biscuit design) >Baking > Cooling > Packaging. All steps were carried out in accordance with good manufacturing and handling practices.

At baseline (Visit 0), all participants' adherence to the Mediterranean diet was measured using the 14-item PREDIMED study adherence questionnaire. Subjects with a score of 9 or higher were classified as having "good adherence," while those with a score below 9 were classified as having "poor adherence."

The mean adherence in the sample under study was 10.18 ± 1.09, being slightly higher in the control group (10.27 ± 0.98) than in the intervention group (10.09 ± 1.19), with no statistically significant differences between groups ($p = 0.76$).

The two groups had similar adherence to the MD, reflecting the fact that both were homogeneous in terms of their eating habits at the beginning of the study.

Acknowledgements: *Research project Development of Functional Foods through the Integral Valorization of Natural Pistachio, funded by the 2023 PERTE Agri-Food Programme (Spanish Ministry of Industry and Tourism). We thank Pistacyl S.L for providing the raw material.*

PP-F14

Mediterranean diet and pistachio flour biscuit intervention in older adults with metabolic syndrome: a pilot study design

Rosario Pastor[1,2], Carolina García-Barroso[1], Ángela García-Solaesa[1], Paula Jiménez[3], Elena Álvarez-Olmedo[4], Marina Villanueva[4], Felicidad Ronda[4], Pedro A. Caballero[4]

[1]*Faculty of Health Sciences, Catholic University of Avila,05005 Avila, Spain;*

[2]*Research Group on Community Nutrition and Oxidative Stress, University of Balearic Islands, 07122 Palma de Mallorca, Spain;*

[3]*PhD student, doctoral school Catholic University of Avila,05005 Avila, Spain;*

[4]*PROCEREALtech group, Research Institute on Bioeconomy (BioEcoUVa) and Department of Agriculture and Forestry Engineering, University of Valladolid, Valladolid, Spain*

Nuts, a key food of the Mediterranean diet (MD), have been shown to exert beneficial effects on cardiometabolic health.

To assess the impact of a DM-based intervention, incorporating a biscuit made from partially defatted pistachio flour, on metabolic syndrome (MetS) parameters.

A 7-week, parallel-group randomized pilot trial of cardiovascular prevention in older adults with MetS has been designed.

Participants will be randomly assigned to one of two groups: the intervention group (IG), which will receive pistachio flour biscuits, and the control group (CG), which will consume Maria-type cookies.

The pistachio biscuits were produced following the optimization of formulation and processing conditions, through the following stages: Weighing and mixing the ingredients > Kneading > Resting > Rolling > Docking the dough and sealing (Maria biscuit design) >Baking > Cooling > Packaging. All steps were carried out in accordance with good manufacturing and handling practices.

Following the initial nutritional assessment (visit 0), each participant will attend weekly sessions (visits 1 to 7). At the end of the 7-week intervention, a final evaluation will be conducted (visit 8).

During each intervention session (visits 1 to 7), anthropometric and body composition measurements will be taken. Participants will also receive a personalized MD plan and the corresponding biscuits, packaged in individual daily portions. Biochemical parameters will be assessed at visits 0 and 7.

A MD-based intervention that incorporates pistachio-based foods may contribute to improvements in cardiovascular risk factors.

This study may provide practical tools for implementing longitudinal interventions in older adults, using functional foods made with heart-healthy and easy-to-chew pistachio flour.

Acknowledgements: *Research project Development of Functional Foods through the Integral Valorization of Natural Pistachio, funded by the 2023 PERTE Agri-Food Programme (Spanish Ministry of Industry and Tourism). We thank Pistacyl S.L for providing the raw material.*

PP-F15

Scavenging of methylglyoxal by Maillard reaction products: Antiglycation effects of norfuraneol and coffee melanoidins and impact on their antioxidant properties

Anna Průšová, Karel Cejpek, Zuzana Procházková
Faculty of Food and Biochemical Technology, University of Chemistry and Technology Prague, Czech Republic

This study focuses on the reaction of α-dicarbonyl compounds, particularly methylglyoxal (MGO), with methylene-active Maillard reaction products (MRPs), such as norfuraneol (NF), and coffee-derived melanoidins, with the aim of evaluating their MGO-scavenging potential and associated effects on antioxidant properties. α-Dicarbonyls formed during Maillard reaction are key intermediates in the formation of numerous advanced MRPs, which contribute to food browning, flavor, and antioxidant activity. However, their reactions/interactions with MRPs may modulate functional properties of particular MRPs.

NF-MGO reactions were studied at 95 °C under mildly acidic (pH 5.5) and neutral (pH 7.0) conditions. High-performance liquid chromatography with photodiode array detection (HPLC-PDA) was employed to monitor MGO depletion kinetics, while antioxidant capacity was assessed using HPLC with electrochemical detection (HPLC-ELD) and ABTS radical cation scavenging assays. NF demonstrated a rapid and nearly quantitative reactivity with MGO within two hours, yielding primarily (*Z,E*)-4-hydroxy-5-methyl-2-(3-oxopropan-2-ylidene)furan-3(*2H*)-one isomers, followed by formation of secondary adducts via sequential MGO addition.

Coffee melanoidins were fractionated into soluble/insoluble fractions and further fractionated by ultrafiltration into molecular weight cut-off (MWCO) ranges >30 kDa, 10–30 kDa, 3–10 kDa, 1–3 kDa, <1 kDa). The >30 kDa fraction exhibited the highest MGO-scavenging efficiency, correlating with its intense coloration. However, scavenging activity was associated with a measurable reduction in antioxidant capacity. Despite the above fact, modification of processed food with MRPs added, particularly melanoidins, could still increase the overall antioxidant capacity while mitigating the negative effects of reactive carbonyls like MGO. Nonetheless, the dual role of the MRPs in mitigating reactive carbonyl species while contributing to antioxidant potential supports their application in enhancing the quality, stability, and safety of processed foods.

PP-F16

Free asparagine concentration in wheat and rye grain depending on different agronomic approaches

Matěj Satranský[1], Petr Dvořák[1], Beverly Hradecká[2], Eva Benešová[2], Martin Král[1], Hana Pírová[2], Josef Vršťala[1], Karolína Loužecká[2], Ivana Capouchová[1], Jana Hajšlová[2]

[1]*Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague, Czech Republic;*
[2]*Faculty od Food and Biochemical Technology, University of Chemistry and Technology Prague, Czech Republic*

Free asparagine is a precursor to acrylamide, a potential carcinogen, making its concentration in cereal grains a critical factor for food safety. The concentration of free asparagine in cereal grains can vary significantly depending on the agronomic practices used in crop cultivation.

This study aimed to assess the effect of conventional and organic cultivation systems on the free asparagine concentration in grains of two wheat and two rye cultivars. Wheat and rye were cultivated under conventional conditions with nitrogen and sulfur fertilization, while in the organic system, no fertilizers were applied. Besides free asparagine determination, correlations between free asparagine concentration and key production and quality parameters were determined.

In the conventional system, the free asparagine concentration in wheat ranged from 196.17 to 305.83 mg/kg, and in rye, it ranged from 808.13 to 1029.00 mg/kg, with significant varietal differences observed. As nitrogen application increased, free asparagine concentration also increased, while sulfur application reduced it. Additionally, different timings of fertilization affect significantly free asparagine concentration. In organic cultivation, the free asparagine concentration was 272.30 mg/kg in wheat and 898.00 mg/kg in rye. Significant positive correlations were found between free asparagine concentration and grain yield (0.7946**), crude protein content (0.6716**) and Zeleny sedimentation (0.5312*) in wheat, while thousand kernel weight (TKW) showed a negative correlation (-0.5775**). In rye, positive correlations were found between free asparagine and grain yield (0.4082*), TKW (0.7771**), and crude protein (0.8973**).

Agronomic practices, particularly nitrogen and sulfur fertilization as well timing of their application, significantly influence free asparagine concentrations in wheat and rye. These findings can help optimize cultivation methods to reduce potential health risks associated with asparagine in cereal grains.

PP-F17

Malting process to improve legume pulses nutritional properties: an NMR metabolomics characterization

Mattia Spano[1,2], Alessio Cimini[3], Annamaria Giusti[4], Lorenzo Maria Donini[4] , Mauro Moresi[3], Luisa Mannina[1,2]

[1]*Department of Chemistry and Technology of Drugs, Sapienza University of Rome, Piazzale Aldo Moro 5, 00185 Rome, Italy;*

[2]*NMR-Based Metabolomics Laboratory (NMLab), Sapienza University of Rome, Piazzale Aldo Moro 5, 00185 Rome, Italy;*

[3]*Department for Innovation in the Biological, Agrofood and Forestry Systems, University of Tuscia, Viterbo, Italy;*

[4]*Department of Experimental Medicine, Sapienza University of Rome, P.le Aldo Moro 5, 00185 Rome, Italy*

Legume pulses are one of the world's most important sources of nutrients. However, their consumption presents several disadvantages, namely long boiling times, resistance to mechanical damage, and high levels of anti-nutritional factors. To avoid these problems, food industry is trying to apply several technological approaches to improve legume nutritional properties. Among them, malting process is one of the most recent and promising.

In the present work, malting process was developed and applied on legume pulses produced in Lazio region. The effects of the applied approach were observed by both NMR-based untargeted and targeted approaches.

1D and 2D NMR experiments were applied to define the metabolomic profile of both hydroalcoholic and organic fractions of legume pulses, using an untargeted approach. Moreover, ^{31}P NMR spectroscopy was used to specifically identify and quantify phytic acid.

Several metabolites belonging to different chemical classes were identified in both hydroalcoholic and organic Bligh-Dyer extracts, showing significative concentration changes related to malting process. In particular, free amino acids content increased together with some organic acids, whereas antinutritional factors namely raffinose-family oligosaccharides and phytic acid decreased.

The observed metabolite changes obtained with the developed malting process confirmed the efficiency of this approach to improve their nutritional properties.

Acknowledgements: *Gruppo Italiano Discussione Risonanze Magnetiche (GIDRM) Society is thanked for having financed the participation to the congress with the "Stefano Caldarelli" scholarship.*

PP-F18

Rapid contamination assessment through GC-IMS for probiotic production in a lab-scale environment

Marta Lo Re[1], Chiara Carini[2], Margherita Stampini[2], Tamara Attard[2], Patrizia Malfa[1], Marco Arlorio[2] and Vincenzo Disca[2]

[1]*SynBalance Srl, Origgio, 21040, Italy;*

[2]*Dipartimento di Scienze del Farmaco, Università del Piemonte Orientale, Novara, 28100, Italy*

Contamination control remains a critical concern in fermentation and probiotic production, particularly in lab-scale environments where minor microbial intrusions can significantly compromise strain stability, metabolic output, and overall culture integrity. Conventional detection methods—such as plating, microscopy, and molecular assays—often lack the speed and sensitivity necessary for early-stage contamination assessment. In this study, we evaluated Gas Chromatography–Ion Mobility Spectrometry (GC-IMS) as a rapid, non-invasive technique for detecting microbial contamination during the production of probiotic *Lactobacillus* spp. under standard laboratory conditions.

Fermentations were conducted in a bench-top bioreactor (IKA Habitat 1 L) without the intentional introduction of contaminants; however, unexpected contamination events occurred naturally during routine operations. GC-IMS was employed to monitor volatile organic compound (VOC) profiles across multiple time points. Notably, acetoin—a key microbial metabolite—was detected in contaminated samples, serving as an early and reliable marker of microbial interference before any visible signs or standard microbiological methods could confirm contamination.

The method demonstrated superior sensitivity and specificity in detecting early-stage metabolic deviations, outperforming conventional methods that require longer evaluation times. Indeed. our results show that GC-IMS enables rapid, real-time assessment of contamination risk in probiotic production processes, with the added advantage of early detection through volatile markers such as acetoin. This approach enhances quality control and process reliability, making it a valuable tool for research and development environments where maintaining culture integrity is essential. The ability to detect contamination at the earliest stages offers a proactive strategy to safeguard microbial production workflows and reduce potential losses.

Acknowledgment: *This study was conducted within the NUTRI.AGE project funded by NODES under the PNRR program*

PP-F19

Authentication of Argentinean NFC citrus juices using nuclear and complementary techniques

Daniel Wunderlin, María Verónica Baroni, Romina Di Paola, Pablo Yunes, Gabriel Lutti

ICYTAC, Institute for Food Science and Technology Córdoba, CONICET-Universidad Nacional de Córdoba, Córdoba, Argentina

The authentication of high-value food products is essential to prevent fraud and ensure consumer confidence. This study aimed to develop and validate nuclear and complementary analytical techniques to verify the authenticity of Argentine NFC (not from concentrate) orange juice, distinguishing it from adulterated juices and those prepared from concentrates (FC).

A combination of Isotope Ratio Mass Spectrometry (IRMS); HPLC-RI and HPLC-UV/Vis were employed to detect adulterants such as high fructose corn syrup (HFCS), sucrose, and tangerine juice. $\Delta^{13}C$ analysis of washed pulp and soluble sugar fractions effectively identified HFCS adulteration at levels above 20%, while $\delta^{2}H$ and $\delta^{18}O$ isotopic measurements differentiated NFC from FC juices by detecting added water. HPLC-RI sugar profiling revealed HFCS adulteration at 10% levels, while HPLC-UV/Vis analysis of organic acids suggested potential markers for tangerine juice addition. While $\delta^{13}C$ and sugar profiling proved effective in detecting HFCS adulteration, they were unable to identify the presence of tangerine juice. On the other hand, the organic acids profile was useful to differentiate juices adulterated with tangerine, particularly using citric-to-malic acid ratios.

Multivariate statistical analyses confirmed the effectiveness of the developed methods, grouping NFC and FC juices separately from those adulterated with HFCS. However, tangerine-adulterated samples clustered with pure orange juices, indicating the need for additional markers. The combined use of isotopic and chromatographic approaches successfully identified adulterations in commercial samples, demonstrating the robustness of the methodology.

These findings contribute to the implementation of reliable authentication techniques for citrus juices, supporting food integrity and regulatory enforcement. Further research is needed to enhance the detection of tangerine adulteration and improve differentiation between authentic and modified products. The integration of additional markers, such as volatile organic compounds and advanced statistical modelling, could further improve the ability to detect fraudulent practices in the citrus juice industry.

PP-F20

The effect of controlled viral infection on the antioxidant potential of basil leaves

Urszula Złotek[1], Urszula Gawlik[1], Anna Złotek[1], Marta Budziszewska[2], Patryk Frąckowiak[2], Aleksandra Obrępalska-Stęplowska[2]
[1]Department of Biochemistry and Food Chemistry, University of Life Science in Lublin, Lublin, Poland; [2]Department of Molecular Biology and Biotechnology, Institute of Plant Protection – National Research Institute, Poznań, Poland

The study aimed to determine the effect of a controlled viral infection on the antioxidant potential of basil leaves. Sweet basil plants (*Ocimum basilicum* L.) grown in controlled conditions were treated with cucumber mosaic virus (CMV, *Cucumovirus*). Part of the basil plants were also treated with resistance inducers (RI): benzothiadiazole (BTH) and chitosan (CHIT). RI-untreated and uninfected plants served as negative controls, additionally, some plants were only treated with Ris. Samples were collected and freeze-dried after 3, 7, 10, and 14 days post-infection (dpi). The infection of plants with CMV was confirmed with RT-PCR on total RNA isolated from analysed plants. The content of phenolic compounds and antioxidant activities (antiradical properties against ABTS, reducing power (RP), $OH^{\bullet}$ scavenging ability (OH), the superoxide anion scavenging activity (O_2^-) and chelating power (CHP) were determined in extracts made from the dried leaves of the studied basil.
The phenolic compounds (TPC) content was the highest in samples collected 14 dpi, subjected to viral infection and treated with BTH and CHIT. Also, in the case of samples collected at 3 and 7 dpi, BTH and CHIT treatment caused increased TPC content. In the case of antiradical activity (against ABTS) and RP, samples treated with BTH and CHIT and viral infection supported by the tested RI, increased these activities. In some cases, superoxide anion scavenging was also higher compared to the control: samples treated with BTH and CHIT, as well as CMV infection supported with BTH (3 dpi), BTH and CMV infection supported with CHIT at 14 dpi.
In summary, controlled CMV infection has a positive effect on the antioxidant potential of basil leaves, and this effect is significantly enhanced by the use of plant immunity inducers.

Acknowledgment: *This research was funded by NCN grant number 2021/43/B/NZ9/00970*

PP-F21

Sweet chestnut (*Castanea sativa* Mill.) catkins and leaves extracts: assessment of phenolic content and antibacterial activity against human pathogenic bacteria

Jelena V. Živković[1], Slavica Sunarić[1], Nemanja Stanković[2], Tatjana Mihajilov-Krstev[3], Zoran Zeković[4]
[1]*Department of Pharmacy, Faculty of Medicine, University of Niš, Niš, Serbia;*
[2]*Institute of Public Health, Niš, Serbia;*
[3]*Department of Biology and Ecology, Faculty of Science and Mathematics, University of Niš, Niš, Serbia;*
[4]*Faculty of Technology, University of Novi Sad, Novi Sad, Serbia*

The sweet chestnut (*Castanea sativa* Mill.) provides various by-products, including burs, leaves, and catkins, which are valuable sources of phytochemicals. The primary objective of this study was to evaluate the antimicrobial activity of extracts from chestnut catkins and leaves.
Catkins and leaves from traditional sweet chestnut and the Italian Marrone cultivar were collected in the Una-Sana Canton, Federation of Bosnia and Herzegovina. After being dried at room temperature, the samples were milled. The plant material was then extracted using 50% acetone as the solvent, with ultrasound treatment applied, followed by evaporation under vacuum at 40 °C. The antimicrobial activity of the extracts was studied against nine bacterial strains isolated from human samples using a microwell dilution assay.
The highest extraction yield of 33.56±0.17% (w/w) was obtained from the catkins of Italian Marrone. The total phenolic content varied from 327.10±2.16 mg to 454.10±0.92 mg of gallic acid equivalents (GAE)/ g of dry extract in the leaves of the Italian Marrone and catkins of traditional chestnut, respectively. The extracts demonstrated significant activity against all tested bacterial strains, with minimal inhibitory concentrations (MIC) ranging from 0.39–3.13 mg/mL and minimal bactericidal concentrations (MBC) ranging from 0.78–12.5 mg/mL. The highest antimicrobial activity was determined in the extract of catkins from traditional chestnut, which was effective against the tested strains at a concentration of MIC/MBC = 0.39–3.13 mg/mL/0.78–6.25 mg/mL. This extract was particularly potent against *Staphylococcus aureus* from wound of the skin, *Staphylococcus aureus* from throat swabs, and *Acinetobacter* sp. From blood (MIC/MBC = 0.39 mg/mL/0.78 mg/mL).
Overall, the leaves and especially the catkins of *Castanea sativa* Mill. Are a promising new source of compounds with significant antimicrobial activity.

***Acknowledgements**: The financial support for this study from the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia (Grant number 451-03-137/2025-03/200113) is gratefully acknowledged.*

PP-F22

Sweet chestnut (*Castanea sativa* Mill.) spiny burs and bark extracts: assessment of phenolic content and antibacterial activity against human pathogenic bacteria

Jelena V. Živković[1], Slavica Sunarić[1], Nemanja Stanković[2], Tatjana Mihajilov-Krstev[3], Zoran Zeković[4]
[1]*Department of Pharmacy, Faculty of Medicine, University of Niš, Niš, Serbia;*
[2]*Institute of Public Health, Niš, Serbia;*
[3]*Department of Biology and Ecology, Faculty of Science and Mathematics, University of Niš, Niš, Serbia;*
[4]*Faculty of Technology, University of Novi Sad, Novi Sad, Serbia*

This study evaluates the antimicrobial activity and total phenolic content (TPC) of extracts obtained from chestnut by-products. The spiny burs and inner and outer bark of trees were extracted using 50% acetone as the solvent, with a sample-to-solvent ratio of 1:10 (w/v) and subjected to ultrasound extraction for 30 minutes. The extracts were filtered and dried by evaporation under vacuum at 40 °C. The antimicrobial potential of the extracts was tested against nine common human pathogenic bacterial strains, including *Staphylococcus aureus* (from three isolates: a skin wound, throat swab, and eye swab), *Proteus mirabilis* (from a skin wound), *Klebsiella* sp. (from sputum), *Escherichia coli* (from aspirate), *Pseudomonas aeruginosa* (from sputum), *Acinetobacter* sp. (from blood), and *Acinetobacter baumannii* (from aspirate). The microwell dilution test was used for this examination, with DMSO as solvent and chloramphenicol as control.

The yield of dry extract ranged between (7.75±0.08)% (w/w) for spiny burs and (12.48±0.08)% (w/w) for inner bark. TPC of the inner bark, outer bark, and spiny burs was (483.70±2.82), (440.20±0.96) and (150.50±0.44) mg gallic acid equivalents (GAE)/g dry extract, respectively. The extracts showed antimicrobial activity against all the tested bacteria, with minimal inhibitory concentrations (MIC) ranging from 0.39-6.25 mg/mL and minimal bactericidal concentrations (MBC) ranging from 0.78-50 mg/mL. The most active were inner and outer bark extracts against *Acinetobacter* sp. (MIC/MBC = 0.39/0.78 mg/mL). Overall, the inner bark extract proved to be the most effective against all tested strains (MIC/MBC = 0.39-6.25 mg/mL/0.78-12.5 mg/mL) and has the highest TPC.

These findings highlight the potential of extracts from chestnut by-products, produced with 50% acetone, as valuable sources of dietary polyphenols with antimicrobial properties.

Acknowledgements*: The financial support for this study from the Ministry of Science, Technological Development, and Innovation of the Republic of Serbia (Grant number 451-03-137/2025-03/200113) is gratefully acknowledged.*

PP-F23

Impact of bioactive agent encapsulation on chlorophyll a, chlorophyll b, and total carotenoid content in carrots

Lana Živković[1], Marko Vinceković[1], and Adrijana Novak[2]

[1]*Department of Chemistry, University of Zagreb Faculty of Agriculture, Svetošimunska cesta 25, 10000 Zagreb, Croatia;*

[2]*Laboratory for mycology, Institute for plant protection, Croatian Agency for Agriculture and Food, Gorice 68b, 10000 Zagreb, Croatia*

Encapsulation shows great potential as a sustainable and environmentally friendly technique for boosting carrots' nutritional content and growth. It delivers essential nutrients, beneficial microorganisms, and bioactive compounds in a controlled manner. Encapsulation of bioactive agents was used to improve the nutritive value of carrots by increasing the production of secondary plant metabolites (SPM) – chlorophyll a, chlorophyll b, and carotenoids. This study used calcium ions, humic acid, and *Trichoderma harzianum U-22* spores as encapsulated agents. Calcium ions are essential to various physiological processes in plants, including growth, development, and the biosynthesis of secondary metabolites. Likewise, humic acid contributes to plant development by improving nutrient uptake efficiency and serving as a nutrient source for beneficial soil microorganisms. *Trichoderma* species further support plant health by promoting root development, enhancing nutrient assimilation, and functioning as a biological control agent through the antagonism of pathogenic fungi responsible for plant diseases. The highest increase in all analyzed secondary plant metabolites was obtained by microcapsules with humic acid – chlorophyll a up to 31%, chlorophyll b up to 23%, and total carotenoid content up to 29%. These results showed that encapsulation is a promising method for producing carrots with improved nutritional quality.

PP-F24

Japanese knotweed – threat or opportunity?

Eugen Kiss, Stanislav Baxa, Pavol Tóth, Elena Panghyová
National Agricultural and Food Centre, Food Research Institute, Modra, Slovakia

There is a new challenge for the agri-food industry the supply of raw materials for energy use. In view of the decreasing area of cultivated land and the increasing demands on the quantity of primary production under pressure of ecological requirements, one of the few ways to ensure this requirement is to find untapped resources.
In our work, we focused on evaluating the potential of Japanese wingwort, also known as Japanese knotweed (*Fallopia japonica, Reyonoutria*), which, despite its listing as an invasive plant, can contribute to solving the current requirements with lack of sources.
The primary objective of our work was to test the possibility of using Japanese knotweed as an alternative source of biologically active substances from the stilbene (trans- resveratrol and piceid) and anthraquinone (emodin) groups.
In our experiments, we focused on the optimization of stilbene extraction, where ethanol at a concentration of 55-70% v/v was determined as the optimal solvent for extraction from the dried root of wingwort and the concentration of total stilbenes obtained was in the range of 1.8-2.0 g/g dry weight at a piceid: resveratrol ratio of 4:1.
The second factor in favour of the Japanese knotweed is the fact that it flowers in August-September, which makes it interesting for bee keepers as a natural source of nutrients for bee colonies.
A third factor in favour of the use of Japanese knotwood is the fact that Japanese knotwood is able to sorb heavy metals from the soil and can be an important source of biomass due to the rate of biomass production. Data are available that show that 30 tonnes of dry matter can be extracted from one hectare, which represents approximately 600 GJ of usable energy when burnt. As a solid fuel, it is prepared in the form of briquettes, but it can also be used as an insulating material.
The following findings emerge from our work and the literature review:
- Japanese knotweed can be an efficient source of piceid as a stable precursor of resveratrol in particular,
- Japanese knotweed can serve for culinary purposes and as a honey-bearing plant,
- Japanese knotweed can be an important source of biomass.

In conclusion, Japanese knotweed has significant potential to become an important crop with multiple uses.

Acknowledgements: *This work has been supported by the Recovery and Resilience Plan, Component 19 for the project: Development and promotion of sustainable biomethane, organic fertilizer and circular bioeconomy production 19R01-18-P01-00001, co-financed by the European Regional Development Fund.*

PP-F25

Food, energy and phytoproducts compete for agricultural biomass

Pavol Tóth, Stanislav Baxa, Lucia Baľák Lukáňová, Marek Kunštek
National Agricultural and Food Centre, Food Research Institute, Modra, Slovakia

The Repower project focuses on collecting and updating data on the type, quality, quantity and spatial location of food production, as well as energy crops and crops from which phytoproducts are sourced from agricultural land. It also aims to update data regarding the type, quality, quantity, and spatial location of biowaste produced by waste processors and the network of biogas/biomethane stations ("BPS/BMS") and other biomass processors.

Currently, 111 biogas power generating stations with a total capacity of 103 MW and a planned annual production of 810,526 MWh of electricity are connected to the electricity grid in Slovakia. These stations are planned to be converted into biomethane stations in the near future.

The objective of the project is to utilize this data for improved decision-making regarding the comprehensive recovery of nutrients from biowaste through the creation of a detailed map displaying the production potential for biogas and biomethane. The project will also support other methods of biowaste recovery by developing a catalogue of technologies and technical procedures for converting biowaste and green waste into organic fertilizers. Additionally, it will include a catalogue of measures, solutions, and practical examples that facilitate the return of nutrients to the soil in the form of biomass and organic fertilizers, thus enhancing soil biology. Furthermore, the project involves testing the effects of applying digestates and organic fertilizers on soil.

Our objective is to conduct an analysis and develop a comprehensive catalogue of "BPS/BMS" technologies. This catalogue will offer supporting documentation for designers, cost calculations, overview of suppliers on the market, benchmark costs for "BPS/BMS" construction, process procedures, testing of "BPS/BMS" inputs and outputs – standards.

***Acknowledgements**: This work was made possible thanks to the support of the Recovery and Resilience Plan programme, component 19 for the project: Development and support of sustainable biomethane production, organic fertilizers and circular bioeconomy 19R01-18-P01-00001, co-financed by the European Regional Development Fund.*

PP-F26

3D printing of protein-based ink: Multivariate analysis of printing conditions on physicochemical properties

Yeison Barrios-Rodríguez[1], Marta Igual[1], Javier Martínez-Monzó[1], Purificación García-Segovia[1]
[1]*i-Food, Instituto Universitario de Ingeniería de Alimentos-FoodUPV, Universitat Politècnica de València*

Food 3D printing faces challenges in formulating and evaluating inks for continuous, controlled, and reproducible extrusion. Parameters like printing speed and nozzle diameter influence material behavior, affecting system pressure and the ink's structural and rheological properties.
This study conducts a multivariate evaluation of the effects of printing parameters on the rheological and structural properties of a rice protein-based ink.
A randomized block design was employed, incorporating printing speed (20, 35, 50 mm/s) and nozzle diameter (0.85, 1.2, 1.55 mm) as variables, with each condition replicated three times. For each combination of these factor levels, the pressure curves of the printing system, rheological parameter curves (G', G", and η*), and the spectral characteristics of the protein ink were assessed. These data were subjected to multivariate analysis, including principal component analysis (PCA) and heat map visualization.
Utilizing PCA and heat maps, the influence of printing parameters on system pressure was discerned. It was observed that under low-intermediate printing conditions ([50 mm/s and 0.85 mm], [35 mm/s and 0.85 mm], [20 mm/s and 1.2 mm]), there is a diminished impact on pressure. Furthermore, the printing process alters the rheological properties, sometimes increasing or decreasing stiffness. These parameters also affect the structural network of food inks, as identified by FTIR, particularly in the amine functional group regions (1500–1700 cm^{-1}). The conditions that exhibited a lesser effect on pressure also demonstrated minimal structural alteration.
The relationship between pressure behavior and the changes observed in rheology and FTIR is only partial. As revealed by FTIR, the molecular structure was strongly influenced by the printing conditions, which is also reflected in the pressure variations. In contrast, rheological properties exhibit greater internal variability, with similar pressure profiles sometimes corresponding to different rheological responses, suggesting the involvement of additional underlying factors.

PP-F27

Antibacterial activity of honeys from Slovakia

Jana Minarovičová, Kristína Kukurová, Zuzana Ciesarová
National Agricultural and Food Centre, Food Research Institute, Priemyselná 4, 824 75 Bratislava, Slovakia

Honey has been not only considered a food or a sweetener but widely used for its various health benefits since ancient times. Antibacterial activity is a characteristic of the biological value of honeys. The antibacterial activity of honey was assessed against a clinic isolate of *Staphylococcus aureus* (NCTC 10654, enterotoxin B producer) and two food isolates of *Listeria monocytogenes* (persistent and non-persistent strains). The antibacterial efficacy of 62 various honey samples (29 honeydew honeys, 29 multi-floral and 4 mono-floral honeys) was evaluated by the minimum inhibitory concentration (MIC) assay. The MIC was defined as the lowest concentration of honey inhibiting 99 % bacterial growth. Serial dilutions of each honey sample were prepared from a 50 % (w/ v) honey solution, resulting in final concentrations of 45, 40, 35, 30, 25, 20, 18, 16, 14, 12, 10, 8, 6, 4 a 2 %. A lower MIC value represents a higher antibacterial effect of honey. The honey samples showed antimicrobial activities against *Staphylococcus aureus* and *Listeria monocytogenes* using the microtiter broth dilution method. Higher antibacterial effect of honey was shown for *Staph. aureus* than *L. monocytogenes* strains. Excellent MIC against *Staph. aureus* of less than 8 % was found in 25 samples, 80 % of which were honeydew honeys. Up to 23 honey samples showed a relatively high level of MIC against *L. monocytogenes* lower than 16 %. No significant differences in MIC of honey against *L. monocytogenes* were observed between persistent and non-persistent strain. Honeydew honeys usually present a higher content of bioactive compounds (phenolics, proteins, and amino acids) compared to floral honeys. Due to the antibacterial and antioxidant activity of honeydew honey, this type of honey could be considered a health promoting food.

Acknowledgements: *Presented work was supported by the Slovak Research and Development Agency under the contract No. SK-AT-20-0022*

LIST OF PRESENTING AUTHORS

SURNAME	FIRST NAME	E-MAIL ADDRESS
Abbas	Sana	sana.abbas@ktu.edu
Adamo	Paola	paola.adamo@unina.it
Afzal	Adeel	adeel.chem@pu.edu.pk
Aksoy Dirim	Merve	merveaksoy15@hacettepe.edu.tr
Aktas	Ayse Burcu	burcuaktas@cumhuriyet.edu.tr
Albernaz Teixeira Fonseca Lobo	Francine	francine.lobo@unirio.br
Albuquerque	Bianca	bianca.albuquerque@ipb.pt
Alimzhanova	Mereke	alimzhanova.mereke@gmail.com
Almeida	Cláudio	claudio@eq.uc.pt
Alves	Vitor	vitoralves@isa.ulisboa.pt
Amaral	Joana	jamaral@ipb.pt
Añibarro-Ortega	Mikel	mikel@ipb.pt
Antunes	Madalena	madalena.f.antunes@ipleiria.pt
Apak	Reşat	rapak@istanbul.edu.tr
Aparicio Muriana	Maria	m.apariciomuriana@qub.ac.uk
Araújo-Rodrigues	Helena	hrodrigues@ucp.pt
Arlorio	Marco	marco.arlorio@uniupo.it
Arserim-Uçar	Dılhun Keriman	ducar@bingol.edu.tr
Ashraf	Jawad	jawadashraf1@outlook.com
Ataç Mogol	Burçe	burcea@hacettepe.edu.tr
Balagiannis	Dimitris	d.balagiannis@reading.ac.uk
Barrios Rodriguez	Yeison	yfbarrod@upv.es
Başman	Arzu	basman@hacettepe.edu.tr
Bayram	Sinan	sbayram@bayburt.edu.tr
Beck	Eva	eva.m.beck@fau.de
Beglaryan	Meline	meline.beglaryan@cens.am
Belović	Miona	miona.belovic@fins.uns.ac.rs
Beneventi	Elisa	elisa.beneventi@efsa.europa.eu
Bensa	Maja	maja.bensa@zf.uni-lj.si
Berk Aydın	Ecem	eccemberk55@gmail.com
Bilgin	Hakki	hakki.bilgin@ktu.lt
Blanch	Gracia Patricia	gblanch@ictan.csic.es
Block	Jane Mara	janeblock@gmail.com
Bork	Leon	l.bork@tu-berlin.de
Bošnjak	Dora	dbosnjak@agr.hr
Brežná	Barbara	barbara.brezna@nppc.sk

Brunner	Ján	jan.brunner@stuba.sk
Cacciola	Francesco	cacciolaf@unime.it
Çakmak	Selin	selincakmak@hacettepe.edu.tr
Çalişkan Koç	Gülşah	gulsahcaliskan86@gmail.com
Carini	Chiara	chiara.carini@uniupo.it
Carpena	María	mcarpena@uvigo.es
Carrasco-Pancorbo	Alegría	alegriac@ugr.es
Çebİ	Ayşegül	aysegul.cebi@giresun.edu.tr
Čech	Matej	matej.cech@uniag.sk
Cejpek	Karel	cejpekk@vscht.cz
Celebi	Yasemin	yasemincelebisezer@gmail.com
Çelik	Ecem Evrim	ecemevrim@gmail.com
Çelİk	Saliha Esin	secelik@iuc.edu.tr
Chirkova	Viktoriia	victory.chirk@gmail.com
Choi	Siweon	choissui@korea.kr
Cirkovic Velickovic	Tanja	tanja.cirkovic16@gmail.com
Coelho	Elisabete	ecoelho@ua.pt
Colombo	Raffaella	raffaella.colombo@unipv.it
Cosme	Fernanda	fcosme@utad.pt
Costa	Elisa	ecmatos@gmail.com
Cruz	Luis	luis.cruz@fc.up.pt
Cunha	Sara A.	saracunhasc@gmail.com
Dalal	Nidhi	nidhi.dalal@unina.it
Delević	Mitar	delevic.mitar@gmail.com
Dias	Maria Inês	maria.ines@ipb.pt
Djahandideh	Jasmin	djahandideh@foh.uni-hannover.de
Doménech	Tania	tdomval@doctor.upv.es
Dugo	Laura	l.dugo@unicampus.it
Durec	Ján	durec@mccarter.sk
Ecem Bayram	Nesrin	ecem.nesrin@gmail.com
Elbir Abca	Tuğba	telbir05@hotmail.com
Erdem	Naz	nazerdem@hacettepe.edu.tr
Fernandes	Ana	ana.fernandes@fc.up.pt
Fernandes	Beatriz	beatriz.c.fernandes@tecnico.ulisboa.pt
Ferreira	Bernardo	bacferreira@ua.pt
Ferreira	Isabel	isabel.ferreira@ff.up.pt
Ferreira-Dias	Suzana	suzanafdias@mail.telepac.pt
Figueroa Pires	Arona	arona@esac.pt
Fiori	Jule	jule.fiori@fau.de
Freitas	Lais	laisfreitas@ipb.pt
Freitas	Victor	vfreitas@fc.up.pt

Gabel	Anna	anna_katharina.gabel@tu-dresden.de
Gabiger	Anastasia	anastasia.gabiger@fau.de
Gabriunaite	Inga	inga.gabriunaite@chf.vu.lt
Gashi	Albert	albertgashi27@gmail.com
Gonçalves de Oliveira	Tatiane Cristina	tatiane.oliveira@ipb.pt
Göncüoğlu Taş	Neslihan	neslihangoncuoglu@hacettepe.edu.tr
Grebenteuch	Sandra	sandra.grebenteuch@ilu-ev.de
Grünwald	Mona	gruenwald@foh.uni-hannover.de
Gude	Thomas	tgu@thomasgude-gmbh.ch
Güleryüz	Didem	dguleryuz@bayburt.edu.tr
Halford	Nigel	nigel.halford@rothamsted.ac.uk
Hamzalioglu	Aytul	aytulhamzalioglu@hacettepe.edu.tr
Hecht	Elise	hecht@tugraz.at
Hellwig	Michael	michael.hellwig@tu-dresden.de
Holkovičová	Tatiana	tatiana.holkovicova@stuba.sk
Hruška	Ondrej	ondrej.hruska@stuba.sk
Imamou Hassani	Mouandhe	mouandhe.imamou@ktu.edu
Inoue	Ippei	ippei_inoue@suntory.co.jp
Jain	Prachi	prachi_j@pt.iitr.ac.in
Janković	Mina	mina.jankovic@mf.uns.ac.rs
Jasińska	Karina	karina_jasinska@sggw.edu.pl
Juśkiewicz	Jerzy	j.juskiewicz@pan.olsztyn.pl
Kanzler	Clemens	clemens.kanzler@tu-berlin.de
Karoui	Romdhane	romdhane.karoui@univ-artois.fr
Kince	Tatjana	tatjana.kince@lbtu.lv
Kiss	Eugen	eugen.kiss@nppc.sk
Kitrytė-Syrpa	Vaida	vaida.kitryte@ktu.lt
Klempová	Tatiana	tatiana.klempova@stuba.sk
Kocadağlı	Tolgahan	tolgahan@hacettepe.edu.tr
Koch	Elisabeth	elisabeth.koch@bfr.bund.de
Kolarič	Lukáš	lukas.kolaric@stuba.sk
Kopjar	Mirela	mirela.kopjar@ptfos.hr
Kopsacheili	Maria	mkopsa@chem.auth.gr
Kopuncová	Mária	maria.kopuncova@nppc.sk
Kouřimská	Lenka	kourimska@af.czu.cz
Kovacevic	Jelica	jelica.kovacevic@uibk.ac.at
Kreps	František	frantisek.kreps@stuba.sk
Kruma	Zanda	zanda.kruma@lbtu.lv
Kukurová	Kristína	kristina.kukurova@nppc.sk
Kutlu	Naciye	naciyekutlu@bayburt.edu.tr
Laçin	Meltem	meltemlacin@hacettepe.edu.tr

Laronha	Helena	h.laronha@ua.pt
Lindekamp	Niklas	niklas.lindekamp@bfr.bund.de
Lörinc	Dávid	david.lorinc@stuba.sk
Loužecká	Karolína	louzeckk@vscht.cz
Maia	Maria Luz	mlmaia@ucp.pt
Maliar	Tibor	tibor.maliar@ucm.sk
Marx	Ítala	itala.gouveia.marx@uco.es
Masnicová	Kristína	kristina.masnicova@stuba.sk
Mayo	Chloe	chloe.mayo@brunel.ac.uk
Mayser	Jan Peter	mayser.j@shimadzu.eu
Melgar Castañeda	Bruno	bruno.melgarc@ipb.pt
Mesias	Marta	mmesias@ictan.csic.es
Miserez	Bram	bram.miserez@ciboris.org
Mittau	Keven	keven.mittau@tu-berlin.de
Mocanu	Andreea - Lavinia	andreea.mocanu1@yahoo.com
Moldão	Margarida	mmoldao@isa.ulisboa.pt
Nguyenová	Chi Mai	nguyenox@vscht.cz
Nhu-Trang	Tran-Thi	nhutrang.tran@toulouse-inp.fr
Nunes da Silva	Raquel	raq.silva@fc.up.pt
Oliveira	Hélder	helder.oliveira@fc.up.pt
Oliveira	Joana	jsoliveira@fc.up.pt
Olmo-García	Lucía	luciaolmo@ugr.es
Ombugadu	Jesse	01167684@pw.edu.pl
Owsienko	Diana	diana.owsienko@ri.se
Ozalp Unal	Derya	derya.ozalpunal@tarimorman.gov.tr
Papetti	Adele	adele.papetti@unipv.it
Paraskevopoulou	Adamantini	adparask@chem.auth.gr
Parker	Jane K	j.k.parker@reading.ac.uk
Pasqualone	Antonella	antonella.pasqualone@uniba.it
Passos	Cláudia P.	cpassos@ua.pt
Pastor	Rosario	rosario.pastor@ucavila.es
Pedreschi	Franco	fpedreschi@uc.cl
Pereira	Carla	carlap@ipb.pt
Pestana	José	jose.assuncao@eshte.pt
Průšová	Anna	prusovaa@vscht.cz
Púčiková	Vanda	pucikova@igzev.de
Radványi	Dalma	gerene.radvanyi.dalma@uni-bge.hu
Ratautaite	Vilma	vilma.ratautaite@ftmc.lt
Renard	Maylis	mrenard@ucm.es
Rueger	Tatjana	t.rueger@tu-berlin.de
Saldanha	Ana	ana.saldanha@ipb.pt

Sankowski	Larissa Vivienne	sankowski@tu-berlin.de
Sarić	Beka	bsaric@mrizp.rs
Satransky	Matej	satransky@af.czu.cz
Scholten	Kai	k.scholten@tu-berlin.de
Secco	Federica	federica.secco@agroparistech.fr
Seixas	Natália L.	natalia.seixas@ipb.pt
Selenius	Otto	ovosel@utu.fi
Serrano	Carmo	carmo.serrano@iniav.pt
Siegmund	Barbara	barbara.siegmund@tugraz.at
Silva	Andreia	andreia.silva@colab4food.com
Silva	Aurora	mass@isep.ipp.pt
Silva	Lisete M.	lisete.silva@fc.up.pt
Šimko	Peter	qsimko@stuba.sk
Siopa	João	jsiopa@outlook.com
Skef	Lara	lara.skef@tugraz.at
Šola	Ivana	ivana.sola@biol.pmf.hr
Sousa	Gabriela	gabriela.spsousa@gmail.com
Spanic	Valentina	valentina.spanic@poljinos.hr
Spano	Mattia	mattia.spano@uniroma1.it
Spooner	Heather	h.g.spooner@pgr.reading.ac.uk
Stampini	Margherita	margherita.stampini@uniupo.it
Starowicz	Małgorzata	m.starowicz@pan.olsztyn.pl
Süfer	Özge	ozgesufer@hotmail.com.tr
Surma	Magdalena	magdalena.surma@urk.edu.pl
Surówka	Krzysztof	rtsurowk@cyf-kr.edu.pl
Švecová	Terézia	xsvecova@uniag.sk
Syrpas	Michail	michail.syrpas@ktu.lt
Teixeira	Natércia	natercia.teixeira@fc.up.pt
Tejedor Calvo	Eva	etejedor@unizar.es
Tobolková	Blanka	blanka.tobolkova@nppc.sk
Todasca	Cristina	cristina.todasca@upb.ro
Tóth	Pavol	pavol.toth@nppc.sk
Tsiaparas	Saskia	tsiaparas@uni-bonn.de
Undeland	Ingrid	undeland@chalmers.se
Užupis	Marius	marius.uzupis@ktu.edu
Várady	Matúš	matus.varady@uvlf.sk
Venskutonis	Petras Rimantas	rimas.venskutonis@ktu.lt
Vergères	Guy	guy.vergeres@agroscope.admin.ch
Vicente	Ainhoa	ainhoa.vicente@uva.es
Vicente-Jurado	Diana	diaviju@upv.es
Villanueva	Marina	marina.villanueva@uva.es

Vipotnik	Ziva	ziva.vipotnik@ki.si
Vougioukas	Patroklos	patroklos.vougioukas@tu-dresden.de
Vovk	Irena	irena.vovk@ki.si
Vukadinović	Jelena	jmesarovic@mrizp.rs
Walczak	Marlene	marlene.walczak@tu-dresden.de
Wierzchowska	Katarzyna	katarzyna_wierzchowska@sggw.edu.pl
Wunderlin	Daniel	daniel.wunderlin@unc.edu.ar
Yiltirak	Suleyman	s.yiltirak@pgr.reading.ac.uk
Zeiler	Sophie	sophie.zeiler@tu-dresden.de
Živković	Jelena	jelena.zivkovic.hemija@medfak.ni.ac.rs
Živković	Lana	lzivkovic@agr.hr
Złotek	Urszula	urszula.zlotek@up.lublin.pl
Zonfrillo	Beatrice	beatrice.zonfrillo@unifi.it

ISBN 978-80-89162-96-3
EAN 9788089162963