Book of abstracts

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CONFERENCE PROGRAMME

Monday, 9 June 2025 – Day 1

08:00-09:00	**Registration for the Anniversary and the BACIF 2025 Conference**
09:00-12:00	**Anniversary celebration of the Faculty of Biotechnology and Food Sciences**
11:00-13:00	**Registration for the BACIF 2025 Conference**
12:00-13:00	**Lunch**
13:00-13:15	**Start of the Conference**
Session I Room S-7	**Chair: Edyta Gendaszewska-Darmach, Krzysztof Kołodziejczyk**
Plenary lectures	
13:15-13:40	**Catherine M.G.C. Renard –** Some mechanisms to understands why lycopene bioaccessability increases with processing
13:40-14:05	**Christiane Kruse Faeste -** Biocontrols – sourcing from nature for controlling pest and disease
14:05-14:20	**Coffee Break**
Session II A Room S-7	**Bioactive compounds in plant raw materials** **Chair: Christiane Kruse Faeste, Maria Koziołkiewicz**
14:20-14:35	**Dorota Derewiaka** - Olive oils as a source of bioactive food compounds
14:35-14:50	**Elham Kamgar** - Investigating the presence of inorganic anions in Shilajit and its supplements: a quantitative approach
14:50-15:05	**Krzysztof Kołodziejczyk** - Sugar beet and beet pulp – a sustainable source of bioactive compounds
15:05-15:20	**Paulina Pakosz** - Influence of microorganisms and enzyme activity on bioactive compound levels in coffee beans
15:20-15:35	**Karolina Bernacka** - Extracts from ripe, unripe, and lactofermented honeysuckle berries - chemical composition, antioxidant activity, and antidiabetic activity *in vitro*
15:35-15:50	**Rebecca Miszczak** - How does common buckwheat cope with heavy metals? Basics of food safety.
15:50-16:00	**Argenta** – sponsor presentation
16:00-16:10	**FOSS** – sponsor presentation
16:10-16:25	**Discussion**
Session II B Room S-8	**Bioactive compounds in food side products** **Chair: Sylvain Guyot, Dorota Piasecka-Kwiatkowska**
14:20-14:35	**Coline Bourseau** - From waste to food preservation: exploring the antioxidant potential of oxidised apple pomace polyphenols
14:35-14:50	**Francisca Isabel Bravo** - Protein hydrolysates from agri-food by-products: A natural aproach to hypertension management
14:50-15:05	**Ahmed A. Zaky** - Reducing food waste: sustainable recycling of apple pomace in food production

15:05-15:20	**Kamila Rułka** - Polyphenols from agricultural waste as stabilizers of polymer compositions
15:20-15:35	**Emre Çolak** - Valorization of onion peel waste as a source of bioactive compounds in the development of chitosan-based active films by using eco-friendly extraction
15:35-15:45	**Polygen** – sponsor presentation
15:45-15:55	**Donserv** – sponsor presentation
15:55-16:10	**Discussion**
16:25-16:55	**Poster session**
19:00-23:00	**Conference dinner**

Tuesday, 10 June 2025 – Day 2

Session III Room S-7	**Molecular structure of bioactive food ingredients** **Chair: Pierto Rocculi, Małgorzata Zakłos-Szyda**
Plenary lecture	
9:20-9:45	**Vassilis Fotopoulous -** Priming technologies for improved soft fruit production
Communications	
9:45-10:00	**Olga Stężycka** - The importance of the carbonyl group present in flavonoids for their interaction with the G-tetrad
10:00-10:15	**Agnieszka Nawrocka** - Gluten proteins-polyphenols interactions studied with application of spectroscopic methods
10:15-10:30	**Agnieszka Krawczyk-Łebek** - The influence of structural changes within the flavonoid compound on the bioactivity of the molecule
10:30-10:45	**Bartosz Sekuła** - Molecular insights into the halo blight in beans – a disease caused by antimetabolites produced by plant pathogens
10:45-11:00	**Discussion**
11:00-11:15	**Coffee breake**
Session IV Room S-7	**Chair: Grażyna Budryn, Alina Kunicka-Styczyńska**
Plenary lectures	
11:15-11:40	**Sylvain Guyot** - How to manage the balance between organoleptic and nutritional qualities in foods? The example of polyphenols in cider apple juices
11:40-12:05	**Pietro Rocculi** - Emerging processing technologies for the functionalization of food products
12:05-13:00	**Lunch**
Session V A Room S-7	**Properties and applications of plant bioactive compounds** **Chair: Catherine Renard, Beata Smolińska**
13:00-13:15	Aleksandra Kuliga - Lactic acid fermentation of whey supplemented with chokeberry powder
13:15-13:30	Małgorzata Nowacka – The YOUng AgRifood European INnovators
13:30-13:45	**Anna Pakulska** - Dehumidified air assisted spray dried bilberry extracts: physicochemical characteristic and the potential in pH-sensitive films for intelligent food packaging
13:45-14:00	**Emilia Janiszewska-Turak** - Evaluation of changes in physicochemical properties of beetroot juice with carriers under different pH conditions
14:00-14:15	**Katarzyna Rybak** - Pulsed light application as a novel pretreatment: effects on freeze-drying kinetics and quality of red bell pepper
14:15-14:25	**Merck** – sponsor presentation
14:25-14:35	**Novel Food R&D Hub** – sponsor presentation
14:35-14:45	**Biomaxima** – sponsor presentation
14:45-15:00	**Discussion**

Session V B Room S-8	**Bioactive compounds and human health Chair: Vassilis Fotopoulos, Agnieszka Bartoszek-Pączkowska**
13:00-13:15	**Manuel Suárez Recio** - Protective role of grape seed proanthocyanidin extract (GSPE) against circadian and metabolic disruptions
13:15-13:30	**Małgorzata Zakłos-Szyda** - Lactate – food component, oncometabolite or master regulator of cellular metabolism
13:30-13:45	**Gabriela Kowalska** - Next-generation flaxseed biopolymers: a sustainable approach to nutraceuticals, drug delivery, and biomedical applications
13:45-14:00	**Aleksandra Twarda-Clapa** - Dietary and endogenous advanced glycation end products (AGEs): receptors and diseases related to AGEs
14:00-14:15	**Selvakumar Murugesan** - Formulation of pepper oleoresin emulsions using tween 80 and chitosan: evaluation of their antimicrobial, antioxidant, and cytotoxic activity
14:15-14:30	**Abdul-Rauf Brenya** - Food and Health
14:30-14:40	**Biokom** – sponsor presentation
14:40-14:50	**Pro Environment** – sponsor presentation
14:50-15:00	**HVD Holding AG Sp. z o.o.** – sponsor presentation
15:00-15:15	**Discussion**
15:15-15:45	**Poster session**
15:45-16:00	**Summary and closing of the conference**

Place of the conference:
Poland, Lodz University of Technology, Faculty of Biotechnology and Food Sciences (W-5), 2/22 Stefanowskiego Street, 90-537 Łódź, GPS: 51,75464 N, 19,45260 E, Plus Code: QF33+V37 Łódź

The conference will take place in the A3 building (CAMPUS A) – rooms S-7 and S-8 Entrance to A3 building is possible from: Stefanowskiego 2/22 Street through the A2 building (Plus Code: QF33+V37 Łódź), https://mapa.p.lodz.pl/?geo=54 or Wólczańska 171/173 Street through the A4 building (Plus Code: QF33+RV Łódź), https://mapa.p.lodz.pl/?geo=55

PLENARY LECTURE

Catherine M.G.C. Renard, Béatrice Gleize, Jiahao Yu

Some mechanisms to understands why lycopene bioaccessability increases with processing

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UMR SQPOV, Joint Research Unit Safety and Quality of Product from Plant Origin
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Keywords: thermomechanical process, lycopene, isomerisation

Carotenoids are lipophilic plant secondary metabolites characterized by an isoprenoid backbone. Some of them are provitamin A, some of them are colored, notably lycopene. Their bioavailability from plant tissues is very low, and markedly increased by processing[1]. Especially, the carotenoid diffusion and solubility into the oil phase from the food matrix play a critical role in determining their bioaccessibility Combined physico-chemical and chemical mechanisms may explain variations in this phenomenon.

In the native plant cell, lycopene, a C40 hydrocarbon with 11 double bonds, is present exclusively in the chromoplasts, where it can be present in amore or less crystalline stade, and as its all-*E* isomer. Processing and notably thermomechanical processes first enable rupture of the hydrophilic plant cell walls[2], which realized a natural barrer to its dissolution in oil droplets in the stomach. A second limiting factor is the nature of the interface in gastric juices: time courses and levels of incorporation of lycopene in oil droplets is strongly dependant on the nature of the tensioactive molecules, including those derived from the chromoplast and other plant membranes. The lycopene molecule itself is modified during processing, with the generation of *Z*-isomers, which are more soluble than the all-*E* isomer, and more bioaccesssible. This also contributes to understanding why *Z*-isomers of lycopene are more abundant in the blood. A last observation is that this generation of *Z*-isomers can be influenced by the recipe, and notably increased by the presence of *Allium* vegetables. Among the microconstituants of *Allium* vegetables, the alk(en)yl cysteine sulfoxides (e.g. alliin) were identified as key players, not in their native forms but through their degradation products by (alliinase)-catalyzed breakdown following tissue disruption.

Understanding these intricate and complex phenomena, and how they can be modulated by processing and recipe, is key to improve our understanding of the health-beneficial properties of fruit and vegetables.

References:

1. Rock & Swendseid, The American Journal of Clinical Nutrition, 1992, 55, 96-99.
2. Degrou et al. Food Chemistry, 2013, 136, 435-441.
3. Yuet al. Food Chemistry, 2019, 296, 9–16.
4. Yu et al. LWT, 2019, 113, Article 108284

Christiane Kruse Fæste

Biocontrols – sourcing from nature for controlling pest and disease

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Keywords: biocontrols, biostimulants, nutrients, antimicrobial resistance

Biologicals are products derived from biological sources, comprising a wide range of commodities including bioactive substances, which can be divided into three major groups: biocontrols, biostimulants and nutrients. Biocontrolling agents include small molecules (metabolites) and antimicrobial peptides, which differ from commonly used pesticides and antibiotics, making them less susceptible to resistance development. Antimicrobial resistance (AMR) to important pesticides and drugs is globally on the rise in pathogens affecting crops, livestock and humans, endangering health, wellbeing as well as feed and food security.

AMR is increasing mostly because of over- and non-targeted use. Even "last-resort" drugs no longer guarantee successful treatment. Against this backdrop, the search for novel biocontrolling compounds with unusual properties is essential to avoid a relapse into the times when microbial infections were irremediable.

Vasileios Fotopoulos

Priming technologies for improved soft fruit production

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Keywords: plant priming; abiotic stress; nanomaterials; polymer coatings; strawberry; raspberry

Increased frequency of extreme environmental events resulting from global climatic changes remarkably influences plant growth and development. Close examination of plant-to-plant communication in nature has revealed the development of unique strategies from plants for responding to abiotic stress, with one of the most interesting being through priming for improved defense responses. The process of priming involves prior exposure to a biotic or abiotic stress factor making a plant more tolerant to future exposure. Priming can also be achieved by applying natural or synthetic compounds which act as signaling transducers, 'activating' the plant's defense system. The development of sustainable, 'green' technologies is therefore becoming of utmost importance, also due to the need for reduced agrochemical use. The current presentation gives an up-to-date description of main research activities carried out at the Cyprus University of Technology with the employment of chemical compounds, advanced nanomaterials and polymers applied as priming agents for plant stress protection and improved growth. Focus is given on soft fruit (strawberry, raspberry), which represent a high added value crop. This technology offers an attractive alternative to established approaches such as conventional breeding and genetic modification with key advantages, representing a characteristic example of integrative plant physiology where multiple disciplines such as materials science, agriculture and analytical chemistry join forces to develop exciting new tools in modern agriculture.

Sylvain Guyot

How to manage the balance between organoleptic and nutritional qualities in foods ? The example of polyphenols in cider apple juices

INRAE, Biopolymers, Interaction & Assemblies Research Unit, Polyphenol, Reactivity & Processing group, 35653 Le Rheu France.
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Keywords: polyphenols, oxidation, cider

In the orchard or in the field, phenolic compounds are specialized plant metabolites that play an important role in plant defense mechanisms against pathogens and bio-aggressors, and their degradation into humus also makes them good contributors to soil quality. Moreover, present in appropriate quantities in food crops such as fruit, vegetables and seeds, as well as their processing products, they are natural antioxidants contributing significantly to the nutritional qualities of various foodstuffs for both humans and animals. For all these reasons, these compounds are natural contributors to the "One Health" concept (the notion of global health for soils, plants, animals and humans).

However, too high a concentration of polyphenols in foods can have a negative impact on their sensory properties. Excessive bitterness or astringency, uncontrolled browning, or the appearance of colloidal disorders in certain beverages are all criteria that can alter the visual and gustatory qualities of food products derived from the processing of plant resources.

Several examples, largely taken from the work of our research group and collaborations, in connection with the transformation of cider apples (known for their richness in polyphenols), will be used to illustrate the structural diversity, biochemical reactivity and the main physicochemical properties of these compounds (oxidation, tanning properties, colouring properties, antioxidant activities). This will include showing how, from a polyphenol-rich raw material and transformation techniques in adequation to sustainable food processing, these properties could be more extensively used to produce fruit juices and ciders combining organoleptic and nutritional quality.

Pietro Rocculi

Emerging processing technologies for the functionalization of food products

Department of Agricultural and Food Science (DISTAL), Interdepartmental Centre of AgriFood Industrial Research (CIRI Agro), Alma Mater Studiorum, University of Bologna
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Keywords: non-thermal technologies, cold formulation, electroporation

Technological innovation in food processing is a key factor in increasing the quality and sustainability of the agri-food sector, also with regard to new market trends. The use of mild/non-thermal stabilisation technologies together with new conditioning and packaging methods have developed strongly in recent years, both in basic research and in industrial applications. The potential of techniques based on the modulation of physical parameters such as pressure and composition of the atmosphere (e.g. high hydrostatic pressure and homogenisation; vacuum impregnation; transformation and packaging in a protective atmosphere), the use of electroporation and cold plasma technologies, etc., is described from the perspective of process/product innovation aimed not only at extending the shelf life of food products but also at improving their functional properties. In this direction, the use of these technologies to produce healthy products such as dried fruit snacks, fermented products and functionalised juices, fortified fresh-cut fruit and vegetables is extremely important both for increasing the added value of sustainable food production and for improving consumer health.

ORAL PRESENTATIONS

Dorota Derewiaka, Karolina Majdak, Paulina Pakosz

Olive oils as a source of bioactive food compounds

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Keywords: olive oil quality

Olive oil is an ingredient in many diets, including the Mediterranean diet. Due to its unique properties, i.e., high content of unsaturated fatty acids, fat-soluble vitamins, and other unique bioactive ingredients, e.g., carotenoids, phytoestrogens, flavonoids, and polyphenols, cold-pressed olive oil is very eagerly consumed by consumers. These compounds can significantly reduce the risk of cancer and cardiovascular diseases.

Consumers are increasingly looking for first-press olive oils from organic farming on the food market, which are often more expensive than conventional ones. In connection with the above, the question arises whether the composition of olive oils from organic farming is richer and whether these products can better affect human health?

The research aimed to determine the composition of olive oils from the highest quality olives from European countries from both conventional and organic farming. In the experimental, the following analyses were performed: determination of fatty acid profile, determination of sterol content, measurement of acid and peroxide value, spectrophotometric measurement of absorbance in ultraviolet, examination of DPPH antiradical capacity, measurement of antioxidant activity using the FRAP method and determination of selected phenolic acids content (oleuropein, tyrosol and hydroxytyrosol) using liquid chromatography coupled with DAD detector.

The results of the obtained analyses indicate no statistically significant differences in physicochemical properties and the presence of bioactive components between conventional and organic farming products. There were only differences in the composition of individual olive oil samples. However, there were cases where oils pressed from olives from conventional farming were characterized by a more favorable antioxidant potential.

Elham Kamgar[1], Joanna Zembrzuska[1], Wiktor Lorenc[2], Massoud Kaykhaii[3]

Investigating the presence of inorganic anions in Shilajit and its supplements: a quantitative approach

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Keywords: Shilajit, Inorganic anions, Ion chromatography.

Shilajit is an enigmatic natural substance that is infrequently discovered in the high-altitude sedimentary rocks of Central Asia and certain regions of the Middle East. It has been acknowledged for its considerable medicinal properties and value as a dietary supplement for millennia. In contemporary times, Shilajit and its derived supplements are utilized to treat a diverse array of health issues, including injuries, bone fractures, and skin conditions. This complex substance comprises a variety of components, such as organic compounds, humic substances, fossilized plant and animal, mineral resins, inorganic elements, and microbial metabolites. Today, numerous companies and dietary supplement manufacturers offer a wide range of Shilajit-based products, promoting them for various therapeutic applications. Despite its growing popularity as a medicinal and supplemental agent, there remains a lack of comprehensive information regarding its chemical composition, particularly concerning inorganic anions.

This study aims to fill a research gap in existing literature by assessing the concentration of inorganic anions in 14 raw Shilajit samples as well as in 6 commercially available supplements from different parts of the world. The analysis utilized ion chromatography to measure significant anions, including chloride, sulfate, nitrate, hydrogen phosphate, and fluoride. The presence of these inorganic anions is crucial for human health and physiological functions. The results indicated that chloride and sulfate were the predominant anions found in both raw Shilajit and the supplements. Fluoride was detected in only one sample at a concentration of 0.064 $mg.g^{-1}$, while nitrate was present in lower amounts, with a maximum concentration of 9.504 $mg.g^{-1}$ in raw Shilajit. Shilajit has been approved by the European Food Safety Authority for its ability to enhance strength and provide rejuvenating effects, with a recommended usage of 1.00-0.05 g per day. Given these results and the suggested dosage, the levels of inorganic anions consumed through Shilajit are deemed safe. These findings underscore the importance of establishing standardized formulations and implementing rigorous quality control measures in the production of Shilajit supplements to ensure consumer safety and product effectiveness.

The work was supported by the 'PhDBoost' Program for doctoral students of the Doctoral School of Poznan University of Technology (in 2024) from the University's subsidy financed from the funds of Ministry of Science and Higher Education (0911/SPHD/2502).

Krzysztof Kołodziejczyk, Radosław Gruska**,** Magdalena Molska

Sugar beet and beet pulp – a sustainable source of bioactive compounds

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Keywords: polyphenols, saponins, betaine, sugar beet

Presented work is a review on sugar beetroot (*Beta vulgaris* subsp. *vulgaris*) and its processing by-products, containing significant bioactive substances, classified as phenolic compounds, enzymatic products, oligosaccharides, saponins, and betaine. Phenolic compounds exhibit significant presence, with epicatechin (31 mg/100 g), gallic acid (31 mg/100 g), and quercetin-3-O-rutinoside (30 mg/100 g) being the major components. These substances demonstrate potent antioxidant effects, safeguarding cells from oxidative stress and decreasing the likelihood of chronic diseases, including cardiovascular ailments and neurological conditions. Improved extraction techniques have produced elevated concentrations: gallic acid (1293 mg), epicatechin (486 mg), and cyanidin-3-O-glucoside chloride (241 mg). The total polyphenol content varies from 0.45 to 1.72 g GAE per 100 g of dry weight. The subsequent group encompasses enzymatic products and oligosaccharides, including feruloylated arabino-oligosaccharides (FAOs) with a yield of 1.52% (w/w), alongside other enzymes like β-amylase (2 units/ml), β-glucooxidase (13-70 units/g), and α-galactosidase (118÷230 units/g). These molecules demonstrate varied properties: phenolics serve as antioxidants and functional dietary additives, while oligosaccharides act as prebiotics, boosting gut flora health and aiding digestion. The next group includes saponins. Quantitative tests indicated differing saponin concentrations in various plant parts: sugar beet roots exhibited 862÷2452 mg/kg, leaves displayed 907÷5398 mg/kg, while sugar beet fibre and dried pulp produced elevated quantities of 13 g/kg and 10 g/kg, respectively. Multiple reference studies have revealed new compounds, with confirmation of 17 previously unrecognized saponins in sugar beet. Saponins are associated with numerous health advantages, such as cholesterol reduction, immune system regulation, and possible anti-cancer activities. The betaine concentration in sugar beet roots is about 1-2%. Betaine has a critical role in regulating cellular hydration and osmotic equilibrium, supporting liver function, and decreasing homocysteine levels, which is advantageous for cardiovascular health. These findings underline the potential of sugar beet and its by-products as rich sources of bioactive chemicals, justifying its possible applications in functional food, medicinal, and biotechnological applications.

Paulina Pakosz, Anna Bzducha-Wróbel, Rafał Wołosiak

Influence of microorganisms and enzyme activity on bioactive compounds in coffee beans

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Keywords: coffee modification, antioxidant activity, bioactive compounds

Great taste, stimulating effect and increased productivity are some of the most common reasons behind coffee consumption. In search for products with unique sensory quality, new methods of coffee processing are created, such as anaerobic fermentation, carbonic maceration or digestion methods. The latter one is not limited to animal-processed coffee but also includes the use of enzymes and/or microorganisms to modify coffee material. Additional processing might not only affect the organoleptic properties of coffee, but also its properties connected with its bioactive compounds content. The aim of this research was to evaluate the effect of combined enzymatic (pepsin) and microbial (*Bacillus subtilis*, *Gluconobacter* sp., *Lactiplantibacillus plantarum*) modification of Robusta coffee on the composition of bioactive compounds most commonly associated with coffee. The enzyme was applied either during sample preparation or together with bacterial inoculum. Furthermore, roasted coffee beans were analyzed for their antioxidant activity and selected compounds formed during roasting. Modification process was not significantly affected by the stage at which the enzyme was dosed. The use of enzyme alone resulted in a decrease of caffeine and phenolic compounds content; in combination with microorganisms slight positive changes were observed in both green and roasted beans, especially in the case of acid producing bacteria. Changes of the bean composition by the additional processing had an effect on roasting, as samples varied based on the amount of Maillard reaction products created during that process. Different trends in changes of antioxidant activity of roasted coffee were observed when methods based on various reaction mechanisms were used. The effect of microbial modification on bioactive compounds content in coffee was greater than the effect of enzymatic modification. Changes in the amounts of compounds associated with positive and negative effects on human health were observed. There is a need for further studies with regards to roasting degree and brew preparation methods, which might affect the amount of bioactive compounds consumed by costumers.

Karolina Bernacka, Agata Czyżowska, Anna Otlewska, Narcyz Piórecki, Tomasz Sozański, Alicja Z. Kucharska

Extracts from ripe, unripe, and lactofermented honeysuckle berries - chemical composition, antioxidant activity, and antidiabetic activity *in vitro*

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Keywords: *Lonicera*, chemical composition, antioxidant activity

Honeysuckle berry (*Lonicera caerulea*) fruits are the source of both dietary and bioactive compounds, and are abundant in health-promoting phenolics. To date, it has been reported that anthocyanins from *L. caerulea* act as *α*-glucosidase inhibitors [1], while the polyphenolic fraction acts as *α*-amylase inhibitor [2]. The study aimed to determine the chemical composition, antioxidant properties, and antidiabetic activity *in vitro* of extracts from ripe, and unripe (raw and lactofermented) honeysuckle berry fruits. Unripe fruits were fermented in brine with herbs and starter strains in different combinations. One product was selected for extract preparation. The juices from ripe, unripe, and fermented fruits were passed through the Amberlite XAD-6 resin column. The chemical composition of lyophilized extracts was determined by UPLC-ESI-qTOF MS/MS and HPLC-DAD. Total phenolic content (TPC), antioxidant properties, and enzyme inhibition *in vitro* were determined using spectrophotometric methods. The concentration of phenolic acids in both unripe and unripe-fermented fruit extracts was over two times higher than in ripe fruit extract. However, the latter sample contained anthocyanins, with cyanidin 3-*O*-glucoside as the dominant compound, which was absent in the other samples. Additionally, the extract from ripe fruits demonstrated the highest TPC and the strongest antioxidant properties in the ABTS, FRAP, and DPPH assays, and the strongest ability to inhibit *α*-amylase with statistically significant differences. The *α*-glucosidase inhibition was not significantly different for the tested extracts. In conclusion, all examined extracts from unripe and unripe-fermented honeysuckle berries, as well as ripe ones, may be considered as potential antioxidant and antidiabetic agents.

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How does common buckwheat cope with heavy metals? Basics of food safety

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Keywords: rutin, niacin, lysine

Common buckwheat (*Fagopyrum esculentum*) is an economically important pseudocereal often growing on degraded soils.
The present experiment aimed to investigate how cadmium (Cd) and lead (Pb) influence the level of beneficial compounds in human diet in common buckwheat.
Pot experiments with the 'Korona' cultivar showed high tolerance to cadmium (Cd) and lead (Pb). Treatment with 45 mM Cd (15,199 µg/g DW in soil) slightly inhibited plant growth and accumulated in leaves (402 µg/g DW), and in seeds (19 µg/g DW), lower Cd and Pb treatments have not shown phytotoxicity. Notably, Cd accumulation in fruits exceeded phytotoxic levels (5–10 µg/g DW) in all treatments. High dose of Cd (45 mM) also significantly increased lysine content in fruits (five times over the control), treatment with Pb also increasing lysine but to the lesser extent. Rutin production tripled at the highest Cd concentration, while niacin remained unchanged. In summary, common buckwheat tolerates high doses of Cd and Pb, however, despite increased levels of beneficial compounds, consuming buckwheat fruits from heavy-metal-treated plants should be cautioned due to high toxic element content.

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From waste to food preservation: exploring the antioxidant potential of oxidised apple pomace polyphenols

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Keywords: polyphenols, apple pomace, antioxidant potential

In the food industry, polyphenols show promising antioxidant capacity for food preservation. Valorising plant co-products supports sustainable sourcing and food transition. Here, we investigate the antioxidant potential of cider apple pomace (CAP), the main co-product of apple juice and cider production.

During juice processing (crushing, pressing), polyphenol oxidase (PPO) catalyses phenolic oxidation with oxygen, generating reactive quinones. This leads to diverse oxidation products (OPs) in CAP, with distinct structures (1) and antioxidant properties. As CAP blends multiple varieties, its polyphenol profile varies, influencing OPs formation. Additionally, pH variations in food matrices may favor autoxidation, making both pathways relevant to explore. This study aims to clarify the mechanisms governing polyphenol reactivity and correlate oxidation kinetics with OPs formation and antioxidant potential.

Varietal CAP, prepared under anoxic conditions, underwent controlled oxidation by cumulative oxygen additions using a custom module. Two oxidation pathways were investigated: (i) PPO catalysed oxidation in malate buffer (pH < 3.8) and (ii) autoxidation in phosphate buffer (pH > 8). Samples were collected after up to eight oxygen additions to monitor oxidation kinetics. LC-UV-MS enabled both the targeted quantification of native polyphenols and the non-targeted identification of OPs. Multiple linear regressions were performed to explain the composition of CAP as a function of its oxygen consumption. Three antioxidant assays—DPPH, FRAP, and ORAC—were used to evaluate antioxidant capacity. Correlations between oxidative substrates, OPs, and antioxidant potential were established to assess the impact of oxidation and pH on OPs formation and functionality.

These results enhance our understanding of the oxidation mechanisms of CAP polyphenols and their impact on antioxidant properties. They also highlight the potential of oxidized polyphenols as functional ingredients for food preservation, supporting the evaluation of apple pomace as a natural antioxidant source for various food applications.

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Protein hydrolysates from agri-food by-products: A natural aproach to hypertension management

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Keywords: antihypertensive activity, bioactive peptides, gut microbiota

Hypertension (HTN) is a major risk factor for cardiovascular disease, and finding natural ways to manage blood pressure (BP), such as through bioactive peptides, is a topic of increasing interest. Several of our projects aimed to obtain antihypertensive hydrolysates from agri-food by-products and identify the underlying mechanisms and their bioactive peptides. In the first study, hydrolysate Hpp11 obtained from chicken feet was selected for its ability to inhibit angiotensin-converting enzyme (ACE, an essential enzyme in controlling BP). Notably, Hpp11 reduced systolic BP in both spontaneously hypertensive rats (SHR) and in a diet-induced hypertensive rat model after acute and 3-week administration, respectively. This outcome was linked to an improvement in endothelial dysfunction. The peptide AVFQHNCQE, identified within Hpp11, was found to exert antihypertensive effects by interacting with opioid receptors in the gastrointestinal tract. In the second study, a wine lees (WL)-derived hydrolysate showed higher ACE inhibitory and antioxidant properties and longer lasting antihypertensive effects than the original WL liquid fraction. These effects were associated with the higher content of phenolic compounds (57.20%) released during enzymatic hydrolysis from the insoluble WL fraction and the presence of antihypertensive peptides (FKTTDQQTRTTVA, NPKLVTIV, TVTNPARIA, LDSPSEGRAPG, and LDSPSEGRAPGAD). The third study showed that the gut microbiota could be involved in the antihypertensive effects of several protein hydrolysates, given that their effects on BP were eliminated when SHR were orally pretreated with an antibiotic cocktail. Additionally, these hydrolysates modulated the growth of several gut microbiota populations associated with health benefits after *in vitro* fermentation with fecal bacteria from hypertensive models. Protein hydrolysates derived from agri-food by-products may serve as functional ingredients for HTN management. Their use not only enhances cardiovascular health, but also supports the revaluation of agri-food waste, promoting sustainability and a circular economy.

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Reducing food waste: sustainable recycling of apple pomace in food production

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Keywords: apple pomace, extraction of bioactive compounds, applications

Apple pomace, a major by-product of apple juice production, is often discarded as waste, contributing to environmental harm and posing potential health risks. This review aims to explore the composition, bioactive components, extraction methods, and current food applications of apple pomace. It emphasizes the economic benefits of adopting novel extraction techniques that yield higher outputs. In addition to bioactive compounds, apple pomace is rich in dietary fiber, which could be incorporated into new food formulations. The pomace can be used to enhance the nutritional content and marketability of food products, such as bread, confectionery, dairy, and meat items, thereby improving their phytochemical and health-promoting properties. The review also addresses the challenges associated with incorporating this by-product into such products. The findings are intended to serve as a valuable resource for food industry professionals looking to develop cost-effective and sustainable extraction methods that transform apple waste into functional, value-added products. Further research is needed to confirm the bioactivity of these compounds, as well as to assess the stability of bioactive substances and the mechanisms regulating them.

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Polyphenols from agricultural waste as stabilizers of polymer compositions

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Keywords: polymer stabilizers, polyphenols, biomaterials

Plant waste from the food industry has been identified as a valuable source of active chemical substances, including polyphenols. Among this extensive group of compounds are substances with a broad spectrum of action, including antioxidant properties. Plant raw materials containing polyphenols, which possess antioxidant activity, can function as both an active filler of polymers and a stabilizer [1]. The integration of polyphenol-rich agricultural byproducts into diverse polymeric materials has the potential to influence the processes associated with their degradation [2]. The present study examined plant materials such as various fruit pomace and herbs for their polyphenol content, antioxidant activity, and thermal stability. Selected agricultural byproducts were utilized to produce polymer composites with the potential to serve as food packaging materials. These samples were then subjected to rigorous testing to ascertain their capacity to stabilize particular polymers. The incorporation of agro-waste in the composition of food packaging materials signifies an innovative approach that is congruent with the principles of the circular economy.

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Valorization of onion peel waste as a source of bioactive compounds in the development of chitosan-based active films by using eco-friendly extraction

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Keywords: onion peel, green extraction, active film

Onion peels, which are released as a by-product in the food industry, are considered as a low-cost source of bioactive compounds due to their high phenolic compound content. Onion peel extract offers potential use not only in food formulations but also in active packaging materials to provide functional properties. Extractions from onion peel waste were performed by microwave and ultrasound-assisted extraction using water as a sustainable solution at different solid ratios (10, 20, and 30% w/v). The extracts were characterized by total phenolic content (TPC), antioxidant activity (AA), and extraction yield. The best extract was utilized in the development of active chitosan films with superior antioxidant properties. Onion peel extract was incorporated into chitosan film solution at different concentrations (5, 7.5, and 10% v/v) and the films were coded as CF5, CF7.5, CF10, and CF0 (control). Thickness, moisture content (MC), water vapor permeability (WVP), color and opacity, tensile strength (TS), elongation at break (EAB), total phenolic content (TPC), and antioxidant activity (AA) of the films were determined. The study offers a water-based green extraction by obtaining high TPC ranging from 126.41 to 187.70 mg GAE/g from onion peel waste by microwave and ultrasound-assisted extraction. AA in the range of 7.81 and 8.45 mg trolox/g indicated the highest level at the 10% solid ratio with the highest extraction yield (80%). The onion peel extract obtained at 10% w/v solid rate was used in the film formulation. WVP of chitosan-based active films ranged from 0.148±0.01 to 0.236±0.01 g.mm/m2.h.kPa, with the lowest WVP in the CF5 film. The addition of onion peel extract positively influenced the WVP values of the films by reducing the permeability. MC varied between 9.17 and 11.84%, with a gradual decrease as the extract concentration increased in the films. The highest opacity value (2.81±0.13) was achieved with the addition of 10% onion peel extract. The onion peel extract provided a considerable change in the color values of the films and an increase in a* and b* values was observed as the amount of extract increased. The tensile strength of films ranged from 11.11±0.05 to 9.55±0.42 MPa, with the highest tensile strength in the CF5 film. As the extract concentration increased, a decrease in elongation at the break percentage was observed. The highest TPC (151.31±4.14 mg gallic acid/g dry weight) and AA (74.09±1.07 %inhibition) were observed in the CF7.5 and CF10 films, respectively. As the

extract ratio increases, active properties of films also increase, but this increase does not progress linearly. This study revealed that integrating onion peel extract into the chitosan film matrix provided improvements in functional properties such as antioxidant activity, opacity, and water vapor permeability.

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The importance of the carbonyl group present in flavonoids for their interaction with the G-tetrad

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Keywords: flavonoids, G-tetrad, mass spectrometry

Nucleic acid fragments rich in guanosine form a characteristic three-dimensional structure called a G-quadruplex. The basic unit of this structure is a G-tetrad, formed by four interacting guanines. Interaction of these structures with ligands can increase their stability [1]. It is assumed that flavonoids, due to their antioxidant properties, can protect guanine from oxidation, which is the most easily oxidized nucleic base. Flavonoids are a wide group of natural compounds that exhibit biological activity [2-4]. Studies of ions in the gas phase can provide many important information about biological processes. Electrospray mass spectrometry can be effectively used to determine the stability of nucleic acids complexes [5]. Electrospray ionization and collision-induced dissociation mass spectrometry (ESI-CID-MS) was used to study the interactions between G-tetrad and flavonoids. The use of the survival yield method (SY) method allowed the assessment of the stability of ions of interest. In order to determine the influence of flavonoid structure on interactions with G-tetrad, four isomeric flavones containing one hydroxy and one methoxy group were used for the study. For comparison of results, apigenin and tectochrysin 5-O-glucoside were also used. Analysis shows that flavonoids with a more accessible C4=O carbonyl group form more stable complexes with the G-tetrad, which results from the binding properties of this group. Studies show that flavonoids form more stable complexes with the guanosine tetrad than with the deoxyguanosine tetrad [6].

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Gluten proteins – polyphenols interactions studied with application of spectroscopic methods

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Keywords: gluten proteins, infrared spectroscopy, Raman spectroscopy

Gluten proteins i.e. gliadins and glutenins are part of the gluten network. Glutenin polymers are made up of high and low molecular weight subunits that are attached to each other via disulphide bonds, whereas gliadins interact with glutenin polymers via hydrogen bonding and non-covalent hydrophobic interactions. Structure of gluten proteins directly affect quality of the bread dough as well as bread. Addition of some supplements e.g. dietary fibre preparations, or polyphenols extracts to the bread dough changes its sensory quality and hence disturb structure of the gluten network.

Spectroscopic methods are widely used in the studies of proteins structure. Among these methods, infrared and Raman spectroscopies are used the most often. Both methods are complimentary to each other and provide information about secondary structure, conformation of disulphide bridges, environment of two amino acids – tyrosine and tryptophan, and water populations. In some cases, fluorescence spectroscopy is also applied to determine changes in proteins structure by e.g. analysis of fluorescence emission spectra of aromatic amino acids – phenylalanine, tyrosine and tryptophan (1).

Results of the spectroscopic studies showed that mechanism of interactions between gluten proteins and polyphenols depends on the chemical structure and molecular size of the used phenolic compound. Small phenolic compounds such as phenolic acids led to formation of aggregated β-structures (e.g. pseudo-β-sheets, H-bonded β-turns) (2), while larger phenolic compounds such as flavonoids, especially their glycosides, caused disaggregation of the H-bonded structures into basic secondary β-structures (e.g. β-sheets and β-turns). Phenolic compounds affected strongly tryptophan environment and disulphide bridges. However, they did not interact with tyrosine residues.

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The influence of structural changes within the flavonoid compound on the bioactivity of the molecule

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Keywords: chlorinated flavonoids, antimicrobial activity, antiproliferative activity

Flavonoid compounds are widely recognized for their numerous biological activities, including antioxidant, anti-inflammatory, antimicrobial, and anticancer properties. Among the vast array of flavonoid structures, derivatives with chlorine atoms attached to the flavonoid core deserve special attention. One example of such derivatives is a flavonoid called chlorflavonin, isolated from endophytic filamentous fungi of the species *Mucor irregularis*, which exhibits antimicrobial activity against *Mycobacterium tuberculosis*[1]. However, these compounds occur rarely in nature and are poorly understood. Available literature data indicate their significant antimicrobial, anti-inflammatory, and immunomodulatory potential. Results from *in vitro* studies show that flavonoids demonstrate the ability to neutralize excess hypochlorous acid produced by neutrophils during inflammatory processes in immune responses to factors recognized as pathogenic. During this process, they undergo chlorination while maintaining or even enhancing their anti-inflammatory and antioxidant potential, as well as regulating neutrophil viability[2]. Chemical methods can be utilized to obtain structurally diverse flavones with chlorine and hydroxyl substituents. Using these methods, a series of structurally different flavones were synthesized and subsequently evaluated for their antimicrobial and antioxidant activities, as well as antiproliferative activity against healthy and cancerous cell lines. The obtained results indicate that the activity of flavone derivatives is influenced by the presence of chlorine atoms and hydroxyl groups, their quantity, and their position within the flavone structure.

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Molecular insights into the halo blight in beans – a disease caused by antimetabolites produced by plant pathogens

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Keywords: halo blight, plant arginine metabolism, antimetabolites

A very common disease in beans causing a significant loss in their yield is halo blight caused by *Pseudomonas syringae* pathovars. Halo blight is characterized by small water-soaked spots on leaves, which become dark brown over time. These spots are surrounded by a wide greenish yellow halo. The systemic chlorosis in plant tissue is caused by the action of antimetabolites produced by the invading pathogen. These toxins target the enzymes of arginine metabolism in attacked plants.

The best characterized toxin produced by *Pseudomonas syringae* is phaseolotoxin, which inhibits the action of ornithine transcarbamylase. Ornithine transcarbamylase is an enzyme producing citrulline from ornithine and carbamoyl phosphate. The toxin is transported into plant tissues, where it undergoes proteolytic cleavage to octicidine. The latter mimics the intermediate state of the reaction catalyzed by ornithine transcarbamylase. It penetrates the active site of the enzyme blocking its physiological function.

Our findings show the crucial structural elements responsible for this inhibition, suggesting the modification of the enzyme which may prevent the disease. Also, we have validated the phaseolotoxin inhibition mode into the strategy of weed control in crop production.

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Lactic acid fermentation of whey supplemented with chokeberry powder

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Keywords: Lactic acid fermentation, whey, chokeberry

The current increase of civilization diseases has led to an urgent search for functional food that can improve health. Fermented products, especially probiotic dairy products are becoming very promising in this field. Help in functioning of the digestive system, boost immunity, and even support mental well-being are a few of the many benefits that come with them. By enriching the diet with polyphenols, products with antioxidant or anti-inflammatory effects can be obtained. Lactic acid fermentation with selected bacterial strains allows to process a lot of raw materials and potentially create a beverages with attractive sensory characteristics, health-promoting or nutritional values. The aim of this study was to investigate the kinetics of fermentation of whey enriched with freeze-dried chokeberry powder with different sets of potentially probiotic bacterial strains (*Lactobacillus delbrueckii* subsp. *bulgaricus* BK and *Streptococcus thermophilus* 2K, as a yoghurt cultures and additionally *Lactobacillus plantarum* W42 and *Bifidobacterium animalis* subsp. *lactis* Bi30), the microbiological quality and color change of the resulting mixture. Chemical analysis of the raw materials (whey and chokeberry freeze-dried) was carried out. Preliminary conditions for lactic fermentation were established. An experiment was carried out using different variants of bacterial sets. The bacterial count and microbiological purity of the mixture before and after fermentation and after 14 days of storage were determined. In addition, color analysis was also carried out using by ColorFlex. The results obtained are promising, as no *E.coli* was detected after fermentation with the strain sets used, despite its selective presence before this process. It is also satisfactory that no undesired microbiota was detected after 14 days. The results of the color analysis indicate that the addition of chokeberries statistically significantly modified the color of the product. In some cases, the color was also found to be influenced by the strain sets, which may be correlated with the change in pH resulting from the use of these bacteria. Further analyses may shed further light on the role of polyphenols and their correlations with milk proteins in the fermentation process and functionality of such fermented beverages.

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Keywords: self-study, sustainable production, business approach

The YOUng AgRifood European INnovators (YOUAREIN) project is a dynamic initiative designed to empower the next generation of food entrepreneurs by integrating innovation, sustainability, and entrepreneurial education. Recognizing the pressing need for sustainable practices and innovative solutions in the food industry, YOUAREIN offers a comprehensive platform for aspiring leaders to develop essential skills and knowledge. The e-learning platform provides over 100 hours of interactive modules, engaging multimedia content, and real-world case studies. Participants can explore topics such as sustainable food processing technologies, novel technologies, alternative protein sources, and circular design principles, equipping them with the tools to navigate real-world challenges in the agri-food sector. By joining the YOUAREIN e-learning platform, participants become part of a collaborative learning community, gaining the skills and knowledge necessary to create impactful solutions for the future of food. Whether you aim to start your own sustainable food business or drive innovation within an organization, YOUAREIN provides the tools and expertise to help you succeed.

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Dehumidified air assisted spray dried bilberry extracts: physicochemical characteristic and the potential in pH-sensitive films for intelligent food packaging

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Keywords: bilberry extracts, edible packaging, smart packaging, pH indicators

Today's food industry faces challenges in monitoring and extending the shelf life of products. One innovative approach is using innovative packaging enriched with pH indicators. Such smart packaging contains natural indicator pigments, such as anthocyanins derived from bilberries, that indicate the state of the product. This allows them to change colour in response to pH changes caused by food spoilage processes.

This study aimed to investigate the optical properties of edible films containing concentrated powdered bilberry colorants and evaluate their suitability as colourimetric pH indicators in intelligent packaging systems. For this purpose, bilberry powdered colorants were obtained using two different carriers (maltodextrin and nutriose) and spray drying method assisted with dehumified air The resulting extracts were added to edible biopolymer films. The thickness, absorbance and colour of the produced films were then examined.

Thanks to the use of innovative spray drying assisted with dehumified air, the obtained colorants were very concentrated (70% dry mass of bulberrys and 30% dry mass of carrier). Traditionally produced powders contain about 50% of carrier. Analysing the drying efficiency of dehumified air spray drying of bilberry juice, it can be seen that drying with nutriosis yields a higher process efficiency (59.3%) than using maltodextrin as a carrier (40.8%). The water activity of the analysed materials was in the range of 0.159-0.172, which is below 0.6, indicating microbial stability. No significant difference in water content was observed between the analysed materials (0.034-0.036 g/g d.m.). Comparing the results obtained for the apparent density of bilberry powders, it was observed that in each case, they were characterised by the same loose density (0.50-0.56 g/cm^3), as well as bulk density (0.67-0.73 g/cm^3). The films produced were characterised by an intense violet colour, which was highly sensitive to changes in the pH of the environment in the range 2-12. The film adding bilberry extract with maltodextrin showed a higher transparency, where the value of L^* was 13.75. For the film with the addition of bilberry extract with nutriosis, the value of this parameter was 12.56. The film coloured with bilberry extract with maltodextrin was characterised by a higher parameter value a^* (7.63). The variant with nutriose obtained a much lower value for this parameter (2.27). These values indicate a red colouration of the film. The results of the parameter b* obtained for the films with nutriosis berry extract indicated a nibby colour (-1.35). In contrast, films with bilberry extract with maltodextrin

showed a colour towards yellow (0.92). The film with bilberry extract with nutriosis showed higher opacity (5.93). The addition of maltodextrin would produce films with an opacity of 4.15.

Concentrated powdered bilberry colorants based on maltodextrin and nutriose, can be used as a pH changing agent in food companies. On the other hand, the change of film colour depending on acidity/alkalinity makes it possible to use the produced films as colourimetric pH indicators in smart packaging for food quality assessment.

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Evaluation of changes in physicochemical properties of beetroot juice with carriers under different pH conditions

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Keywords: beetroot, betalain, acidity

Beetroot juice, derived from the root vegetable Beta vulgaris, is renowned for its bright red colour and nutritional richness. In addition to its colour, beetroot juice contains bioactive compounds such as betalains, which have antioxidant and anti-inflammatory properties, and dietary nitrates, which have been linked to improved blood flow and potential cardiovascular benefits. The present study aimed to determine the effect of pH variation and the use of different carrier materials on the physicochemical properties of beetroot juice solutions, with particular emphasis on the stability of plant pigments. The study encompassed juices at pH 3, 4, 5, raw juice pH, 8, 9 and 10, in the absence and presence of maltodextrin (MD) or gum Arabic (GA). The analysis covered a range of parameters, including dry matter content, extract, colour, pH, acidity, and betalain content. The findings revealed that the incorporation of carriers had a substantial impact on the dry matter and extract content of beetroot juice. The presence of crystalline citric acid resulted in an increase in these values, while NaOH led to a decrease. Maltodextrin (MD) and glycerol aldehyde (GA) also led to significant increases ($p < 0.05$) in both parameters. Colour analysis revealed that juices devoid of carriers exhibited no significant variance in lightness (L*). GA addition led to a lightening of solutions at pH levels of 3, 4, and 9, while the chromaticity parameter a* decreased with increasing pH, indicating a shift from red to green. GA solutions exhibited a more intense red colour compared to MD solutions, with a positive correlation between a* value and betanin content. The carriers significantly affected the acidity, especially in alkaline environments, with GA reducing pH more than MD. The addition of MD to fresh juice resulted in an increase in pH, while the incorporation of GA led to a decrease in pH. The highest betanin content was found in juices with a pH range of 3-8, while vulgaxanthin-I was predominant at pH 4 and 9. Conversely, raw juices exhibited higher concentrations of betacyanins compared to juices containing carriers, with GA-rich raw juices displaying the highest levels of red pigments, and yellow pigments being predominant at pH 8 in juices with GA. To summarise, the addition of 10% MD and GA carriers to beetroot juice resulted in enhanced physicochemical properties, characterized by a reduction in alkalinity and an increase in extract and dry matter contents. Optimal betanin levels were observed to occur within the pH range of 3 to 8.

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Pulsed light application as a novel pretreatment: effects on freeze-drying kinetics and quality of red bell pepper

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Keywords: red bell pepper, drying, pulsed light

Drying is one of the oldest and most energy-intensive preservation methods for fruits and vegetables. Pulsed Light (PL) technology is a non-thermal processing technique commonly used for surface decontamination of fresh produce to extend their shelf life. This study aimed to evaluate the effect of PL pretreatment on the drying kinetics and quality parameters of red bell pepper (Capsicum annuum). Samples were exposed to PL at fluences of 4, 12, and 32 J/cm² and dried using freeze-drying (30°C, 63 Pa).

The influence of pretreatment was assessed in terms of drying kinetics and changes in physical properties (color, hygroscopicity, rehydration rate) and chemical composition (polyphenols, carotenoids, sugars, antioxidant activity). Structural changes were analyzed using scanning electron microscopy and micro-computed tomography (micro-CT). FT-IR spectroscopy was used to confirm changes in the bioactive compound profile. The microbiological stability of the dried samples was also evaluated.

PL significantly reduced drying time in freeze-drying up to 21% at pulsed light fluence of 32 J/cm². The treatment did not significantly affect color, but it led to increased retention of bioactive compounds. The highest increase in polyphenol content was observed at the lowest fluence (4 J/cm²) and it was 27% higher in comparison to untreated freeze-dried red bell pepper. Carotenoid retention improved by up to 11%, and antioxidant activity was maintained or increased. In the case of sugar content, there were no significant changes. PL improved structural properties by increasing porosity, resulting in higher hygroscopicity and better rehydration. Furthermore, the pretreatment effectively reduced microbial and fungal contamination, achieving >3 log CFU/g reductions at the highest fluence.

Due to PL treatment's ease of use, short application time, and positive effects on product quality, PL appears to be a promising technique for improving drying efficiency and the nutritional value of dried vegetables. Integrating PL into drying protocols may contribute to more sustainable and effective processing strategies.

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Protective role of grape seed proanthocyanidin extract (GSPE) against circadian and metabolic disruptions

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Keywords: biological rhythms, (poly)phenols, disruption

Biological processes are regulated by central and peripheral clocks, which follow approximately 24-hour cycles, known as circadian rhythms. Disruptions of these rhythms are strongly linked to adverse cognitive and metabolic outcomes. However, the metabolic signatures associated with chronodisruption and its metabolic consequences remain insufficiently explored. Interestingly, it has been shown that bioactive compounds, including (poly)phenols can modulate the control of these rhythms. This study aimed to identify the impact of grape seed proanthocyanidin extract (GSPE) on the changes induced by circadian rhythm desynchrony in Wistar rats. Male rats were divided into three groups: a control group (12h light/12h darkness), a chronodisrupted group (11h light/11h darkness) and a chronodisrupted group (11h light/11h darkness) supplemented with GSPE (25 mg/kg body weight, daily) for 8 weeks. Weekly measurements included body weight and phase-specific food intake. Telemetry sensors collected data on blood pressure, locomotor activity, and temperature during a 48-hour period over seven weeks. Plasma biochemical parameters were determined using commercial kits, and RT-qPCR was used to assess gene expression changes. The chronodisrupted group showed significant metabolic changes, including reduced body weight gain, altered food intake patterns, and changes in lipid profiles. Furthermore, rhythmicity of blood pressure and temperature was abolished. The consumption of GSPE was able of preventing some of the alterations caused by disruption. These findings highlight the significant impact of chronodisruption on multiple biological pathways.

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author's view, and the Agency is not responsible for any use that may be made of the information it contains.

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Lactate – food component, oncometabolite or master regulator of cellular metabolism

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Keywords: lactate, cell signaling, metabolism

Numerous metabolites generated from cellular and tissue metabolism have been recently rediscovered as signaling molecules. They may act as cofactors of enzymes, be linked covalently to proteins as post-translational modifiers, or act as receptor ligands. Lactate, for a long time thought as a metabolite devoid of any biological function, recently it has gained much attention in several physio-pathological processes.

Lactate is a main product of glycolytic metabolism that accumulates acutely upon exercise and chronically in cancer and inflammatory sites. Mass spectrometry methodologies confirmed that lactate is often the most concentrated metabolite in these sites. Recent studies have established mechanisms of sensing lactate via transporters and receptors, but also have identified signaling pathways, including metabolic reprogramming and protein modification, with a novel type of post-translational modification known as lactylation. The studies clarified that protein lactylation by adding a lactyl group to histone lysine (K) residues not only regulates gene transcription [Zhang et al., 2019], but also function of multiple proteins by epigenetic modifications [Wang et al., 2024]. Yang et al. demonstrated a global lactylome profiling on a collected hepatocellular cancer (HCC) cohort, and 9275 Kla sites were identified by analyzing the proteome of the tumor and adjacent liver. Of these, 9256 sites are on non-histone proteins, showing that Kla is a universal modification beyond histone and transcriptional regulation [Yang et al., 2023]. Lactate can also regulate cellular response to low oxygen concentration, therefore it arises as a master regulator of hypoxia responses, promoting cell growth and angiogenesis. On the other hand, there are a lot of questions about lactate-specific transporters, as well as lactate-specific receptors like GPR81 and GPR132. There is an urgent need to identify and characterize these transporters and receptors especially on cells of gastrointestinal tract. It is worth to underline, that targeting lactate-induced signaling pathways is a promising tool to reduce inflammation, to prevent autoimmunity and to restore antitumor immune response. These novel discoveries will be the focus of this review.

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Next-generation flaxseed biopolymers: a sustainable approach to nutraceuticals, drug delivery, and biomedical applications

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Keywords: flaxseed biopolymers, encapsulation, delivery systems

Flaxseed biopolymer is a heteropolysaccharide composed of neutral and acidic monosaccharides. Its presence is concentrated in the seed coat; thus, it can be easily extracted by water from whole seeds, meals, or hulls of flaxseed. Due to its excellent film-forming and emulsifying properties, it has gained attention as a natural encapsulation material for bioactive compounds.

This study aimed to evaluate the use of flaxseed biopolymers as matrix materials in the microencapsulation process to develop controlled delivery systems with enhanced health-promoting potential. Microcapsules with honeydew honey as the core were obtained through spray drying using biopolymers as the matrix.

The analysis of EPR antioxidant activity indicated that encapsulation enhanced the antioxidant activity of the microcapsules by 78.7% compared to that of honey. Simulated *in vitro* digestion analyses demonstrated that encapsulating honey ensured the biostability of its bioactive components, enabling the programmed transport of active substances to a targeted release point. Additionally, encapsulation led to an average 629% increase in the release of phenolic compounds in the small intestine compared to the digestion of native honey.

Furthermore, *in vitro* conditions demonstrated an average 39% increase in the synthesis of microbial metabolites, primarily short-chain fatty acids (SCFAs), including butyric acid. Scanning electron microscopy revealed that the microcapsules had spherical and homogeneous surfaces.

These findings confirm the effectiveness of natural biopolymers in encapsulating various substances, including honey, thereby enhancing their health-promoting potential. The use of natural biopolymers derived from by-products for encapsulation presents a sustainable and innovative alternative to conventional carrier materials, with promising applications in the food, pharmaceutical, and cosmetic industries. By improving the stability and bioavailability of bioactive compounds, this approach can contribute to the development of functional foods and targeted drug delivery systems. Additionally, the increased release of phenolic compounds and short-chain fatty acids highlights the potential of encapsulation technology in modulating gut microbiota and supporting digestive health.

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Dietary and endogenous advanced glycation end products (AGEs): receptors and diseases related to AGEs

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Keywords: advanced glycation end-products, AGEs, RAGE, Stab2

Advanced glycation end-products (AGEs) constitute a chemically diverse, non-homogenous group of compounds formed exo- or endogenously. In general, they are created non-enzymatically by condensation between carbonyl groups of reducing sugars and free amine groups of nucleic acids, proteins or lipids, followed by further rearrangements yielding stable, irreversible end products.[1] Exogenous (dietary) AGEs are the most abundant in thermally processed foods such as grilled or fried meats, as a product of Maillard reaction. The way of food processing has a significant impact on the level of AGEs which is delivered to our body. Endogenous AGEs are formed on the course of various pathways in human body. In the last decades, AGEs were found interesting to the scientific community due to the increasing evidence of their involvement in many pathophysiological processes and diseases such as diabetes, cancer, cardiovascular, and neurodegenerative diseases.[1]

AGEs are recognized by several receptors, including the primary Receptor for AGEs (RAGE), and trigger numerous signaling pathways related to inflammation and oxidative stress. They are also bound and cleared from the bloodstream by a group of scavenger receptors, including the Hyaluronic Acid Receptor for Endocytosis (HARE), also called stabilin-2 (Stab2). Except for AGEs, it is responsible for the removal of several ligands, i.e. glycosaminoglycans and antisense oligonucleotides. The structural aspects of AGEs recognition by their receptors are still limited, and deciphering the ligand binding mode could expand the understanding of their deleterious impact on cells. This work focuses on the structural aspects of receptor-ligand interaction, and the diseases in which AGEs are involved. We hereby present the high-resolution crystal structure of FAS1 domain of Stab2, which provided the first and only experimental information about the three-dimensional fold of a fragment of this receptor. Molecular models of AGEs binding to Stab2 are also proposed.

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Formulation of Pepper Oleoresin emulsions using tween 80 and chitosan: evaluation of their antimicrobial, antioxidant, and cytotoxic activity

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Keywords: Pepper Oleoresin, isothermal titration calorimetry, chitosan

The present study investigated the formulation and stabilization of Pepper Oleoresin (PO) Oil-Water emulsions using Tween-80 (TW80) and Chitosan (CH) employing ultrasonication. PO emulsions were formulated with various surfactant concentrations (1% to 4% w/w of TW80). The CH concentration was varied from 0.005% (CH1) to 1% w/w (CH9) in the PO-TW80 emulsions. The average droplet size, zeta potential, viscosity, density, and morphology were analyzed to understand the emulsion stability. The PO emulsion with 4% w/w TW80 exhibited a homogenous emulsion with nano-sized droplets of around 165 ± 5.9 nm and a zeta potential value of -29 mV. The PO emulsion with TW80 (4% w/w) exhibited good stability (up to 6 months) at room temperature (25 ºC ± 2) as the concentration of CH increased (0.005% to 1% w/w). Stable PO emulsions were obtained at 4% w/w TW80 and 1% w/w CH9 with nano-sized droplets around 362.5 ± 18.82 nm and a zeta potential of 45 mV. The interaction between TW80 and CH was confirmed through Isothermal Titration Calorimetry (ITC) and FTIR analysis. In addition, the PO-TW80-CH9 (1% w/w CH) emulsion inhibited the ABTS free radicals (>85%). It also exhibited potential cytotoxicity activity towards MDA-MB-231 cells and displayed antimicrobial effects. The results suggest that combination of TW80 and CH could serve as efficient emulsifier system for stabilization of oleoresin emulsions for food and pharmaceutical applications.

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Food and health

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Keywords:

In many parts of the world the relationship between food and health is predominately defined by a nutritional and medical discourse today. This discourse focuses on food intake as a core determinant of individual bodily and mental health, [prevention of under or overweight, and of future diseases.

Sociologists and other social scientists, however, have a broader understanding of the relationship between food and health and emphasize how cultural meanings and beliefs as well as social structures and institutions such as education, media, law, politics, and economy shape food practices.

The aim of sociological research, reviewed here, is to understand the conditions of possibility for the emergence and prominence of a medical nutrition discourse on food and health and what it tells us about contemporary society.

POSTER SESSION

P-1

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Photoprotective and anti-inflammatory potential of Polyphenol-Rich Extracts from Agricultural By-Products in UV-B-exposed 3D human skin equivalents (poster)

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Keywords: Polyphenols; skin health; circular bioeconomy; dermo-cosmetic

Human skin equivalents (HSEs) serve as a robust model to evaluate the photoprotective effects of bioactive compounds. Polyphenols, known for their antioxidant, anti-inflammatory, and anti-aging properties, have emerged as promising agents for skin health applications in cosmetic industries. In this study, we evaluated the preventive effects of four polyphenolic extracts obtained from agricultural residues - chicory leaves, red onion peel, vineyard pruning, and olive pruning-on collagen metabolism, inflammation, and structural damage induced by UV-B radiation in HSEs. Polyphenol extracts were obtained using Subcritical Water Extraction (SWE) from these residues, followed by an enrichment step with Amberlite resins to increase purity. The extracts were characterized for total phenolic content (TPC) and specific polyphenols using UPLC-MS-MS. Human skin equivalents were treated with the extracts to assess their effects on collagen synthesis and gene expression, and histological analysis was performed to evaluate the epidermal layer. Results demonstrated that all extracts reduced the presence of UV-B-induced sunburn cells and modulated extracellular matrix (ECM) components and pro-inflammatory pathways. Notably, vineyard pruning extract significantly reduced IL6 expression, indicating anti-inflammatory properties. This study highlights the potential of polyphenolic extracts obtained from agricultural residues for skin photoprotection, although further research is necessary to elucidate the underlying mechanisms of action.

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research and innovation programme under grant agreement No. 101023225, and by the Agència Catalana per la Competitivitat de l'Empresa (grant ACCIÓ-Eurecat TRAÇA 2023-NAMOBIN).

P-2

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Pigskin-collagen source of anti-inflammatory peptides (poster)

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Keywords: carrageenan-induced paw edema, cyclooxygenase-2, RAW 264.7 cells

Hydrolyzed collagen is a commonly used functional ingredient. Some collagen hydrolysates exert anti-inflammatory effects after its oral administration. However, there is no evidence that food-derived hydrolysates can reduce local inflammation after topical application. This study aimed to evaluate the effects of a pigskin-collagen hydrolysate and its <10 kDa fraction after topical administration on carrageenan-induced paw edema, and to identify the peptides responsible for these effects. Samples were applied to the rat paw 30 min before subplantar carrageenan injection (15 mg). Paw volume was measured at 1, 2, 3, and 24 h after the induction of the edema. Sodium diclofenac was used as the positive control. Hydrolysate peptides were separated by ultrafiltration and RP-HPLC. Peptide identification in the collected fractions was performed by UHPLC-Orbitrap MS/MS. The ciclooxigenase-2 inhibitory (COX-2i) activities of the RP-HPLC fractions and the synthetic peptides were determined using a commercial kit at 45 and 9 µg/mL, respectively. RAW 264.7 cells were 24h incubated with the synthetic peptides (0.1 mg/mL) prior to LPS stimulation. After 24 h of exposure, nitric oxide (NO) production (Griess method) and COX-2 and inducible NO synthase (iNOS) protein levels (Western Blot) were measured. The <10 kDa fraction reduced carrageenan-induced paw edema by 53.7% and 38.1% at 1 and 2 h, respectively. Both samples also showed COX-2i activity *in vitro*. In the peptide identification, peptides of <3 kDa in the hydrolysate were separated into 23 fractions using RP-HPLC. Fractions F3 and F20 showed the highest COX-2i activities (92.6 and 47.5%, respectively). Nine peptides were identified. Sequences AGERGEQ, GSKGRPG, AGPAGKP, and PGPAGPV selectively inhibited COX-2 between 32.2 and 41.3%. No effects were observed in COX-1 inhibition. Moreover, these peptides reduced NO production (17.9-23.4%) in LPS-stimulated macrophages, and AGERGEQ and GSKGRPG also reduced iNOS and COX-2 protein levels in these cells. These results suggest the

potential of collagen-derived hydrolysate as functional ingredients for the inflammation prevention. Moreover, collagen-derived peptides, specifically AGERGEQ and GSKGRPG, could be useful to manage inflammation by acting on different inflammatory targets. Further studies are needed to evaluate their effects *in vivo*.

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P-3

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Prebiotic properties of fruit and vegetable products enriched with a fibre preparation of potato starch (poster)

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Keywords: prebiotics, microbiota, obesity

Overweight and obesity are currently a social problem affecting over 20% of the population of developmental age and over 50% of the adult population. Among the many factors promoting the development of overweight and obesity, excessive consumption of high-calorie products and those containing easily absorbed, high-calorie food components is significant. The development of overweight and obesity is closely correlated with changes in the intestinal microbiota. The use of a diet containing large amounts of dietary fiber and prebiotics contributes to the establishment of a favorable proportion of the intestinal microbiota of *Bacteroidetes* and *Firmicutes*.

The aim of the study was to determine the prebiotic properties of fruit and vegetable products enriched with a fibre preparation of potato starch (SDexF).

The starch content in the fiber preparation obtained on a semi-industrial scale was determined using the polarimetric method. Morphological and structural studies of starch were performed before and after dextrinization (on a semi-industrial scale) using scanning electron microscopy (SEM) and Fourier transform infrared spectroscopy. The total dietary fiber content (TDF) was determined using the official AOAC 2011.25 method, water solubility by Richter's method and pasting properties using Rapid Visco Analyzer. The prebiotic index was determined after pasteurization of a demonstration batch of processed fruit and vegetable products enriched with a SDexF using the classic breeding method. It was shown that the starch content in the tested preparation was >30%. Dextrinization caused partial loss of graininess. The product had a more or less deformed surface, which was capable of agglutination. The average total fiber content in the preparation was about 32%. SDexF was characterized by almost 100% water solubility and low viscosity. According to the color parameters, fiber preparation was more yellow than native potato starch and the difference in color was noticeable. A positive prebiotic index was shown, which indicates the preservation of prebiotic properties of the potato starch fiber preparation after pasteurization in fruit and vegetable products.

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P-4

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Differential effect of fruit extract consumption on the serum metabolome of Fischer 344 rats depending on the photoperiod (poster)

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Keywords: biological rhythms, metabolomics, phenolic compounds

Phenolic compounds can exert multiple health effects and modulate biological rhythms. Previous studies by our research team have shown that ethanolic extracts obtained from fruits (EEF) modulated triglyceride, glucose, and cholesterol levels in Fisher 344 (F344) rats depending on the consumption photoperiod. The aim of the present study was to investigate the effects of four EEF on the serum metabolome of F344 rats subjected to two different photoperiods. With this in mind, F344 male rats fed a standard diet were divided into two groups: L6 photoperiod (6h light/ 18h darkness, simulating winter) and L18 photoperiod (18h light/ 6h darkness, simulating summer). After 4 weeks of adaptation, the diet was supplemented daily with 100 mg/kg of one EEF (obtained from grape, orange, pomegranate, or persimmon kaki) or 1.5 mL of water (control group) for 2 weeks (n=8 per group). Serum metabolites were quantified by GC-qTOF MS. Metabolomics data were analyzed using PCA identify metabolic patterns and significant interactions between photoperiod and fruit consumption were underscored by PERMANOVA. Key metabolites discriminating metabolic patterns were identified by PLS-DA (VIP-score > 1), and differences were confirmed by Mann-Whitney analysis. Selected metabolites were further used for KEGG pathway enrichment analysis. The results suggested that L6 exposure shifted the serum metabolome towards a higher cardiometabolic risk profile. EEF consumption at L18 induced a metabolome similar to L6-C, except for persimmon kaki. These findings highlight the impact of photoperiod on the effects of phenolic compound consumption and may offer new insights into dietary strategies and nutraceutical development.

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P-5

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A POPi chicken-foot hydrolysate delayed amyloid-β-induced paralysis in *Caenorhabditis elegans* and identification of its peptides (poster)

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Keywords: Alzheimer's disease, bioactive peptides, prolyl oligopeptidase inhibitory activity

Alzheimer's disease (AD) is a progressive neurodegenerative disorder and the most common form of dementia, affecting 40 million people globally. Factors like amyloid β (Aβ) toxicity, tau protein hyperphosphorylation, and neuroinflammation contribute to AD progression by promoting synaptic dysfunction and neurodegeneration. During neuroinflammation, microglia cells release different pro-inflammatory cytokines, inflammatory mediators, and cytosolic enzymes such as prolyl oligopeptidase (POP) into the extracellular space. Inhibition of POP enzyme has been suggested as a potential target for anti-neurodegenerative drugs. This study aimed to obtain a protein hydrolysate from chicken feet with neuroprotective effects and identify its peptides. Twelve hydrolysates with variable POP inhibitory (POPi) activity were obtained under different hydrolysis conditions. Hydrolysates CFH3 and CFH5, showing a remarkable POP inhibition, were assayed against Aβ-induced paralysis in the CL4176 strain of *C. elegans*. Treatment with hydrolysate CFH3 decreased the percentage of paralyzed worms at the end of the study in a concentration-dependent manner (0.5 - 5 mg/mL). This hydrolysate was further fractionated by RP-HPLC, and the peptides from the fraction with the highest POPi activity (F15) were identified by UHPLC-Orbitrap MS/MS. Twenty-three amino acid sequences were selected based on ion abundance and Mascot Ion Score. Nine of them had a PeptideRanker score ≥0.5, indicating a good probability of showing some bioactivity. Moreover, eight of these novel nine peptides contained proline in their structure, which have been associated with good POPi activity. This preliminar study show the potential of protein hydrolysates as a source of neuroprotective peptides. However, further research is needed to validate this neuroprotective effects in other animal models and humans.

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P-6

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Plant-derived peptides ameliorate metabolic syndrome risk factors in diet-induced metabolic syndrome rats (poster)

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Keywords: antihypertensive, cholesterol, protein hydrolysates

Metabolic syndrome, a significant public health issue, involves risk factors like high blood pressure, increased blood sugar, abnormal lipid profiles, and abdominal obesity. In a previous study, the protein hydrolysates Hv62 and Hv12 obtained from a plant-based agri-food by-product under different enzymatic conditions reduced systolic blood pressure (SBP) in SHR and improved the plasma glucose profile after an oral glucose tolerance test (OGTT) in Wistar rats, respectively, after a single administration (currently preparing the patent). The present study evaluated the efficacy of the 4-week administration of a mixture of Hv12 and Hv62, namely HMix, on SBP and biochemical parameters in diet-induced metabolic syndrome rats. The mechanisms underlying antihypertensive effects were also investigated. Wistar rats fed a cafeteria diet (CAFd) for 8 weeks were supplemented the last 4 weeks with HMix (140 mg/kg) or water (control). Body weight (BW) and BP (measured using a telemetry system) were recorded weekly. OGTT was performed at 7th-week. Blood biochemical parameters were analyzed at the end of the study. The hepatic malondialdehyde (MDA) and aortic gene expression of several endothelial function-related factors were analyzed using a spectrometric method and qPCR, respectively. CAFd increased BW during the experiment, although no differences were observed between groups. HMix-treated rats showed an improved plasma glucose profile after OGTT compared to control rats. At the end of the study, HMix reduced total cholesterol levels compared to the water group and SBP (from the first week of administration). Moreover, treated rats showed reduced hepatic MDA levels and upregulated aortic expression levels of endothelial nitric oxide synthase and Kruppel-like factor 2 genes. HMix could be useful as functional ingredient to ameliorate different risk factors linked to metabolic syndrome, although further studies are needed to confirm their effects in humans. Its antihypertensive effects could be attributed to improvements in oxidative stress levels and endothelial function.

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P-7

Justyna Bucholska, Anna Iwaniak

Bioactive peptides from barley (*Hordeum vulgare L.*) as preventive agents for chronic non-communicable diseases (poster)

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Keywords: bioactive peptides, barley, bioinformatics, antioxidative peptides, peptide inhibitors.

A diet based on cereal grains is not only a source of energy for humans but can also reduce the risk of chronic non-communicable diseases e.g. hypertension, type 2 diabetes. Barley is one of the most genetically diverse cereals. It is a source of polysaccharides, lipids, phenols, proteins [1]. Peptides that build the structure of food proteins have many properties including antioxidant, antihypertensive, antimicrobial functions. The aim of the study was determination of the inhibition of: ACE and α-glucosidase as well as antioxidative activity of barley. The analyses included two steps: *in silico* and *in vitro* experiment. Bioinformatic studies included the analysis of over 100 barley protein sequences. The following tools were used: UniProt database and BIOPEP-UWM databases [2,3]. *In vitro* analysis i.e. extraction of barley proteins, enzymatic hydrolysis using human digestive enzymes, determination of ACE- and α- glucosidase-inhibiting activity and antioxidant effect of barley hydrolysates was empoyed. The last step of experimental study was identification of bioactive peptides with above activities in barley protein hydrolysates. The results showed that barley proteins and their hydrolysates exhibited ACE- and α- glucosidase- inhibiting function and antioxidant activity. Peptides with these biological activities were identified both in barley grain proteins and their hydrolysates.

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P-8

Grażyna Budryn, Joanna Grzelczyk, Ilona Gałązka-Czarnecka

Improved method of maturing black garlic with high antioxidant activity (poster)

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Keywords: black garlic, ultrasound, Maillard reaction products

Black garlic is created by hydrothermal treatment of garlic, which can last up to several weeks. As a result of the Maillard reaction and enzymatic changes, the taste of garlic takes on new sensory characteristics, becomes sweetish vanilla-plum, is soft, slightly sticky and has a dark brown color. The composition of garlic changes significantly, substances with very high biological activity are created, mainly S-allyl-cysteine and its derivatives. In Asian culture it is used to season dishes, while currently in Western countries, due to its proven antimicrobial, anti-atherosclerotic, anti-diabetic, strengthening the immune system and connective tissue properties, it is consumed as a functional food. Black garlic can be provided with such health properties as: contributes to normal immune function, maintens heart health, normal cholesterol and homocysteine levels, contributes to the resistance against temporary stress, helps to maintain the healthy functioning of the heart and blood vessels and a healthy liver function. The scale of black garlic production is constantly growing and new production methods are being sought that allow saving time and energy necessary to achieve optimal transformations in garlic. The scale of black garlic production is constantly growing and new production methods are being sought that will save time and energy needed to achieve optimal garlic transformations.

By using a combination of pre-treatment and maturation conditions of garlic heads, the time required to obtain black garlic intended for direct consumption has been shortened to 2 weeks, while for processing into spice paste, to 1 week.

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P-9

Łukasz Byczyński, Dominik Sikora

Optimization of phycobiliproteins isolation from *Arhrospira platensis* (poster)

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Keywords: spirulina, phycobiliproteins, protein isolation

Arthrospira platensis (spirulina) is a prokaryotic microalga that is an abundant source of protein with a favorable amino acid profile. The majority of the proteins in the cells of this microorganism are two phycobiliproteins: C-phycocyanin (C-PC) and allophycocyanin (APC) occurring in a ratio of about 10:1. These are light blue, fluorescent, and water-soluble molecules that are used in food, as colorants, but also as nutrients. Their hydrolysis products (peptides) are also used, because they have antioxidant, anti-inflammatory, immunomodulatory, and antibacterial properties.

Although several methods have been developed for the separation and purification of phycobiliproteins from spirulina, they are tedious and time-consuming. The aim of our study was to select the most advantageous method of phycobiliprotein extraction from the three proposed ones: mechanical grinding in a planetary ball mill, freeze-thaw cycles, and enzymatic lysis using lysozyme. The research material was a 5% solution of spirulina in 0.05 M succinate buffer at pH 6.5. Mechanical grinding in a ball mill (600 rpm) was carried out in ceramic vessels using zirconium balls of various diameters and a mass of 25 g. Samples were taken after 10, 20, 30, and 40 minutes of simultaneous homogenization and extraction. In a separate experiment, a 5% solution of spirulina was subjected to 8 freeze-thaw cycles. Samples were taken after 2, 4, 6, and 8 cycles. The effect of enzymatic lysis on the amount of released phycobiliproteins was studied using lysozyme at a concentration of 1 mg/ml at the designated incubation times of 10, 20, 40 and 80 minutes at 30°C. All samples were centrifuged at 5000 rpm to remove cell debris. Then, soluble proteins were precipitated using different concentrations of ethyl alcohol: 70, 75, 80 and 85%. The tested protein was centrifuged (10000 rpm), dissolved in deionized water and subjected to analysis of phycobiliprotein content by measuring absorbance at a wavelength of 750 nm and the total protein content using the Lowry method.

The best isolation results were obtained using the method of cyclic freezing and thawing in the range of 4-6 cycles, a larger number of cycles did not increase the protein yield. On the other hand, enzymatic lysis turned out to be the least effective, and homogenization in a planetary ball mill provided good results, but significantly lower than

in the case of cyclic freezing and thawing. On the other hand, ethyl alcohol at a concentration of 85% was the most effective in precipitating phycobiliproteins (regardless of the extraction method).

P-10

Justyna Borawska-Dziadkiewicz, Katarzyna Bykowska, **Małgorzata Darewicz**

Harnessing bioinformatics for unlocking bioactive peptides from fish waste: predicting their release and health potential (poster)

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Keywords: bioactive peptides, fish collagen, bioinformatic tools

The growing demand for sustainable and health-promoting food ingredients has intensified research into the valorization of fish processing by-products. Currently, fish waste constitutes 50–75% of total processed biomass, with collagen-rich fractions such as skin, bones, and scales being an underutilized source of bioactive compounds. Collagen, a major structural protein, has gained attention due to its potential to release bioactive peptides with significant health benefits, particularly in the prevention of civilization diseases.

This study aimed to assess the potential of collagen from selected freshwater fish waste as a source of bioactive peptides with antihypertensive (ACE and renin inhibitors), antidiabetic (DPP-IV, DPP-III, α-amylase, α-glucosidase inhibitors), and antioxidant properties. A bioinformatics-based approach was applied to analyze the amino acid sequences of collagen proteins from grass carp (*Ctenopharyngodon idella*), silver carp (*Hypophthalmichthys molitrix*), pike (*Esox lucius*), zander (*Sander lucioperca*), and rainbow trout (*Oncorhynchus mykiss*). The sequences were retrieved from the UniProtKB database and processed using Clustal Omega to eliminate redundant entries (<80% sequence identity).

Potential bioactive peptide motifs were identified using the BIOPEP-UWM database, and *in silico* hydrolysis simulations were performed with thermolysin, trypsin, proteinase K, papain, and subtilisin to determine the most efficient enzyme for biopeptides release. The generated peptides were further analyzed using ToxinPred for toxicity prediction, PeptideRanker for bioactivity potential, and ADMETlab for intestinal absorption assessment. The results revealed a high frequency of bioactive peptide sequences within fish collagen, with ACE and DPP-IV inhibitors being the most prevalent in type I and XII collagen. In silico hydrolysis demonstrated the efficient release of short-chain (di- and tri-) hydrophobic peptides, which exhibited no predicted toxicity and a high potential for intestinal absorption. These findings suggest that enzymatic hydrolysis of fish collagen could provide valuable biopeptides for functional food applications aimed at cardiovascular and metabolic health support. This study highlights the potential of fish waste valorization within the scope of zero-waste technology and sustainable food production. By integrating

bioinformatics tools with enzymatic hydrolysis simulations, we demonstrate a promising strategy for unlocking the health potential of bioactive peptides from fish collagen, contributing to the development of innovative functional food products.

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P-11

Niall Dickinson, Monika Mieszczakowska-Frąc

Extracting valuable products from food waste streams (poster)

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Keywords: polyphenols, anthocyanidins, berries, chokeberry

Fruit juices such as orange, apple and berry juice are very popular as part of a balanced diet, providing refreshment as well as a host of vitamins and functional compounds such as antioxidants which are important to health and wellbeing. Poland is the largest producer of berries in the EU and is among the world leaders in berry production alongside Mexico, Papua New Guinea, Vietnam and Bangladesh (FAOstat). Berries which are dark in colour, such as blackberries, blackcurrants and chokeberry are characterized by their extraordinary antioxidant potential, largely due to the high content of anthocyanidins. A significant proportion of these berries are processed into fruit juices, which results in the production of large amounts of pomace. This pomace is often utilized as animal feed, sources of biofuel and in compost production. Fruit pomace, especially from berries, contains large amounts of antioxidants, such as polyphenolic compounds (PPs) which have high valorization potential, for example in the incorporation of cosmetic and health food products. The potential of the PP extraction process is that there is zero waste – the green solvents used to extract PPs can be recovered and reused, while the pomace post PP extraction can continue to be processed as before.
The poster will describe our process of extracting PPs from chokeberry pomace using ethanolic water mixtures, the characterization of these PP extracts by chromatographic methods and the potential application of these extracts in human health, agriculture, environmental protection and material sciences.

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P-12

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Effect of *in vitro* digestion on biological activities of vegan lunch soups naturally enriched with cholinesterase inhibitors (poster)

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Keywords: dinner soups, Alzheimer's disease, anti-cholinesterase activity

The aim of this work was evaluation of the anticholinesterase, antioxidant, and anti-inflammatory activities of newly designed dinner soups (undigested and after *in vitro* digestion), created for the supporting of Alzheimer's disease (AD) prevention. Mushroom, asparagus, leek and sea buckthorn soups were chosen among 18 pre-tested soups. All freshly prepared soups were very rich sources of polyphenols (TPC in the range of 90.43–247.36 μg GAE/cm^3). In the case of all soups, the significant ($p<0.05$) loss of TPC was observed until the addition of bacterial *inoculum*, but at this time point, TPC of asparagus soup further insignificantly decreased until the end of digestion whereas, in the case of other soups, significant ($p<0.05$, sea buckthorn soup) or insignificant ($p>0.05$, mushroom and leek soups) increases were observed. Antioxidant activities, measured with DPPH*, initially high in the case of all four undigested soups, were significantly decreased either at the "mouth", "stomach" or "small intestine phase". Then, significant, or insignificant ($p<0.05$) increase (sea buckthorn and asparagus soups, respectively), no change (mushroom soup) or the insignificant ($p<0.05$) loss (leek soup) was observed. As for the antioxidant activities measured with ABTS^{+*}, the consistent, significant ($p<0.05$) loss of the activity was observed in the case of sea buckthorn soup. Other soups also significantly ($p<0.05$) lost their activities relative to corresponding undigested soups, however, in all these three cases, the unexpected significant increase of the activity appeared at the end of the "small intestine". It is worth to note that even if the undigested mushroom soup showed high antioxidant activity in comparison with other soups, its activity was substantially lost and at the end of digestion: it was equal to the activity of digested asparagus soup and even significantly ($p<0.05$) lower than the activity of sea buckthorn soup. Soups digested in the "large intestine" after adding bacteria had the highest affinity for the enzyme. In particular, mushroom soup, ΔG=-71.18 kJ/mol, which also showed a high ΔH response, -66.99 kJ/mol and a low soup dose (7.78 μmol/μmol AChE) to inhibit 50% of the enzyme activity. **In**

summary, soups are a potential source of non-toxic, natural AChE and BChE inhibitors, protecting acetylcholine from hydrolysis.

P-13

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Effects of sea buckthorn pulp oil on the cholesterol biosynthesis pathway (poster)

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Keywords: cholesterol, palmitoleic acid isomers, sea buckthorn oil

Sea buckthorn pulp oil (SBO) has garnered attention for its potential health benefits, particularly in the context of lipid metabolism and cholesterol biosynthesis. We have investigated the effects of SBO on the cholesterol biosynthesis pathway in HepG2 cells, a model for human hepatocytes. Our findings indicated that SBO, mainly when in vitro digested, significantly reduced cholesterol levels in steatosis-induced HepG2 cells. This reduction was associated with the modulation of 3-hydroxy-3-methylglutaryl-coenzyme A reductase (HMGCR) expression, a rate-limiting enzyme in the cholesterol biosynthesis pathway. Additionally, molecular docking suggested that components of SBO may directly interact with HMGCR, potentially inhibiting its activity. The study also highlighted the differing effects of SBO on normal and steatotic cells, showing a more pronounced cholesterol-lowering effect in steatotic conditions. These results emphasize the potential of SBO as a therapeutic agent for managing cholesterol levels and addressing metabolic disorders, such as metabolic dysfunction-associated steatotic liver disease.

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P-14

Radosław Gruska, Alina Kunicka-Styczyńska, Andrzej Baryga

Fructooligosaccharides (FOS) – the hidden treasure of sugar industry (poster)

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Keywords: fructooligosaccharides, sugar industry, sugar beetroots

Prebiotic properties of fructooligosaccharides (FOS) and their positive impact on animal intestinal tract homeostasis have received substantial attention in both scientific study and the food industry. By stimulating the growth of probiotic bacteria such as *Bifidobacterium* and *Lactobacillus* genus, FOS improve gut microbiota balance and mineral absorption, ultimately contributing to overall health. The global FOS market is anticipated to increase to USD 3.9 billion dollars by 2027, driven by increasing demand for functional food and infant formulas. This review presents recent investigations on the possibilities of FOS sourcing from sugar beets and semi-finished products or by-products of the sugar industry, specifically pulp, sugar juices and molasses. Rich in cellulose and pectin, sugar beetroot pulp can be hydrolysed enzymatically with cellulases and polygalacturonases to produce oligogalacturonides and arabinooligosaccharides (AOS), with the best yields about 27 kg of oligosaccharides per 100 kg of pulp. Additionally, molasses and juices, with high sucrose contents can also be converted into FOS (GF_2, GF_3, GF_4) through the action of transfructosylases, resulting in carbohydrate conversion yield of 49–56%. Various enzymatic synthesis procedures have been examined, including the use of fructosyltransferase and β-fructofuranosidase to catalyze the transfructosylation of sucrose into FOS. Fresh and stored sugar beet roots also represent potential sources of FOS, with stored roots collecting kestose up to about 3.5%.

The economic advantages to avail of sugar beets, sugar industry semi-finished or by-products are considerable due to lowering of raw material costs by 30–50% compared to pure refined sucrose. However, issues remain in the balance between transfructosylation and hydrolysis, as well as in refining of purification methods to remove unwanted monosaccharides and melanoidins.

In conclusion, not only sugar beet, but also semi-finished products and sugar industry's by-products, once considered waste, are now viable substrates for FOS production. However, it should be underlined that expanding the application of FOS and to unlock the full potential of FOS as the "hidden treasure" of the sugar industry, significant investments in biorefinery technology and improvements in enzyme engineering are necessary.

P-15

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The potential of the combined osmoconcentration-lactic fermentation process in shaping the profile of bioactive components of different onion varieties (poster)

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Keywords: onion, osmoconcentration, lactic fermentation

It is extremely important to look for natural ways to maintain the shelf life of the food as well as ensure the health of the consumers. One way is to use osmoconcentration, another - lactic acid fermentation. However, the mechanism of their mutual relationship is unknown. One of the aims of the research was to use both osmoconcentration and lactic acid fermentation and determine their effect on the properties of fermented onion varieties. The research material was onions of popular varieties on the European market. As well as the bulbs of new varieties at the market launch, with promising yields and disease resistance. Selected onions varieties (Medaillon, SG 8411, SG 8441, SG 8444, 37-128, Hybelle, Red Tide and Redshine) were subjected to the osmoconcentration process using sorbitol, lactitol, lactose and glucose-fructose syrup in various concentrations. Fermentation was carried out by strains *(Lactiplantibacillus plantarum* P3 and P27) isolated from spontaneous fermentations of raw onion and selected based on probiotic features from 34 cultures. Additionally, a strain with documented probiotic features, *Levilactobacillus brevis* ŁOCK 0944, was used. The effect of osmoconcentration on the course of lactic acid fermentation was assessed on the basis of the growth of lactic acid bacteria, changes in bioactive compounds and the profile of bacterial metabolites.

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P-16

Joanna Grzelczyk, Joanna Ziętala, Grażyna Budryn

Evaluation of the health-promoting properties of a functional drink based on teas and herbs (poster)

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Keywords: functional drink, tea, herbs

Functional drinks have beneficial physiological effects. They provide essential nutrients such as protein, fiber and vitamins. They also play a key role in disease prevention. Depending on the ingredients used, they can increase energy and vitality, improve sleep, improve the digestive system or have antidepressant effects. Most often, functional drinks contain teas and herbs, which are products with a high content of bioactive compounds [1,2].

The aim of the study was to evaluate the health-promoting properties of a functional drink based on tea and herbs. For this purpose, various types of teas and herbs with mood-enhancing properties will be used. The following contents were determined in functional beverages: water using the dryer method, mineral compounds in the form of ash using the combustion method, tannin content using the titration method, colour, pH, organoleptic evaluation, antioxidant activity using the DPPH method.

In this study, a blend of green tea, black tea, lemon balm, chamomile, mint, ginseng, matcha, and ginkgo extracts was used to create 3 functional drink recipes. The resulting drinks had a calming effect and influenced sleep, energy and arousal, as well as memory and concentration. The drinks showed high antioxidant potential and low tannin content. Beverages with the addition of apple juice instead of sugar showed the highest consumer acceptability.

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P-17

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Kiwiberry (*Actinidia arguta*) as a marinade ingredient – antioxidant potential, bioactive compounds and fatty acid profile and their impact on the health properties of beef (poster)

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Keywords: minikiwi, polyphenols, fatty acid

Antioxidants are compounds that protect cells and tissues from the adverse effects of oxygen-free radicals, which contribute to the development of diabetes, heart disease and cancer in the human body. The primary sources of antioxidant compounds are vegetables and fruits, including kiwiberry, also known as minikiwi. At the same time, fat intake and the amount and composition of fats are also associated with the risk of developing metabolic diseases. The lipids of kiwiberries (located mainly in seeds) contain large amounts of linolenic acid (C18:3n-3), which is valuable from a nutritional point of view. One of the objectives of this study was to evaluate the antioxidant properties and fatty acid profile of minikiwi fruit pulp (*A. arguta* cv. 'Ananasnaya') and its impact on selected meat characteristics when used as a marinade component. On a fresh mass basis, the total polyphenol content in the fruit pulp was 656.62 mg GA/100 g FM. The antioxidant activity, measured using the ABTS method, was 6.97 mmol TE/100 g FM, while the FRAP method yielded 10.42 mmol TE/100 g FM. According to the study, the total chlorophyll content in the fruits was 5.37 mg/100 g FM, and the total carotenoid content was 1.10 mg/100 g FM. The content of phenolic acids was 380.37 mg/100 g DM, and the flavonol content was 51.45 mg/100 g DM. Since the 'Ananasnaya' is a green-red skin variety, trace amounts of anthocyanins were also detected in the pulp. The fat content of kiwiberry fruit pulp was 0.54 g/100 g FM. The lipids of the 'Ananasnaya' cultivar were dominated by PUFA (74.87%), the leading representative of which was C18:3n-3 (65.55%). The only representative of MUFA was C18:1n-9cis (15.66%). The proportion of SFA was 9.48%, including 7.3% of C16:0 and 2.18% of C18:0. Beef marinated in brine with 10%, 20%, and 30% added fruit pulp and treated sous-vide had higher antioxidant activity than the control group but decreased with storage time. Beef marinated with fruits had a more favourable PUFA/SFA ratio than the control samples. Despite the higher content of ALA in the samples marinated with fruits, there were no significant differences in n-6/n-3. For the 30% samples, the n-6/n-3 ratio was less favourable, possibly due to C18:2n-6 content in

kiwifruit. The lipids of beef treated with 30% fruit had more C16:0 acid, which is known to contribute significantly to the pathogenesis of various diseases.

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P-18

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Phenolic compounds as cholesterol esterase inhibitors

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Keywords: cholesterol esterase, phenolic compounds, chokeberry fruit

Obesity is considered an epidemic of the 21st century and is primarily seen as a lipid metabolism disorder that is closely related to excessive levels of lipids and cholesterol in the blood. Excessive levels of free cholesterol in the blood contribute to increased levels of low-density lipoproteins (LDL) and triglycerides, which contributes to the accumulation of LDL particles in the inner layer of arteries, which may result in atherosclerosis and cardiovascular diseases. The efficiency of dietary cholesterol absorption depends on the activity of cholesterol esterase (CE). Therefore, targeted inhibition of this enzyme, similarly to pancreatic lipase, is used as one of the therapeutic approaches.

The aim of this study was to evaluate the inhibitory potential of phenolic compound extracts from chokeberry fruit, radish root and red cabbage against CE. Moreover, five reference substances of phenolic compounds (chlorogenic acid, (+)-catechin, procyanidin B1, quercetin-3-glucoside and cyanidin-3-glucoside) as well as simvastatin were studies. The effect of the above-mentioned samples on cholesterol esterase activity was assessed using 3 methods: (1) in a simple measurement system with *p*-nitrophenyl butyrate (*p*-NPB); (2) a new, previously undescribed method with cholesterol esters as substrates, and (3) in a simulated intestinal digestion system of egg yolk.

Chokeberry fruit extract demonstrated the ability to inhibit CE activity in the method with a synthetic substrate and natural cholesterol esters, while vegetable extracts did not show any inhibitory properties. Simvastatin, a drug lowering LDL cholesterol, was characterized by lower inhibitory activity towards CE than chokeberry extract. In the simulated digestion method, none of the extracts significantly demonstrated the ability to inhibit the release of fatty acids from egg yolk. Moreover, the results using standard substances confirmed the influence of the structure of phenolic compounds on their efficiency in inhibiting cholesterol esterase activity, as well as the dependence of the IC_{50} value on the type of substrate used.

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P-19

Elżbieta Karlińska, Monika Kosmala, Joanna Milala

Seasonal changes in the agrimoniin content in the fragrant agrimony *Agrimonia procera* Wallr (poster)

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Keywords: *Agrimonia procera* Wallr., agrimoniin

The physiological role of secondary metabolites in plants has not yet been fully explained. So far, it is known that they may serve as natural agents protecting the plant against pathogens (viruses, bacteria, fungi), pests, herbivores, and stressful effects of abiotic environmental factors (UV radiation). Plants have developed systems that strictly regulate the processes of accumulation and/or secretion of secondary metabolites by individual tissues and organs, and translocation of natural compounds between plant organs also often occurs[1]. Fragrant agrimony, *Agrimonia procera* Wallr. belonging to the genus *Agrimonia* (*Rosaceae*) is a rich source of polyphenolic compounds, especially agrimoniin – a dimeric ellagitannin composed of two bis-hexahydroxydiphenyl-glucose units connected by an α-glycosidic bond through two gallic acid residues[2]. Agrimoniin has a wide range of biological properties: anticancer, antidiabetic, anti-inflammatory, antiallergic. The aim of the study was to investigate the changes in the content of agrimoniin in leaves, stems and rhizomes together with roots of the fragrant agrimony *Agrimonia procera* Wallr., in the vegetative and generative growth stages. In the above-mentioned morphological parts of the plant, the content of dry mass and agrimoniin were determined. It was shown that the dry matter content in the studied period varied within the range from 22.1 to 40.8 g/100 g in leaves, from 16.1 to 35.1 g/100 g in stems and from 26.0 to 40.0 g/100 g in roots and rhizomes of *A. procera*. The agrimoniin content in *A. procera* leaves in the vegetative and generative periods varied within the range of 3.5–5.2 and 1.2–4.0 g/100 g DW, respectively. In stems, the agrimoniin content was 7.0–17.3 in the vegetative period and 11.1–5.7 g/100 g DW in the generative period. The underground part of *A. procera* in the juvenile growth period was characterized by agrimoniin content in the range of 11.5–17.2 g/100 g DW, while in the generative stage it varied in the range of 6.5–9.8 g/100 g DW.

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P-20

Paulina Kęska, Joanna Stadnik

The effect of the addition of cell-free supernatant (CFS) from *Lacticaseibacillus paracasei* B1 on the quality of cooked pork sausages with reduced sodium nitrite level (poster)

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Keywords: CFS, lactic acid bacteria, pork sausages

The use of post-culture fluids of lactic acid bacteria strains may be a new potential method of protecting meat products against the development of microflora causing their spoilage. CFSs contain many secondary metabolites, including those with antimicrobial and antioxidant activity. Potentially, their use in the meat industry may contribute to a partial reduction in the use of preservatives. However, such an approach requires comprehensive analyses in terms of assessing the quality of finished products and their health safety. The aim of the study was to assess the possibility of using post-culture fluids obtained as a result of a 48-hour culture of the *Lacticaseibacillus paracasei* B1 strain in the form of a lyophilisate (1%) in the production of pork sausages. The scope of the research work carried out included the assessment of basic physicochemical parameters (pH, a_w), the content of secondary fat oxidation products (TBARS) and the level of fatty acids, as well as selected texture parameters. The studies also included an assessment of the antioxidant potential of water extracts obtained from the products and a microbiological analysis of the products. The results indicate the possibility of using post-culture fluids obtained as a result of culturing selected strains of L. *paracasei* B1 bacteria in the form of a lyophilisate to extend the storage life of cooked sausages, but it is impossible to completely eliminate sodium nitrite from the sausage recipe.

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P-21

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Polyphenolic compounds of plant-based milk fortified with fruit powders (poster)

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Keywords: fruit powders, plant-based milks, polyphenolic compounds

Polyphenols are a key component of functional foods and nutraceuticals, valued for their high biological activity, like antioxidant, anti-inflammatory, and cardiovascular protection, and wide occurrence in plants. One of the solutions to increase the durability of polyphenols and facilitate their introduction into the diet is the production of fruit powders rich in bioactive compounds. In the context of the growing trend to abandon animal products and the increase in the consumption of plant-based beverages, polyphenols can be a valuable addition to plant milks, such as soy or oat beverages.

In the study, soy and almond milk were enriched with fruit powders obtained from mixed fruit juices using the spray drying method. The first powder (P1) consisted of apple, rhubarb, and *Rosa Canina* juice and lemon balm extract. The second powder (P2) consisted of pear, rhubarb, and Japanese quince juice, and lemon balm extract.

In the milks analysed after adding fruit powders, statistically significant changes in the profile and content of polyphenols were observed. In soy milk without additives, 24 polyphenolics were identified in a total amount of 90.15 mg/L. After fortification of P1, 29 polyphenols were identified (126.49 mg/L), while in P2, 28 compounds were identified (125.44 mg/L). In oat milk without additives, a total of 8 polyphenols were identified (15.53 mg/L). After fortification with P1, the number of compounds increased to 27 (50.28 mg/L), while after adding P2, the number of compounds was up to 24 (36.19 mg/L).

The analysis showed that fortifying plant milk with fruit powders not only increases its nutritional value, but also improves its health-promoting properties, meeting the current needs of consumers who care about a healthy and plant-based diet.

The research is part of the project SEASONED – Advances in Food Sensory Analyses of Novel Foods (www.seasonedproject.eu), which received funding by the European Union under the Horizon Europe "Widening participation and spreading excellence" program (Grant agreement 101079003).

P-22

Joanna Kolniak-Ostek, Marcelina Stach

Profile of bioactive compounds determined by the UPLC-PDA-Q/Tof-MS method in coloured raspberries (poster)

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Keywords: raspberries, phenolic compounds, UPLC-PDA-Q/Tof-MS

Due to the increasing prevalence of diet-related diseases such as diabetes and obesity, consumers seek foods rich in bioactive compounds with health benefits. One such product is raspberry fruit (*Rubus idaeus* L.), which contains vitamins and has anti-inflammatory, antipyretic and metabolic support properties. The polyphenols in raspberries are highly biologically active, contributing to their antioxidant and anti-inflammatory effects. They neutralize free radicals, reduce peroxides, and prevent oxidation of vitamin C, carotenoids, and unsaturated fatty acids. Polyphenols such as anthocyanins and flavonols offer cardioprotective effects and lower the risk of cancer, diabetes, and Alzheimer's disease. Additionally, they have antibacterial, antiviral, and antimutagenic properties, support vascular stability, inhibit platelet aggregation, and protect LDL from oxidation, reducing the risk of atherosclerosis.

The study analyzed three varieties of raspberry: red 'Polesie', yellow 'Poranna Rosa' and black 'Nord Smelling'. Freeze-dried fruits were extracted using 80% methanol with 1% HCl, and polyphenolic compounds were analyzed using the ACQUITY UPLC system with a Q-Tof mass spectrometer.

A total of 58 polyphenolic compounds were identified, including anthocyanins, phenolic acids, ellagic acid derivatives, and flavonol glycosides. The red raspberries contained the highest number (48 compounds), followed by black (38) and yellow raspberries (34). The highest anthocyanin content was found in red and black raspberries (9 compounds each), while yellow raspberries contained 4 compounds. Red raspberries had the highest amount of phenolic acids and derivatives (10), followed by yellow (9) and black (8). The highest number of ellagic acid derivatives (7) was found in yellow raspberries, followed by red (6) and black (4). Regarding flavonol glycosides, red raspberries contained 18, while black and yellow had 17 each.

The analysis revealed differences in polyphenolic compound profiles among raspberry varieties. Due to the diverse biological properties of polyphenols, these differences significantly impact the health-promoting potential of the fruit.

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P-23

Anna Kononiuk, Anna Korzekwa

Red deer meat as a source of bioactive peptides (poster)

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Keywords: venison, antioxidant properties, simulated digestion

Deer meat seems to be rather undervalued meat. In addition to its high nutritional value including low-fat content with a high proportion of unsaturated fatty acids and higher protein content, it is meat unaffected by pharmaceutical residues, the acquisition of which has less impact on the environment (lower greenhouse gas emissions, extensive nature of farming). Current nutritional trends emphasize food as a source of bioactive peptides (BAPs), which can positively affect physiological functions. In this regard, the potential of deer has yet to be explored. Thus, research aimed to evaluate the potential of red deer meat as a source of bioactive peptides compared with beef. To estimate the potential of both types of meat to form bioactive peptides, bioinformatics tools were used to perform in silico digestion of selected proteins and evaluate the activity of the resulting peptides, protein analysis using bioinformatics tools, and evaluation of the antioxidant potential and for ACE I inhibition of meat hydrolysates subjected to simulated digestion. The research material consisted of wild red deer meat and Limousine. Next, the red deer meat and beef have been digested following the INFOGEST protocol. In the material obtained, the concentration of peptides, their antioxidant activity (ABTS and DPPH), and their ability to inhibit ACE I were determined. The results of the *in silico* study showed that the compared deer proteins are more susceptible to hydrolysis processes than beef proteins and have a higher frequency of bioactive fragments. The most common bioactive protein fragments are responsible for the ability to inhibit ACE, inhibit DPP-4, and antioxidant activity. The results of laboratory studies show that raw deer meat contains about 32% more peptides than beef and their antioxidant activity against the ABTS radical is about 29% higher while the ability to ACEI inhibition is 16% higher. DPPH radical scavenging activity does not differ significantly. In contrast, in hydrolysates after simulated digestion, the differences between red deer meat and beef are no longer so great, and hydrolysates after digestion of deer meat are characterized by about 28% higher content of peptides, whose antioxidant activity against the ABTS radical as well as the ability to inhibit ACE I is higher by 2.5% while DPPH radical scavenging activity is higher by 10% than for hydrolysates from beef meat.

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P-24

Eliza Korkus, Marcin Szustak, Grzegorz Dąbrowski, Sylwester Czaplicki, Maria Koziołkiewicz, Iwona Konopka, Edyta Gendaszewska-Darmach

Sea buckthorn (*Hippophae rhamnoides* L.) as a source of fatty acids involved in maintaining glucose homeostasis (poster)

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Keywords: diabetes, fatty acids, GPCR

Type 2 diabetes is the first non-communicable disease recognized by the United Nations as a pandemic problem of the 21st century. [1] It is necessary to search for new anti-diabetic drugs, including those targeting activation of G Protein-Coupled Receptors, as well as the development of new dietary strategies to alleviate diabetes-related discomfort. An ingredient that can enrich the diet of people with metabolic diseases is sea buckthorn (*Hippophae rhamnoides* L.). Sea buckthorn fruits are a source of many bioactive substances - carotenoids, sterols, tocols and fatty acids, especially the *cis* isomer of monounsaturated palmitoleic acid, which, according to available sources, has a beneficial effect on metabolic parameters disrupted in type 2 diabetes.

In the present study, we evaluated the antidiabetic potential of Luczystaja sea buckthorn fruit pulp oils obtained by various extraction methods. It was proved that the insulinotropic potential of the tested oils is due to the activity of fatty acids, acting as ligands of four receptors involved in the maintenance of glucose and lipid homeostasis: GPR40, GPR55, GPR119 and GPR120.

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P-25

Monika Kosmala, Elżbieta Karlińska, Joanna Milala

Nutritional and phenolic components of edible, aerial parts of selected medicinal plants from *Rosaceae* family (poster)

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Keywords: *Sanguisorba, Geum, Agrimonia*

Edible herbs of the *Rosaceae* family, burnet, agrimony, and avens (*Sanguisorba, Agrimonia, Geum,*) are used in medicine as anti-bacterial, antidiarrheal and anti-inflammatory herbs for the intestines. Their actions are related to the presence of tannins, which are divided into hydrolyzable (ellagitannins, ET) and condensed tannins (proanthocyanidins, PC). ET are esters, usually β-D-glucose and hexahydroxydiphenyl acid (HHDP), with a large variety in structure and properties. The product of the colonic microbiota hydrolysis of ellagitannins are urolithins. Urolithins show antioxidant, anti-inflammatory, and anti-estrogen/estrogen activity. Fresh leaves of the herbs, great burnet, fragrant agrimony, and avens contain mainly water (dry weight: avens, 18.7, great burnet, 19.7, and fragrant agrimony, 24 g/100 g). They are a source of dietary fiber (burnet, 6.5 g/100 g, avens, 8 g/100 g, and agrimony 11.1 g/100 g), mainly insoluble fraction. Ash content was about 2 g/100 g, protein less than 1 g/100 g. The metabolized carbohydrates are 4-5 g/100. The content of vitamin C in fresh herbs *Geum* (*G. urbanum* and *G. rivale*) was 72- 132 mg/100 g; fragrant agrimony *Agrimonia procera* 64- 140; *Sanguisorba minor* 139, and 94 mg/100 g *Sanguisorba officinalis*. Fresh herbs are mainly the source of ellagitannins. In the case of burnet 86% of polyphenols are oligomeric ellagitannins, mainly agrimoniin, lambertianin C, sanguiin H-6 and lambertianin A. Other polyphenols include quercetin glycosides, flavan-3-ols, monomeric ellagitannins and chlorogenic acids. In the case of agrimony, 41% of the total polyphenols is dimeric agrimoniin, 28% polyphenols of flavan-3-ols, 5.6% of flavonols, including rutin, quercetin, and luteolin glycosides and tiliroside. Avens is a source of dimeric gemin A, which accounts for 72% of the total polyphenols, 8% of chlorogenic acids, 8% of monomeric ellagitannin, flavan-3-ols in a smaller amount, and quercetin glycosides in trace amounts. Fresh herbs of burnet (0.004% in fresh weight) and avens (0.01% in fresh weight) contain negligible amounts of flavan-3-ols compared to agrimony (0.95% in fresh weight). Medicinal plants in the early stage of development are several times richer source of ET than berries. Due to their resistance to fungal diseases and pathogens, selected medicinal plants are free from pesticides. *Sanguisorba* and *Geum* are tasty and can be the basis of dishes and salads.

P-26

Dariusz Kowalczyk

Natural vs. synthetic Astaxanthin: properties, applications, and market perspectives (poster)

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Keywords: astaxanthin, dietary supplement, antioxidant

Astaxanthin (ATX), a red amphiphilic keto-carotenoid, has attracted significant attention in the food and cosmetic industries due to its potent antioxidant properties, being 10 to 1000 times more effective than other natural antioxidants, and offering a wide range of health benefits, including cardioprotective, hepatoprotective, anti-inflammatory, neuroprotective, anticancer, and skin-rejuvenating effects [1]. The growing popularity is reflected in the increasing number of publications on ATX, which has risen from just two studies in 1948 to 461 annually by 2024, totaling almost 4,000 studies to date.

Natural ATX is produced by the microalga *Haematococcus pluvialis* and accumulates in organisms such as shrimp and salmon that feed on it. At the industrial scale ATX can also be derived from the yeast *Xanthophyllomyces dendrorhous* (formerly *Phaffia rhodozyma*) [1]. The European Union (EU) regulation 2024/1026 (amending regulation 2017/2470 on novel food) approved ATX-rich oleoresin from *H. pluvialis* for human consumption. Other EU-approved dietary sources of ATX include oils from crustacean *Calanus finmarchicus* and Antarctic krill. Although natural ATX offers various benefits, it faces challenges such as high price, low stability, variability in pigment composition, and the presence of undesirable compounds. Consequently, more than 95% of the ATX on the market is synthetic, primarily due to its cost-effectiveness. However, synthetic ATX exhibits weaker antioxidant activity compared to the natural form, as it lacks the accompanying substances and specific isomer composition [1, 2]. The European Food Safety Authority has set the acceptable daily intake for both natural and synthetic ATX at 0.2 mg/kg body weight. According to EU regulation 2020/998, synthetically obtained astaxanthin-dimethyldisuccinate is approved as a feed additive for fish and crustaceans. It is considered safe for animal health, consumers, and the environment, as it is converted into free ATX in fish intestines [2]. In the USA, since 2020, synthetically derived water-soluble ATX (under trade name AstaSana™ 5% CWS/S-TG) by DSM Nutritional Products LLC has been officially approved as a dietary supplement, with a safe maximum daily dose of 12 mg ATX/kg body weight [3].

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P-27

Bartosz Kulczyński, Anna Gramza-Michałowska

Effect of osmotic dehydration of beet pulp on iron content (poster)

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Keywords: osmotic dehydration, beetroot, iron

In recent years, there has been a growing interest in the development of functional foods, which includes strategies aimed at the selective use of plants and microorganisms as biological carriers to enrich food with specific nutrients [1]. An important element of functional food production is also the use of physicochemical methods that allow for increasing the content of minerals, vitamins, probiotics and antioxidants in plant raw materials. Vegetables and fruits are most often used as a plant matrix. One of the physicochemical methods that allows plants to be enriched with specific bioactive substances is osmotic dehydration. As a result of osmotic dehydration, water migrates out of the cells through semi-permeable membranes, while some substances dissolved in the solution penetrate into the tissue. This process plays an important role in the food industry, especially in the context of food preservation, modification of its sensory properties and improvement of its health benefits [2, 3]. Research has proven that osmotic dehydration is an effective method of enriching beet pulp with iron. This process was carried out with the following parameters: temperature range: 20-60°C, time: 30-120 minutes, chemical form of iron: iron sulphate, level of added iron: 1% of solution mass, osmotic substance: inulin, concentration of osmotic substance: 25-50%. It was shown that the iron content in the dehydrated samples ranged from 47.78 to 74.91 mg Fe/100 g.

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P-28

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Interactions of selected polyphenols with some allergens (poster)

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Keywords: polyphenols, allergens

Foods rich in polyphenols are attributed with beneficial effects on human health. Phenolic compounds are secondary metabolites synthesized by plants in response to environmental stress, along defense proteins. Some of defense proteins exhibit strong allergenic properties. This raises the question: Can health-promoting foods rich in polyphenols be more allergenic?

This study attempts to evaluate the immunoreactivity of Bet v 1 allergen analogs and profilins modified with selected phenolic compounds.

Seven phenolic compounds were used for protein modification: gallic acid, caffeic acid, ferulic acid, o-ferulic acid, p-coumaric acid, m-coumaric acid, ellagic acid, chlorogenic acid, and raspberry extract. Immunoreactivity was assessed using monoclonal antibodies against Bet v 1 and antibodies against plant profilin, as well as sera from patients allergic to birch pollen. Immunoreactivity was determined using the indirect ELISA method.

The study revealed that most phenolic acids reduced the degree of protein-antibody binding. The conjugate formed with ellagic acid exhibited significantly higher immunoreactivity compared to pure Bet v 1 and profilin analogs. This effect was likely due to the formation of allergen conjugates with other raspberry proteins that have increased immunoreactivity, as this effect was not observed with pure allergen standards.

This issue highlights the need for further research, as there have been no previous reports on increased antigenicity of allergenic proteins due to modification with phenolic compounds. This finding is particularly important for allergic individuals, as food processing of polyphenol-rich products may, in some cases, lead to a final food product with increased allergenicity.

P-29

Dasha Mihaylova, Galia Gentscheva, Nadezhda Petkova-Ognyanova, Anton Slavov, Aneta Popova

Phytochemical and nutritional profile of apricot, plum-apricot and plum stones (poster)

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Keywords: sustainability, fruit waste utilization, kernels

Fruit stones present major solid waste from fruit consumption and processing. The present study revealed the potential of fruit stones as possible sources of nutritional compounds. Stones from three fruits (the “Modesto” apricot, the “Stendesto” plum-apricot, and the “Stanley” plum) were evaluated in terms of their protein, carbohydrate, lipid, and mineral contents. Their total phenolic content, total flavonoid content, and total anthocyanin content was also evaluated. The antioxidant activity measured by four contemporary assays (DPPH, ABTS, FRAP, and CUPRAC) uncovered the stones’ biological potential. Results regarding the hybrid plum-apricot variety 'Stendesto' are not found in the available literature, making them novel. The findings of the present study revealed that the hybrid's stone has the lowest caloric value in kcal/100g, including fat content, compared to other known stone fruits. Fruit stones can be successfully used as novel food ingredients in line with the need of proper waste management and its possible utilization in various industries.

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P-30

Karolina Miśkiewicz, Justyna Rosicka-Kaczmarek, Gabriela Kowalska, Monika Maksalon

Influence of extraction method on the physico-chemical and antioxidant properties of bioactive polysaccharides from tomato pomace (poster)

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Keywords: bioactive polysaccharides, tomato pomace, unconventional extraction methods

Industrial processing of tomatoes generates a large amount of by-products. One of these is tomato pomace, which consists of skins, seeds and part of the pulp. These are usually used as animal feed or constitute waste, which in turn causes environmental pollution. At the same time, by-products from tomato processing can be a valuable raw material for obtaining substances with health-promoting properties, including bioactive polysaccharides.

Polysaccharides derived from plant material are characterized by antioxidant, antibacterial, anti-inflammatory, anticancer and antithrombotic properties. They are widely used in medicine, food and cosmetics. Polysaccharide preparations are mainly obtained by acid extraction using sulphuric, hydrochloric or nitric acids. These acids may pose a potential threat to human health and the environment. Another problem can be the disposal of large quantities of highly acidic wastewater and waste that are produced at the same time. Therefore, new methods for the production of polysaccharides that meet the requirements of green chemistry are being sought.

The aim of this study was to obtain polysaccharides from tomato pomace using unconventional methods of extraction in an aqueous environment and to characterize their physicochemical and bioactive properties.

Polysaccharides were obtained using the ultrasound-assisted method (UAE) and microwaves (MAE). For comparison, preparations were obtained without any previous modification of the raw material. The contents of protein, ash, galacturonic acid, carbohydrate profile, total phenolic compounds and total flavonoids in the polysaccharides obtained were determined. In addition, their antioxidant properties were determined using the following tests: DPPH, ABTS and FRAP.

The carbohydrate composition, galacturonic acid content, protein and ash content of the polysaccharide preparations were varied according to the extraction method used.

The type of initial modification of the raw material had an effect on the content of total phenolic compounds, the total content of flavonoids in the polysaccharides obtained and their antioxidant properties, expressed by the ability to scavenge the DPPH free radical, the ABTS+ cation radical and the reduction of ferric ions.

P-31

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Cheddar cheese and prepared cheese product slices, as a source of Neu5Gc (poster)

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Keywords: Neu5Gc, cheddar, N-glycan

Neu5Gc (N-glycolylneuraminic acid) is a non-human sialic acid commonly found in mammalian tissues and dairy products. Due to a genetic mutation, humans lack the ability to synthesize Neu5Gc but can incorporate it into tissues through dietary consumption. This process can lead to immune sensitization and the production of anti-Neu5Gc antibodies, contributing to chronic inflammation and potential health risks. While Neu5Gc is well-documented in red meat, its presence in dairy products remains an area of ongoing investigation.

In this study, we analyzed Neu5Gc-containing N-glycans in two dairy products—sharp cheddar cheese and processed cheese slices. It was analyzed using nano HPLC-ESI-MS/MS. Neu5Gc-containing N-glycans were detected in cheddar cheese but were absent in processed cheese slices. This difference is likely due to variations in processing methods that affect the glycan composition.

The presence of Neu5Gc in cheddar cheese suggests potential dietary implications, particularly for individuals with inflammatory conditions or sensitivities to Neu5Gc. While Neu5Gc does not trigger immediate IgE-mediated allergic reactions, prolonged exposure may contribute to immune dysregulation, resembling delayed hypersensitivity responses. Additionally, similarities between Neu5Gc-containing glycans and α-Gal (galactose-α-1,3-galactose), a known allergen responsible for Alpha-Gal Syndrome (AGS), raise questions about possible cross-reactivity in sensitized individuals. Conversely, some studies suggest that Neu5Gc-related immune activation may have beneficial effects, such as enhancing immune surveillance against tumors.

These findings highlight the need for further research on Neu5Gc bioavailability, its immunogenic effects in different populations, and its potential role in inflammatory and allergic diseases. Understanding the dietary impact of Neu5Gc could provide valuable insights into personalized nutrition and immune-related health strategies.

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P-32

Radosław Mostowski

A new method for producing dried meat snacks, such as Jerky, with reduced hardness (poster)

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Keywords: Jerky, a new jerky production, hardness

The technological process necessary for producing Jerky snacks is drying. Drying aims to reduce water content, thereby extending the shelf life of dried products. It is also the most commonly used method to limit water activity in industrial processes for producing dried meat. However, a negative effect of hot air drying is the high energy consumption of the operation and the rapid drying of the product's surface, resulting in a hard texture, often unacceptable to some meat snack consumers. To eliminate the undesirable hardness caused by technological processes in the production of dried meat products, new solutions are constantly being sought to address the issue of hardness while maintaining sufficiently low water activity in the product. The research material consisted of pork loin and beef bottom round. The meats were trimmed of external fat overgrowths, sliced into portions, and marinated at 2°C for 24 hours. After marination, they were cut using a Mesco-AGD jerky slicer (model SP1000-10, Skarżysko-Kamienna, Poland) and divided into two parts. One part underwent traditional drying in an oven with forced air circulation (75°C, 9 hours). The drying time was experimentally determined based on previous studies to achieve a water activity in the product below 0.6. The second part was subjected to an experimental production process involving surface roasting of the meat at 160°C for 8 minutes (experimentally determined time and temperature required to achieve an internal jerky temperature of at least 75°C), cooling, freezing, and lyophilization in a Christ Delta 2-24 LSC sublimation dryer (Martin Christ GmbH, Osterode am Harz, Germany) for 24 hours.The change in the method of producing Jerky led to an alteration in the proportions of the main components of dried snacks. The Jerky produced using the new experimental method was characterized by a significantly higher protein content, a notably lower water content, and a reduced water activity level compared to traditionally made Jerky. Based on the obtained sensory evaluation results, it can be concluded that beef and pork Jerky produced using the experimental method received significantly higher ratings for texture and overall palatability, although it had a less intense aroma than Jerky made using the traditional method. Analysis of the hardness of the tested dried meat snacks showed that

Jerky produced using the experimental method had only about 10% of the hardness value of traditionally made Jerky.

Thus, it can be stated that the use of the experimental new method for producing Jerky significantly reduces the product's hardness, thereby enhancing its palatability. Additionally, the significant reduction in water activity may contribute to extending the product's shelf life.

P-33

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Influence of the expansion method on the polyphenol profile in potato-based extruded snacks enriched with bee pollen (poster)

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Keywords: bee pollen, snacks, polyphenols profile

The aim of the study was to investigate the effect of the expansion method of potato snacks produced with the addition of bee pollen at amounts of 5% and 10% on the profile and content of polyphenols in the final product.

The raw materials used for snack production were potato starch, potato grits, corn flour, and salt. As an additive, multifloral bee pollen was used in amounts of 5% and 10%. The control sample consisted of snacks without the addition of bee pollen. The expansion method used in the experiment was standard frying of pellets in hot rapeseed oil (185°C, 20s) as well as microwaving (800W, 20s). The polyphenols profile was detected by HPLC MS/MS.

Based on the obtained results, it was found that the addition of bee pollen to the snack recipe, regardless of the expansion method, altered the profile of polyphenolic compounds. Snacks with bee pollen contained, in addition to phenolic acids and flavonols present in the control sample, flavanones and polyamines conjugated with phenolic acids. The predominant compounds found in control snacks were quinic acid, caffeic acid hexoside isomer, caffeic acid, and 1-caffeoylquinic acid, whereas in the snacks with bee pollen - caffeic acid hexoside isomer and caffeic acid.

Fat-free expansion method using microwaving allows for obtaining snacks with a higher content of polyphenolic compounds. Snacks expanded using microwaves contained 25% (control) to 60% (5% pollen) more polyphenolic compounds than fried products.

The research is part of the project SEASONED – Advances in Food Sensory Analyses of Novel Foods (www.seasonedproject.eu), which received funding by the European Union under the Horizon Europe "Widening participation and spreading excellence" program (Grant agreement 101079003).

P-34

Andrzej Okruszek, Monika Wereńska, Gabriela Haraf

Using fruit puree marinades to improve goose meat quality (poster)

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Keywords: goose meat, proteolytic enzymes, meat quality

Introduction

Goose meat is distinguished by its high nutritional value, including a favorable fatty acid profile and high protein content. However, its hardness can be a challenge for consumers, affecting its overall palatability. The use of marinades based on fruits such as pineapple and kiwi allows for improving its texture due to the content of proteolytic enzymes, which break down muscle proteins and enhance tenderness. Additionally, these fruits contain natural antioxidants, which may contribute to the improved quality and shelf life of the meat.
The aim of the study was to determine the effect of marinating goose meat in pineapple and kiwi on its texture parameters and sensory evaluation after heat treatment.

Materials and methods

The study used goose breast muscles marinated in pineapple and kiwi puree at a concentration of 3% by weight relative to the mass of the goose meat for 12 hours. The meat was then subjected to heat treatment using the sous-vide method (70°C and 80°C for 6 hours). The control sample consisted of unmarinated sous-vide goose meat. The texture was assessed using a strength testing machine, the colour was measured using a Minolta, the sensory analysis was performed in accordance with ISO 3972:2011.

Results and Conclusions

Marinating goose meat in pineapple and kiwi had a significant impact on its texture and sensory properties. Marinated meat exhibited greater tenderness and improved chewiness compared to the control sample. The highest tenderness values were observed in samples marinated and processed at 70°C, while meat treated at 80°C was slightly firmer. Color analysis showed that marination resulted in a lighter and more attractive appearance compared to the control sample. Sensory evaluation confirmed that marinated meat received higher scores for juiciness. However, the flavor ratings were lower for marinated samples compared to the control sample. The combination of proteolytic enzyme activity from fruit-based marinades and sous-vide processing contributed to improved textural properties, making the meat more appealing to consumers.

P-35

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Optimizing the harvesting time of *Sorbus commixta* Hedl. leaves for functional food applications (poster)

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Keywords: *Sorbus commixta*, harvesting time, phenolic composition variability

Sorbus commixta Hedl. is the most popular Asian rowan species that can be easily cultivated worldwide. The plant has a long tradition of being used as a polyphenolic-reach herbal remedy (leaves, fruits, stem, bark) for diabetes, atherosclerosis and liver disorders[1]. Among the various parts of the *Sorbus* species, the leaves have the greatest potential for industrial applications, as they are readily available throughout the growing season in diverse climatic conditions[2]. Therefore, this work aimed to optimize the harvesting time of *S. commixta* leaves cultivated in Poland and to validate the antidiabetic, antioxidant and anti-inflammatory effects of leaf extracts in vitro. Although the extraction yield for water-alcoholic dry extracts (3:7, *v/v*) was similar (34-39% dw), the extract composition varied significantly depending on the month the leaves were harvested. For instance, the proanthocyanidin content was 5-12% dw, with the highest levels for samples from August and October; the content of flavonoids was 6-12% dw, with the peak level in August; and the content of phenolic acids 10-20%, with the highest level in May. The proportions of individual phenolic compounds also changed notably (HPLC-PDA + UHPLC-MS^n analysis). Ultimately, August was selected as optimal for harvesting the *S. commixta* leaves of the highest phytochemical quality. The biological potential of the chosen extract was verified by measuring its anti-oxidant and anti-nitrative effects in human plasma ex vivo, its ability to inhibit α-glucosidase and protein glycation in vitro, and its ability to modulate the pro-inflammatory functions of human PBMCs ex vivo. The results suggest that *S. commixta* leaves and their water-alcoholic extracts could serve as promising functional food ingredients. Further studies are encouraged to explore their in vivo effectiveness, molecular mechanisms of action, and cultivation methods.

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P-36

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The role of black garlic produced by an innovative short aging method in high-fat diet-induced metabolic disorders (poster)

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Keywords: black garlic, innovative short aging method, metabolic disorders

Black garlic (BG), obtained through the thermal processing of fresh garlic under controlled temperature and humidity conditions, is gaining increasing attention as a functional food. In contrast to fresh garlic, which contains unstable allicin, black garlic is rich in stable and bioavailable organosulfur compounds such as S-allylcysteine (SAC), as well as melanoidins formed during the Maillard reaction. These components are responsible for its strong antioxidant, anti-inflammatory, antidiabetic, anticancer, immunomodulatory, and cardioprotective properties. Furthermore, BG contains neuroprotective compounds, opening up the potential for its use in the prevention of neurodegenerative diseases such as Alzheimer's and Parkinson's disease.

In the present study, an innovative, significantly shortened aging method (lasting up to 5 days, compared to the traditional 20–90 days) was developed, allowing the production of black garlic with a high level of bioactive compounds. Optimized temperature and humidity profiles accelerate biochemical transformations without compromising the quality of active components. The aim of this study was to evaluate the role of BG, produced using the novel short-aging method, in alleviating high-fat diet-induced metabolic disorders. In an in vivo rat model, the effects of BG supplementation were assessed on insulin, adiponectin, and glutathione levels, which are key biomarkers of metabolic health. The results demonstrate that BG obtained through this novel process significantly reduces insulin levels and improves insulin sensitivity, while also increasing adiponectin concentration—a protein known for its anti-inflammatory and insulin-sensitizing effects. Additionally, an improvement in redox status was observed, evidenced by increased glutathione levels, indicating reduced oxidative stress.

This study suggests that BG produced using a short aging process may serve as a promising, natural dietary component supporting the treatment of diet-induced metabolic disorders, offering an effective tool for the prevention and management of metabolic diseases.

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P-37

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Biological potential of the pectin-like polysaccharide from *Sorbus aucuparia* L. fruits (poster)

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Keywords: polysaccharide, *Sorbus*, biological activity

Numerous studies indicate that plant polysaccharides show multiple functional activities, primarily anti-inflammatory and hypoglycemic effects[1]. Similar properties were reported for *Sorbus aucuparia* fruits (rowanberries) and partly attributed to their polyphenolic fraction[2,3]. Contribution of other constituents like polysaccharides was also suggested; however, this hypothesis lacks experimental verification[3]. Therefore, in this study, the rowanberry polysaccharide, composed of mainly galacturonic acid residue, was isolated from the fruits and proved to strongly inhibit α-amylase and α-glucosidase activity in vitro (with effects similar and 20 times stronger than observed for acarbose, respectively), as well as to reduce the secretion of pro-inflammatory cytokines (TNF-α, IL-2) in the concanavalin A-stimulated PBMC cells (with effects similar to dexamethasone or diclofenac). Moreover, the polysaccharide fraction did not affect Caco-2 and HepG2 cells viability under conditions of normal glucose (12.2 mM) or increased glucose levels (50 mM), and thus it can be assumed safe. promising results indicate the polysaccharide is a primary activity vector of rowanberries and an auspicious candidate for further studies on its potential in treating metabolic diseases and as functional food ingredient.

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P-38

Beata Smolińska

Effect of copper nanoparticles on total phenolic concentration in *Lepidium sativum* L. (poster)

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Keywords: copper nanoparticles, plant growth, phenols

Copper nanoparticles (Cu-NPs) are promising nanotechnological tool in agronomy mainly by improving bioavailability and controlled release of copper. These allow to reduce a dosage of fertilizers applied directly to soil when compared to conventional agrochemicals. However, the environmental persistence and potential phytotoxicity of Cu-NPs should be evaluated before their usage.

The aim of the study was to determine the influence of copper nanoparticles in form of CuO (<50 nm) on total phenolic concentration in *Lepidium sativum* L. cultivated in greenhouse conditions. The experiments were designed in two main variants. The first one was based on seeds treatment by CuO-NPs solution before sowing and the second variant consisted of seeds growing in soil where CuO-NPs were delivered during watering of cultivated plants. Different concentrations of CuO-NPs were used in both variants of experiments. After cultivation plants were harvested. The biometric parameters, plant biomass and concentration of selected elements (AAS method) were determined. The total phenolic concentration in *L. sativum* L. shoots were analysed (spectrophotometric method).

The results showed that the plant growth and development was dependent on the method of CuO-NPs delivery as well as the concentration of CuO-NPs used in the study. Introducing CuO-NPs during plant watering increased plant growth when compared with CuO-NPs seed treatment. Furthermore, the highest concentrations of CuO-NPs slightly increased the plant length in comparison to control, regardless the method of CuO-NPs delivery. Analysis of total phenolic compounds showed their increase, regardless the variant of experiment when compared to control. However, the differences in total phenolic concentrations were seen as CuO-NPs dose-specific. Based on the results it can be stated that CuO-NPs supported *L. sativum* L. growth and accumulation of both selected elements concentration and total phenolic compounds.

P-39

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Influence of circannual light/dark cycles on GSPE metabolite levels in healthy and obese rats (poster)

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Keywords: biological rhythms, (poly)phenols, bioavailability

(Poly)phenols are bioactive compounds produced by plants in response to stress associated with various health benefits. Their bioavailability is influenced by several factors, including sex and health status. Recently, biological rhythms, such as light/dark circannual cycles, have been identified as potential factors affecting the bioavailability of these compounds. This study aims to assess the impact of circannual rhythms on the bioavailability of grape seed proanthocyanidin extract (GSPE) in both healthy and obesogenic conditions. Male Fischer 344 rats, fed either a standard (ST) or cafeteria (CAF) diet, were housed under different photoperiods to simulate seasonal variations (6, 12, or 18 hours of light per day; L6, L12, or L18, respectively) for 9 weeks. An oral daily dose of GSPE (25 mg/kg) was administered for the final 4 weeks. The cafeteria diet is a well-established obesogenic regimen that promotes the development of metabolic syndrome. After euthanasia, serum samples were collected, and GSPE-derived metabolites were quantified by using HPLC-ESI-MS/MS. Rats on a standard diet exposed to L12 had higher levels of metabolites compared to those under L6 or L18. However, in the CAF group, there was a reduction in bioavailability and a convergence of metabolite diversity. These results suggest that the influence of the photoperiod may be diminished in obesogenic conditions. These findings enhance our understanding of the complex interactions between diet, photoperiod, and serum metabolites.

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P-40

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Exploring cyclodextrin encapsulation of hesperetin and its derivatives: methods and analytical benefits (poster)

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Keywords: hesperetin, cyclodextrin, encapsulation

Hesperetin (H) (3',5,7-Trihydroxy-4'-methoxyflavanone), in its aglycone form, belongs to the flavanone class of flavonoids. Hesperetin has demonstrated antioxidant, cytotoxic, and antibacterial activities. However, when combined with other molecules as Schiff bases, its biological properties are enhanced, but its water solubility remains low. Cyclodextrins can address the solubility issue of these molecules. Complexing insoluble compounds with cyclodextrins can increase their water solubility, protect them from factors such as oxygen or light, and eliminate their odor, thereby enhancing their bioavailability. Therefore, it is essential to study the efficacy of cyclodextrins in encapsulating hesperetin derivatives and to investigate the physicochemical properties of potential hesperetin derivative/cyclodextrin systems using various analytical techniques such as ultraviolet-visible (UV) spectroscopy, Fourier transform infrared (FT-IR) spectroscopy, scanning electron microscopy (SEM), differential scanning calorimetry (DSC), and X-ray diffractometry (XRD).

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P-41

Marcin Szustak

Food Additive Polyols: Concerns and Their Impact on Platelets (poster)

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Keywords: polyols, platelets, cardiovascular desease

With increasing awareness of the health risks associated with excessive sucrose consumption, the search for safer sugar alternatives has gained momentum. Natural polyols, such as erythritol and xylitol, have emerged as popular sweeteners due to their low caloric value, non-cariogenic properties, and minimal impact on blood glucose levels[1]. Initially considered metabolically inert, these compounds have been widely incorporated into food products and dietary supplements. However, recent scientific reports suggest a potential link between elevated plasma concentrations of erythritol and xylitol and an increased risk of major adverse cardiovascular events (MACE), including thrombosis, myocardial infarction, and stroke[2]. Although the underlying mechanisms remain poorly understood, emerging evidence indicates a possible role of polyols in modulating platelet function[2,3]. This study aims to explore the molecular interactions between polyols and key components of platelet activation pathways, particularly G protein-coupled receptors (GPCRs) such as P2Y1, P2Y12, PAR-1 and PAR-4. Molecular docking simulations using ICM-Pro software assess polyol binding affinities to these receptors and their potential to alter ligand interactions, which may subsequently influence platelet reactivity. Additionally, computational studies investigate whether xylitol and erythritol interact with COX-1 and HMG-CoA reductase, enzymes involved in platelet function and cholesterol metabolism. Given that HMG-CoA reductase activity has been detected in platelets, potential polyol-mediated inhibition of this enzyme could mimic the effects of statins, thereby affecting both lipid metabolism and hemostasis. By providing a deeper mechanistic understanding of polyol interactions at the molecular level, this research aims to contribute to the ongoing discussion on the cardiovascular safety of polyol-based sweeteners. The findings may have significant implications for public health, particularly in the context of the widespread consumption of these sugar substitutes in functional foods and beverages.

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P-42

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Inhibition of lipoxygenase and xanthine oxidase activity by different fractions of Artist's and Red-Belted Bracket mushrooms (poster)

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Keywords: anti-inflammatory, mushrooms, enzyme inhibition

Artist's Bracket (*Ganoderma applanatum* (Pers.)) belongs to the family Ganodermaceae and is distributed worldwide. It has been have reported that *G. applanatum* possesses numerous medicinal properties, including antibacterial, antiviral, antitumor, antifibrotic, anti-obesity, antioxidative, and immunomodulatory effects. Similarly, the Red-Belted Bracket (*Fomitopsis pinicola* (Sw.) P. Karst.) is a common woody fungus known for its wide range of medicinal benefits, such as anti-cancer, anti-inflammatory, anti-diabetic, and anti-obesity properties. Freeze-dried fruiting bodies were subjected to a multi-step extraction process designed to isolate different groups of active ingredients effectively. The resulting extracts were evaluated for their anti-inflammatory properties by assessing their ability to inhibit the activity of lipoxygenase (LOX) and xanthine oxidase (XO). LOX activity was determined using linoleic acid as a substrate (one unit (U) of enzyme activity converts 1 μmol of linoleic acid in 1 minute under the reaction conditions). XO activity was determined using xanthine as a substrate (one unit (U) of enzyme activity converts 1 μmol of xanthine in 1 minute under the reaction conditions). To determine the degree of inhibition and the kinetic model of the process, the enzyme (LOX or XO) was incubated with the appropriate extract. The inhibition model and parameters were analyzed according to the Lineweaver-Burk methodology. LOX activity was most effectively inhibited by components of the extracts obtained with 80% ethanol from both mushrooms, with IC_{50} values of 1.005 mg d.w./ml (uncompetitive inhibition) for *G. applanatum* (Artist's Bracket) and 0.67 mg d.w./ml (competitive inhibition) for *F. pinicola* (Red-Belted Bracket). The activity of XO was strongly inhibited by the extract from Artist's Bracket, with IC_{50} values of 0.17 mg d.w./ml (uncompetitive inhibition) for the extract obtained with 80% ethanol, 1.61 mg d.w./ml (uncompetitive inhibition) for the extract obtained with 50% methanol, and 2.68 mg d.w./ml (noncompetitive inhibition) for the extract obtained with hot water. In the case of Red-Belted Bracket, XO inhibitory activity was observed only in the ethanolic extract, with an IC_{50} value of 6.67 mg d.w./ml (competitive inhibition). The studied mushrooms represent an interesting source of anti-inflammatory compounds, which may, in the future, predispose them for broader use in the prevention of civilization-related diseases.

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P-43

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Freeze-dried *Actinidia arguta* leaves as a functional additive in the production of puree with increased antioxidant status (poster)

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Keywords: hardy kiwi, polyphenols, antioxidant activity

Mini kiwi, or hardy kiwi (*Actinidia arguta*), is an excellent source of polyphenols, offering potent antioxidant benefits (polyphenols concentrations reaching up to 1300 mg per 100 g of fresh weight). Typically, hardy kiwi is consumed fresh, but due to its delicate structure and the climacteric nature of its ripening process after harvest, exploring processing methods for this valuable fruit is essential. The *A. arguta* fruits lend themselves well to preservation techniques such as drying and freezing. Furthermore, they can serve as versatile ingredients for creating purees, jams, juices, compotes, or jellies. A promising way to increase the antioxidant potential of fruit products is to use the leaves of fruit trees or shrubs (including *Actinidia arguta*) as an additional source of polyphenols. The study aimed to determine the effect of *Acinidia arguta* leaves on the antioxidant potential and polyphenols content of hardy kiwi puree. The fruit and leaves of the varieties 'Ananasnaya' (green flesh) and 'Purpurna Sadowa' (red flesh) were used in the study. Freeze-dried *A. arguta* leaves were added in the amount of 0.5-1.0-2.0% (w/w) to the laboratory-obtained fruit puree. The polyphenol profile of the raw materials was determined using the UPLC–ESI/MS method. The total content of these compounds and antioxidant potential were determined in the products (FRAP method). Sensory evaluation of the purees with the addition of leaves was carried out using the 5-point method. The following quality parameters were assessed: color, taste, aroma, and consistency. The leaves of *Actinidia* were rich sources of phenolic acids, as well as flavonols. Caffeoylquinic acid isomers, including chlorogenic (3-*O*-caffeoylquinic), neochlorogenic (5-O-caffeoylquinic), and cryptochlorogenic (4-*O*-caffeoylquinic) acid dominated in studied raw material. The main flavonol compounds found in hardy kiwi leaves were quercetin glycosides, i.e. quercetin-3-O-rutinoside-7-*O*-rhamnoside, quercetin-3-*O*-rutinoside, quercetin-3-*O*-glucoside, quercetin-3-*O*-(acetyl-rhamnoside)-(1→6)-galactoside, and quercetin-3-malonylglucoside.

The addition of leaves to puree had a positive effect on the content of polyphenols and antioxidant potential. However, it did not demonstrate a significant impact on the sensory

profile of the products. The exception was the taste assessment, which indicated significant, unfavorable changes in the evaluators' perception of this quality feature.

P-44

Monika Wereńska, Gabriela Haraf, Andrzej Okruszek

The use of unconventional plant leaves as natural antioxidants in goose meat products (poster)

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Keywords: goose meat, unconventional leaves, antioxidant

Introduction

The growing interest in natural and functional food products has led to the search for plant-based additives with antioxidant properties. Goose meat, valued for its high nutritional quality, is susceptible to oxidative processes that deteriorate its quality and shelf life. Although synthetic antioxidants are commonly used, increasing concerns about their safety have driven the search for natural alternatives. Nettle (*Urtica dioica*), mulberry (*Morus alba*), and holy basil (*Ocimum sanctum*) leaves are rich in polyphenols and flavonoids with strong antioxidant activity. Their addition to goose meat products may enhance oxidative stability, nutritional value, and sensory characteristics. The aim of this study was to evaluate the effectiveness of these plants as natural antioxidants in goose meat products.

Materials and methods

The study used pâtés made from goose meat enriched with powdered leaves of nettle (*Urtica dioica*), mulberry (*Morus alba*), and holy basil (*Ocimum sanctum*) at a 2% weight concentration. A control sample without any plant addition was also prepared. The pâtés were made by mixing ground goose meat with the selected plant additives and then subjected to heat treatment - baking at 200°C for 50 minutes. The oxidative stability of the goose products was assessed by measuring TBARS, DPPH and ABTS. The color parameters L*, a*, b* were measured using a Minolta colorimeter. Sensory analysis, including the evaluation of taste, aroma, spreadability, and overall acceptability, was carried out by a trained panel in accordance with ISO 3972:2011.

Results and Conclusions

The addition of leaves powder significantly reduced the levels TBARS compared to the control sample, indicating lower lipid oxidation. The color measurements showed no significant difference in the lightness (L*) and chroma (a*, b*) between the plant-enriched and control pâtés, indicating that the plant additives did not alter the color of the product noticeably. The sensory analysis indicated that the addition of plant powders did not negatively affect the taste, aroma, or spreadability of the pâtés. In fact, the holy basil-enriched pâté was rated the highest in terms of overall acceptability, with consumers particularly appreciating the aroma.

P-45

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Effect of preparation method, sweeteners and storage condition on bioactive compounds of rowanberry nectars (poster)

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Keywords: rowanberry nectar, bioactive compounds, antioxidant capacity

Rowanberries (*Sorbus aucuparia*) are trees or shrubs from the *Rosaceae* family. Their fruits are rich in bioactive compounds, mainly polyphenols, and are therefore used in various functional products. Rowanberries should not be consumed raw due to the presence of parasorbic acid. This compound decomposes under the influence of high or low temperatures, which is why the fruits are frozen, dried or cooked before consumption.

The aim of the research was to investigate the effect of preparation method, type and addition of sweetener and storage condition on bioactive compounds of rowanberry nectars.

Rowan clusters were frozen until the research began. Five variants of nectars were prepared, one unsweetened and four differing in the type of added sweeteners: sucrose (20 g/L), xylitol (20 g/L), erythritol (26 g/L), stevia (0.066 g/L). All nectars were prepared in two ways: from fresh fruit pulp or steamed pulp which was mixed in a 1:1 ratio with water. Analyses were performed on freshly prepared nectars and those stored for three months at a temperature of 30°C or in refrigerated conditions at 4°C.

The LC-PDA-QTOF/MS and UPLC-PDA-FL methods were used to determine polyphenolic compounds. The antioxidant potential of nectars was assessed using ABTS and FRAP methods. The concentrations of sugars and organic acids were determined by HPLC (Knauer Berlin, Germany; DAD and RI detectors). Changes in beverage viscosity, pH, total extract, turbidity and dry weight were monitored.

Phenolic acids and flavan-3-ols were the dominant group of polyphenols in all analyzed beverages. Nectars prepared from steamed pulp were characterized by significantly higher viscosity and turbidity. A significant effect of raw material processing on the content of bioactive compounds was observed. Differences in the content of polyphenolic compounds and antioxidant activity were noted depending on the sweetener used. The content of polyphenols changed over time, especially anthocyanins.

POSTER SESSION (STUDENTS)

S-1

Reshma Susan Babu, Adam Jurgoński

Nutritional and metabolic consequences of camelina seed oil compared to flaxseed oil in a rat diet (poster)

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Keywords*: antioxidant status, lipid metabolism, α-linolenic acid*

Camelina sativa, commonly known as false flax, is a notable oilseed crop due to its high content of polyunsaturated fatty acids (PUFAs), particularly *α*-linolenic acid (ALA). A widely recognized and good source of ALA is flaxseed oil with many proven health benefits resulting from its consumption. Unfortunately, camelina seed oil also contains erucic acid (up to 4%), which is considered cardiotoxic and disrupts lipid metabolism. Thus, the safety level of its consumption is institutionally regulated. This experiment investigates the dietary inclusion of camelina seed oil and its effects on body composition, internal organ functions, lipid metabolism and antioxidant status in growing rats by comparing them to flaxseed oil. Rich in ALA, camelina oil should support nutritional and metabolic status, though erucic acid might contribute side effects. A 4-week feeding experiment was conducted on growing lean Zucker rats distributed to 3 groups: PO (control-fed palm oil containing traces of ALA); FO (comparative-fed flaxseed oil); and CO (experimental-fed camelina seed oil). The experiment was model-based and each of the oils was introduced to the semi-purified diet as the main source of fat. The results showed that FO and CO had a higher lean body percentage with greater lean mass gain, and a lower fat percentage compared to PO. The blood lipid profile also showed improvement with higher HDL cholesterol and lower triglyceride levels in FO and CO, which was associated with the upregulation of the liver peroxisome proliferator-activated receptor *γ* gene (*Pparg*). In FO and CO, however, the rise in plasma alanine transaminase and alkaline phosphatase activity, as well as in heart and liver malondialdehyde (MDA) concentration, suggests that excessive dietary PUFAs may burden the organs and stimulate lipid peroxidation within them. Kidney functions did not appear to be altered, and MDA concentrations were lower in FO and CO, suggesting an organ-specific response in this regard. The experiment can be concluded by inferring that the consumption of camelina seed oil exhibits benefits for the growing rats similar to flaxseed oil, including improvements in body composition and lipid metabolism. However, excess PUFA-rich oil may cause local oxidative stress and hepatic overload. This also challenges the prevailing notion regarding the negative effects of erucic acid, especially since the daily dose in our experiment exceeded the recommended intake for humans by 20 times.

S-2

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Natural Bioactive Pigments from the Endophyte *Aspergillus westerdijkiae* (poster)

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Keywords: Endophyte, Natural pigments, Bioactivities

To date, several applications in different industrial sectors of biopigments are gaining strength over time due to the consumers growing interest in natural pigments. Thus, there are pressing scientific and social needs to promote the use of natural pigments as a safer and greener alternative to synthetic colors. In this concern, the search for new fungal strains with better productivity has become a fundamental requirement to meet the growing market demand for industrial sectors. As a first step in this direction, the presented research presents an innovative promising attempt to unfold the untapped potential of endophytic fungi of some underused plant species in the forests of Poland. A promising fungus named *Aspergillus westerdijkiae* 17P was isolated as a pigment producer. The extract was fractionated and several bioactivities were evaluated. Analysis using FTIR, NMR and UHPLC were performed to elucidate the structure of the isolated pigment fractions. It was determined that the orange fraction consists of aspergillic acids or isomers chelated with metal complexes such as aluminiumneoaspergillin and ferrineoaspergillin. The presented research emphasizes the importance of investigating unexplored endophytic fungi as new sources of bioactive natural pigments, holding immense significance in the field of medicine.

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S-3

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Influence of the wild yeast on phenolic compounds in white wine (poster)

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Keywords: wild yeast, polyphenols, white wines

Phenolic compounds, key contributors to wine's colour, taste, and stability, may be affected by the yeast species involved in fermentation. While the influence of *Saccharomyces* strains on the phenolic profile of white wines is relatively well explored, little is known about the role of non-*Saccharomyces* yeasts in shaping phenolic composition. This study investigates the impact of non-*Saccharomyces* yeasts fermentation on phenolic composition of white wine. The yeasts were isolated from a vineyard in Lower Silesia and NFC (Not From Concentrate) white grape juice was used for fermentation. Initially, a different strain of non-*Saccharomyces* yeast was added to each sample to initiate fermentation. After four days, an industrial strain was introduced. A control sample inoculated only with the industrial strain was also prepared. Phenolic compounds in the produced wines were analysed using high-performance liquid chromatography (HPLC) and compared with the control. Antiradical activity was assessed using DPPH assay, while total phenolic content was measured by the Folin-Ciocalteu method. The findings suggest that some non-*Saccharomyces* yeast strains have the potential to enhance flavour complexity and antioxidant properties in white wine, which supports the application of mixed fermentations in industrial winemaking to develop unique wine profiles and meet the growing consumer interest in naturally fermented wines.

S-4

Małgorzata Chobot, Anna Ignaczak, Hanna Kowalska

Effect of pretreatments and infrared drying on antioxidant properties of white radish snacks (poster)

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Keywords: white radish, IR drying, vegetable dried snacks

White radish (*Raphanus sativus* L.) is a root vegetable valued for its composition, combining high dietary fiber content, vitamins C and B-group, and essential minerals, while being low in calories and glycemic load. Beyond its basic nutrients, it contains biologically active compounds, including sulfur-containing and phenolic substances associated with antioxidant and antimicrobial potential.

This study evaluated the effect of selected pretreatment methods, followed by infrared-assisted convective drying, on antioxidant activity (DPPH, ABTS), vitamin C retention, as well as the color and texture of dried white radish snacks. Pretreatments included blanching (microwave and steam), osmotic dehydration (OD) in inulin or trehalose with added vitamin C, and the use of spices such as turmeric and sweet paprika.

Antioxidant activity was determined through DPPH and ABTS radical scavenging assays. Vitamin C content was expressed as the sum of L-ascorbic and L-dehydroascorbic acid. The results showed that the type of pretreatment significantly affected the antioxidant properties of the dried white radish snacks. OD-treated samples had the highest antioxidant activity - more than twice as high as that observed in the control, sweet paprika-treated, and blanched samples. This was due to, among others, the penetration of vitamin C into the radish samples during osmotic pretreatments. Among the spices, turmeric had a notably greater effect than sweet paprika in enhancing antioxidant capacity. Spices also improved the visual appeal and texture. Turmeric yielded the most vibrant yellow hue and the highest chroma values, while the control, blanched, and OD-inulin samples retained color characteristics most similar to the raw material. Overall, spices were particularly effective in improving texture-related parameters.

These findings suggest that combining infrared drying with carefully selected pretreatments, such as osmotic enrichment with vitamin C or the addition of antioxidant-rich spices, may effectively improve the functional and sensory quality of dried vegetable snacks.

S-5

Natalia Galant, Dorota Żyżelewicz, Joanna Oracz

Biological activity and sensory properties of candied fruits of Cornelian cherry (*Cornus mas* L.) (poster)

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Keywords: candied fruits, sugar substitutes, bioactive compounds and antioxidant properties

Fruits of the Cornelian cherry (*Cornus mas* L.) are a rich source of nutrients and bioactive compounds such as vitamins, phenolic compounds, anthocyanins, and iridoidoids. Due to the presence of these substances, the Cornelian cherry fruit and the products obtained from its processing have a number of health-promoting biological activities, including antioxidant, anti-inflammatory and anticancer effects. In recent years, Cornelian cherries have become increasingly popular due to their rich content of nutrients and bioactive compounds and their broad biological activity, and new processing methods for this raw material are being developed. One of them is the candying of Cornelian cherry fruits. However, candied fruits made with traditional sugar or sugar-starch syrups, whose main ingredient is sucrose, are not suitable for all consumers. The World Health Organization recommends that sugar intake should not exceed 10% of the energy value of the daily diet. In particular, diabetics and people trying to lose weight cannot or do not want to consume these types of products because a diet high in sugar increases the risk of obesity and diabetes, increases triglyceride levels and decreases HDL cholesterol levels, impairs glucose tolerance, increases insulin resistance, and increases uric acid levels.

Therefore, the aim of this work was to develop a process for candying Cornelian cherry fruits with selected natural sugar substitutes and to determine which mixture of syrups consisting of fructooligosaccharides and selected polyols and which process conditions would be most beneficial for obtaining candied fruits with the desired sensory characteristics, high content of selected bioactive compounds and strong antioxidant potential. Fruits before and after candying, using syrups with different compositions of fructooligosaccharides and selected polyols (xylitol, maltitol and their mixtures) and two different temperatures (40 and 45 °C), were subjected to tests including the evaluation of water content and activity, color in the CIE L*a*b system, textural parameters, free sugar and polyol, organic acids, phenolic compounds and iridoids, as well as antioxidant activity by various *in vitro* tests. The tested samples were also subjected to panel organoleptic evaluation. The study showed that Cornelian cherry fruits candied in a syrup composed of fructooligosaccharides and xylitol, regardless of the syrup proportions and incubation

conditions, had the most favorable sensory characteristics, high antioxidant activity, and the highest content of bioactive compounds.

S-6

Maja Hrovatić, Joanna Oracz, Dorota Żyżelewicz

Antioxidant properties of chocolates with milk substitutes (poster)

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Keywords: chocolate, milk substitutes, properties of chocolates

Chocolate is one of the sweets readily consumed by people from any age group. It can be eaten as a standalone snack or as part of various meals (e.g. mole sauce). However, there are consumers who cannot or do not want to consume milk (e.g. vegans), which is one of the ingredients of milk and white chocolates. In this situation, plant-based milk substitutes can be used, including protein preparations, which are often also a source of bioactive compounds. In this regard, the aim of the study was to select suitable milk substitutes to obtain vegan chocolates with acceptable organoleptic properties and then to determine their properties: physicochemical, organoleptic and antioxidant. To prepare the chocolates, pistachios and/or plant protein preparations were used: fava beans, hemp, pumpkin seeds, a mixture of pea, brown rice and pumpkin seeds proteins. The control chocolate was milk chocolate. The chocolates were sweetened with sucrose. The vegan chocolate that scored highest in the panel organoleptic evaluation (with fava beans) was also obtained in a sugar-free version, with xylitol.

The study showed that the prepared chocolates were characterised by the correct dry matter contents, low water activity and yield value. The colour and viscosity depended on the milk substitute and the sweetener used. The highest amount of phenolic compounds was identified in the chocolate with the protein preparation from fava beans (433.64 mg/100 g), and the least in two chocolates: with pistachios and with protein preparations from hemp and pumpkin seeds (273.58 mg/100 g in both cases). Most of the prepared samples had higher antioxidant activity than the control chocolate. The highest antioxidant activity in the DPPH radical assay was determined in chocolate with pistachios and the lowest in chocolate with a mixture of three proteins. The highest antioxidant activity in the FRAP test was determined in chocolate with fava bean protein and xylitol, and the lowest also in chocolate with a mixture of three proteins. The chocolate with fava bean protein obtained the highest overall score in the panel organoleptic evaluation. The flavour analysis carried out using the e-tongue showed differences between the intensity of sensation of individual flavours during consumption of the chocolates tested. Analysis of the aroma components of the chocolates using the e-nos showed that among the identified volatile compounds, propanal and acetaldehyde were present in the highest concentration. The other aroma components varied according to the raw materials used to obtain the chocolates. Studies

have shown that it is possible to use milk powder substitutes in the form of various protein preparations for the production of milk chocolates. However, the organoleptic, physico-chemical and antioxidant properties of the finished product depend on the preparation used.

S-7

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Antibacterial activity of postbiotics and parabiotics against food-borne pathogens (poster)

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Keywords: parabiotics, postbiotics, food-borne pathogens

Postbiotics and parabiotics, as bioactive products derived from microorganisms, are gaining increasing recognition in the context of food preservation. Postbiotics, defined as metabolites primarily obtained from probiotic bacteria that confer health benefits, and parabiotics as inactivated microbial cells, represent promising alternatives to conventional preservation methods.

The aim of the study was to evaluate the potential of postbiotics and parabiotics derived from five lactic acid bacterial strains isolated from fermented products in terms of their antibacterial activity against food-borne pathogens. Postbiotics were extracted from a 48-hour bacterial culture in MRS broth (peptone from casein, meat extract, yeast extract, D(+)-glucose, K_2HPO_4, Tween® 80, $C_6H_{14}N_2O_7$, $C_2H_3NaO_2$, $MgSO_4$, $MnSO_4 \cdot H_2O$) by centrifugation (8 min, 6000 rpm) and filtration (0.22 μm). To obtain parabiotics, a number of cell inactivation methods have been used, including: combinations of temperature (60, 80, 95°C) and time (30, 20, 5 min), additional use of ultrasound (5, 15, 30 min, 35 kHz, 20°C), sonification (3–30 min, 20–37 kHz, amplitude 30%, 25–60°C), and UV irradiation of cell biomass (30 min). The efficiency of cell inactivation was confirmed by penetration plating on MRS agar. The obtained postbiotics and parabiotics were subjected to evaluation of antibacterial activity against *Staphylococcus aureus* ATCC 6538, *Escherichia coli* ATCC 10536, *Salmonella enterica* ser. Typhimurium ATCC 51812, *Listeria monocytogenes* ATCC 13992, and *Enterococcus faecium* ATCC 35667. The antibacterial activity of the postbiotics was determined using well diffusion method; pathogens were cultured on tryptic soy agar (pancreatic digest of casein, papaic digest of soya bean, NaCl, agar) surface and 150 μl of tested postbiotics were applied to the wells. Parabiotic activity was tested by plug diffusion method, and plugs were formed from inactivated bacterial cells suspended in agar (2% w/v). After 20 hours of incubation at 30 °C , diameters of the pathogens inhibition zones were measured. The tested postbiotics/parabiotics showed varied antibacterial activity against *S. aureus* (inhibition zones of 8–17 mm), *E. coli* (2–9 mm), *S.* Typhimurium (3–8 mm), *L. monocytogenes* (2–16 mm) and *E. faecium* (1–4 mm). Postbiotics were found to have significantly higher antibacterial activity than parabiotics.

These results indicate the potential use of the obtained postbiotics/parabiotics as natural food preservatives, extending their shelf life and ensuring microbiological safety. However, the diverse antibacterial activity of the tested postbiotics/parabiotics indicates the need to develop a mixture of these bioactive products before use in food preservation.

S-8

Daria Kamińska

Food for Thought: Can diet influence protein prenylation? (poster)

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Keywords: protein prenylation, diet

Prenylation is a posttranslational modification of proteins that occurs in all eukaryotic cells. A well-recognized group of prenylated proteins is the Ras superfamily of small GTPases. This modification includes two major forms, one involving the covalent attachment of either a 15-carbon isoprenoid (farnesylation) and the other a 20-carbon isoprenoid (geranylgeranylation). They can be catalyzed by four prenyltransferases: farnesyltransferase (FTase), geranylgeranyltransferase type I (GGTase-I), Rab geranylgeranyltransferase (GGTase-II, RGGT) and recently discovered geranylgeranyltransferase type III (GGTase-III). Aberrant prenylation is implicated in pathogenesis of several disorders: cancers, neurodegenerative, bone, cardiovascular and metabolic disorders including Alzheimer's disease and diabetes. Protein prenylation can be controlled by the availability of isoprenoid substrates or by regulating the activity of the enzymes that catalyze this process [1]. The number of studies examining the effect of diet on protein prenylation is limited. However, existing evidence suggests that some foods may be a source of natural prenyltransferase inhibitors [2,3]. Moreover, diet can provide lipid substrates such as FPP and GGPP, or their precursors (FOH, and GGOH). It was proved that dietary GGPP and GGOH can impair the cholesterol-independent effects of statins [4,5]. Currently available data indicate that this topic is highly relevant. It may be worth considering this issue in the context of future scientific research for better understanding of the effect of dietary components on protein prenylation.

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S-9

Katarzyna Kucybała, Agnieszka Krajewska

Chemical composition of *Tanacetum vulgare* hydrodistillation products (poster)

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Keywords: *Tanacetum vulgare,* essential oil, hydrolate

Tansy (*Tanacetum vulgare*) is a perennial, herbaceous flowering plant which belongs to the Asteraceae family. *T. vulgare* occurs throughout Europe and Siberia. Tansy is growing up to 1.5 m in height and has dark yellow flowers. The whole plant revealed an intense balsamic scent. Tansy was a valued medicinal plant in previous centuries. It was used in treating parasitic diseases, and pediculosis and as a stimulant and painkiller as well it revealed high repellent activity. Today *T. vulgare* is a very underestimated herb. Oral use of T. vulgare is not recommended due to its high toxicity. However, it can be applied externally to the skin in care products. That is why we decided to study the composition and properties of tansy essential oil and hydrolate as a cosmetic raw material. In addition to a positive influence on the skin, it probably will reveal repellent activity on various insects.

The *T.vulgare* herb comes from organic farming in the northern region of Poland. The fresh herb was collected during the flowering period in August 2024 and subjected to the distillation apparatus Innotech-Tetkov TWE 250-2000VA for essential oil and hydrolate production. The volatile constituents from hydrolate were isolated using liquid-liquid extraction with diethyl ether. Then this mixture of volatile compounds as well as essential oil was analysed using GC-FID-MS. The total content of volatiles in hydrolate was about 380 mg/L. The yield of the essential oil was 0.04%. The qualitative composition of essential oil and hydrolate were similar. The differences concerned the content of individual ingredients. β-thujone, *trans*-chrysanthenyl acetate, and germacrene D were dominant in *T. vulgare* oil, while myrtenol, terpinene-4-ol, and borneol. 1,8-cineol were the major volatile constituents in hydrolate. In further investigation, we plan to assess the biological and repellent activity of these mixtures.

S-10

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Breed, diet and season – what influences the level of antioxidant compounds in milk?

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Keywords: polyphenols, FRAP, coenzyme Q

The aim of the study was to determine a level of compounds with antioxidant activity in cows' milk dependent of on the breed, feeding system and season. The research material consisted of cows' milk collected from cows from 9 conventional farms in eastern and south-eastern Poland. Milk for testing was collected in two feeding seasons: summer (June-September 2024) and winter (October 2024-January 2025), from Holstein-Friesian (HF) and Simmental (SIM) dairy cow breeds. In each feeding season, milk was collected three times, at the same time from each farm (at the beginning of the study period, during it, and at the end of each feeding season). Cows were fed with haysilage and corn silage (HS, CS) or haysilage (HS) or Total Mixed Ration (TMR). The highest average concentration of polyphenols was observed in milk form SIM in summer season but in milk from winter season higher average concentration was found in milk from HF cows. In the summer season, milk from SIM cows the contents of polyphenols and FRAP was: 14.2-108.2 mg/100 g and 2.1-3.25 pg/mL, while in milk from HF cows: 15.7-79 mg/100 g and 2.76-04.84 pg/mL. In milk from HF and SIM cows from the summer season amount of CoQ was also significantly similar. The content of these compound was: HF: non detection level - 23.79 ng/mL and SIM: non detection level – 57.39 ng/mL, respectively. The analysis of milk from the winter season showed that the average content of all compounds was also similar in milk from those breeds. In milk form SIM cows, the obtained values were at the level of 44.8-160.4 mg/100 g for polyphenols and 3.85-9.71 pg/1 mL for FRAP. At the same time, in milk from HF cows, the level of these indicator was: 42.3-115.2 mg/100 g and 3.1-5.45 pg/mL, respectively. The same result was observed in CoQ levels - in milk from HF cows 0.04-1.01 ng/mL and in the milk from SIM cows: non detection level - 0.24 ng/mL. Feeding cows with HS, CS increased the level of polyphenols and FRAP, in the both seasons. In the summer season, the values of these indicator oscillated at the level of polyphenols: 33.4-79 mg/100 g, while FRAP 2.8-9.63 pg/mL. In turn, feeding in the TMR system increased CoQ both in winter and summer season. Based on result it can't be confirmed that system feeding or breed of cow has impact to level of compounds with antioxidant activity in milk. They indicate that feeding season has significantly impact on

levels of compounds milk from both breeding. Another factor with significantly impact on polyphenol and CoQ content is correlation breed x feeding system and for CoQ is also correlation breed x feeding season.

The research was financed by funds from the project: MEiN/2023/DPI/2862.

S-11

Anastasiia Nedilia, Jarosław Popłoński

Enzymatic synthesis of novel α-linked glycosides by amylosucrase DgAS from *Deinococcus geothermalis* (poster)

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Keywords: amylosucrase, transglycosylation, glucosides

Amylosucrase (AS; EC 2.4.1.4) is a group of multifunctional enzymes, which belongs to the glycoside hydrolases family 13. Remarkably, AS does not only provide sucrose hydrolytic activity, but upon reaction engineering can also be utilized in transglycosylation reactions. ASs are able to transfer a glycosyl moiety from sucrose to various phenolic/poly-phenolic compounds, leading to the biosynthesis of α-glucosides with slightly altered properties than corresponding β-glucosides. An α-linked glycosylation might be achieved with AS derived from *Deinococcus geothermalis*. DgAS has shown high thermal stability and specific activity among ASs from various microbiotical species. The transglycosylation mechanism of DgAS follows the double-displacement reaction without using expensive ADP- or UDP-glucose required by glucosyltransferases[1–3].

Flavonoids are secondary metabolites ubiquitous in all plant parts, which in recent decades have shown a wide range of biological activities, such as antioxidant, antibacterial, antiviral, and anti-inflammatory properties. These dietary essential polyphenolic compounds are mainly naturally formed as *O*-glycosides of mono-, di- or polysaccharides, which might be degraded under extraction and purification processes[4]. Enzymatic transglycosylation is a significant biochemical process, which enhances the water-solubility as well as stability and bioavailability of bioactive compounds, especially anticipated due to possible application in functional foods and pharmaceuticals.

In this research, we applied a modular cloning tool (MoClo)[5] for the preparation of IPTG inducible expression vector for the production of DgAS with N-terminal His-tag. Expression was performed in *Escherichia coli*, the recombinant enzyme was purified using IMAC technology. Purified enzyme was used in broad screening experiments covering many natural products (polyphenols, flavonoids, steroids, etc.) to uncover the substrate specificity and possible application in the production of various α-mono-glucosides.

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S-12

Maciej Nielipiński, Agnieszka Pietrzyk-Brzezińska, Bartosz Sekuła

N-acetylornithine glutamate acetyltransferase as a target for safe weed control agents design – structures of NAOGAT from rice and maize (poster)

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Keywords: plant metabolism, arginine, urea cycle, nitrogen metabolism

In this work we present the first high-resolution structures of plant NAOGATs from *Oryza sativa* and *Zea mays* in complex with their natural ligand – ornithine, and in intermediate O-acetylated form. Plants use arginine, an amino acid with the highest nitrogen:carbon mass ratio, as both storage and transport molecule. But before arginine is created it has to be assimilated and then incorporated from glutamate pathway into arginine metabolism [1]. There are two ways the incorporation can happen – linear pathway via acetylornithine deacetylase (AOD) [2] – a ubiquitous enzyme in all kingdoms of life or cyclic pathway via N-acetylornithine glutamate acetyltransferase (NAOGAT) – characteristic for non-enteric bacteria, fungi and plants [3].

These structures represent an opportunity for gaining insight into the nitrogen incorporation into arginine metabolism and reaction mechanism. NAOGAT rises as a promising target candidate for herbicide design, safe for humans, as the enzyme is not present in mammals.

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Innovation Systems) under contract 2018-04969 and Formas under contract 2019-02496.

S-13

Zuzanna Paprocka, Joanna Grzelczyk, Grażyna Budryn

Effect of added bamboo fiber on physical and culinary properties of pasta (poster)

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Keywords: pasta, bamboo fiber, nutrients

Bamboo flour (bamboo fiber) is made from young or mid-mature bamboo shoots. The process of making bamboo flour involves cleaning the bamboo shoots, then drying and grinding them into a fine powder. Bamboo flour, depending on quality, contains from 95.00 to 99.00% dietary fiber. Bamboo flour in 100.00 g contains only 0.10 g of carbohydrates and 0.00 g of fat [1-3]. The culinary use of bamboo flour is to increase its nutritional value through its high dietary fiber content. Improving water absorption in various doughs or masses. Additionally, it can be used as a filler, thickener or anti-caking agent [3].

The aim of the study was to evaluate the physical and culinary properties of noodles based on bamboo flour. The nutritional value of the pasta (protein, fiber, fat, carbohydrate content) and culinary quality of the pasta were assessed. The minimum cooking time [AACC 16-50], dry matter loss during cooking [AACC 44-15A], and product weight gain due to cooking [AACC 16-50] were determined. Research has shown that bamboo flour is suitable as a substitute for wheat flour in pasta production. Pasta with added fiber is high in fiber and low in total fat. It was observed that using a higher percentage of bamboo fiber in a noodle recipe resulted in a shorter cooking time for the noodles compared to wheat (Patent applications P. 451474).

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S-14

Aleksandra Raczyk, Anna Otlewska, Katarzyna Rajkowska

Newly isolated halophilic bacteria as potential ectoine producers (poster)

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Keywords: ectoine, halophilic bacteria

Ectoine ((4S)-2-methyl-1,4,5,6-tetrahydropyrimidine-4-carboxylic acid) is an osmoprotectant naturally produced by some microorganisms in response to unfavorable environmental conditions like high salinity, temperature fluctuations, insufficient water activity, unfavorable pH and ultraviolet radiation (Goraj et al., 2019).

The aim of the study was the isolation of halophilic bacteria and their characterization in terms of ectoine production. Strains were isolated from environments with recorded salinity: brine water, sea water, water in which fresh herring carcasses were stored, and water and soil from a meadow in Pyzdry in Wielkopolska. Each sample was inoculated on tryptic soy agar (agar, casein peptone, sodium chloride, soya peptone) with the addition of 2%, 5%, 10%, and 15% NaCl and incubated at 15°C, 30°C, and 37°C 5 to 7 days. Initial isolation allowed the selection of 94 bacterial strains. Bacteria screening was carried out on media with different salinity levels, i.e. 2%, 5%, 7%, and 12% at 30°C and 37°C to check whether they could be potential ectoine producers under conditions of variable osmolarity of the environment. For 17 strains most resistant to variable salinity, ectoine biosynthesis was carried out based on the “bacterial milking” process. Bacteria were cultured in tryptic soy broth (casein peptone, dipotassium hydrogen phosphate, glucose, sodium chloride, soya peptone) supplemented with 12% NaCl, and then the salinity was reduced to 2%, which exposed the bacteria to osmotic shock and induced the release of ectoine. The substance was extracted and purified using an aqueous biphasic system with 1-butyl-3-methylimidazolium tetrafluoroborate/sulfate salt/ultrapure water phases. The obtained products were determined by thin-layer chromatography (TLC) using silica-coated plates and a mixture of chloroform/ethanol/acetic acid/water (50:32:10:8) as the mobile phase. The collection strain *Halomonas elongata* DSM 2581, for which ectoine is the main bioproduct, was used as a reference strain.

Ectoine has also a positive effect on human cells. It alleviates inflammation, maintains proper hydration, protects against water loss and ultraviolet radiation (Goraj et al., 2019). The range of properties allows it to be recognized as a valuable ingredient in food and cosmetic products created in accordance with the "clean label" philosophy.

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S-15

Natalia Rutkowska, Olga Marchut-Mikołajczyk

Bacterial endophytes of *Galium aparine* L.: biotechnological prospects for food industry (poster)

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Keywords: bacterial endophytes, *Galium aparine* L.'s, metabolites

Bacterial endophytes are microorganisms that inhabit plant tissues without causing any apparent harm to their host. Over the course of their long co-existence, endophytes and plants developed a mutualistic relationship. Microorganisms are provided with access to the constant flow of nutrients and stable environmental niche, and in return, produce compounds crucial for plant growth and fitness. Furthermore, these endophytes are capable of synthesizing *ex planta* diverse array of bioactive compounds with the potential to be utilized in many sectors, including food industry and agriculture.

The primary objective of the study conducted at the Institute of Molecular and Industrial Biotechnology of the Lodz University of Technology was to isolate and identify bacterial endophytes from *Galium aparine* L., a widely distributed herb with significant medicinal uses. Then, ten isolated strains were assessed for the production of phytohormones, extracellular hydrolytic enzymes (amylases, cellulases, proteinases, etc), siderophores, and other compounds potentially useful for food industry.

The results of the study provide compelling evidence for beneficial properties of bacterial endophytes to their plant host, as they were all able to produce significant quantities of phytohormones. The most proficient producers of hydrolytic enzymes, especially proteinases and amylases, as well as siderophores, were identified, opening possible routes for extensive research and industrial applications.

*This work has been completed while the first author was a doctoral candidate in the Interdisciplinary Doctoral School at the Lodz University of Technology, Poland***.**

S-16

Karina Skura, Ilona Motyl

Raw waste materials as a source of bioactive cosmetic components: the potential of brewer's spent grain and horse chestnut (poster)

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Keywords: bioactive ingredients, circular economy, fermentation

With the growing need for sustainability in the cosmetics industry, the use of waste raw materials is becoming an important part of a closed loop economy. The research conducted investigated the potential of using waste raw materials, such as brewer's thresh, various parts of the Horse Chestnut Tree, and the pomace of the Kamchatka berry, as valuable sources of bioactive ingredients in natural cosmetics. The end goal of this research was to develop innovative cosmetic formulations that not only meet market demand, but also promote sustainability by transforming waste into valuable raw materials.

Biofermentation, a process that uses microorganisms to transform waste raw materials, made it possible to increase the content of bioactive compounds in raw materials such as Horse Chestnut (flowers, bark, fruit), kamchatka berry pomace and brewer's mallee. Compounds such as quercetin, kaempferol, escin, xanthohumol, and procyanidins, which have been identified in these raw materials, have broad protective properties for the skin, such as antioxidant, anti-inflammatory, and strengthening effects.

In the context of a circular economy, the use of plant waste to produce bioferments is an excellent example of waste minimization and efficient resource management. Instead of treating them as waste, we can turn them into valuable products that not only contribute to environmental protection, but also support the development of innovative natural cosmetics. In addition, the use of these raw materials in cosmetics contributes to the development of green and sustainable products, which is increasingly appreciated by consumers.

The use of waste plant raw materials in natural cosmetics not only promotes ecological innovation, but also opens up new opportunities in the cosmetics industry, supporting the idea of sustainable development.

S-17

Oliwia Stanisławska, Iwona Majak

Modulating BSA digestion with green tea polyphenols (poster)

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Keywords: BSA, green tea, digestion

Green tea polyphenols are known for their antioxidant properties and potential to influence protein digestion while gaining attention for their bioavailability. This study investigates the effect of green tea polyphenols on the digestion of bovine serum albumin (BSA). BSA was subjected to digestive enzymes in the presence of varying concentrations of green tea polyphenols, and digestion profiles were analyzed to evaluate peptide fragmentation patterns while using sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE).

S-18

Natalia Sygitowicz, Dorota Żyżelewicz, Joanna Oracz

Cornelian cherry (*Cornus mas* L.) by-products as a source of valuable bioactive compounds for food fortification (poster)

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Keywords: Cornelian cherry, bioactive compounds, food enrichment

The modern food, cosmetics and pharmaceutical industries are moving towards sustainable development, focusing on the full utilization of natural resources and waste minimization. The fruits of the Cornelian cherry (*Cornus mas* L.) are valued for their remarkable health-promoting properties, which are due to their high content of polyphenols, anthocyanins, iridoids, vitamins and organic acids. During the processing of these fruits, in processes such as the production of juices, jams, liqueurs or fermented beverages, significant amounts of by-products are produced, such as pomace and peels. Although they are often treated as waste, they are a valuable source of bioactive ingredients that can be used in the food, cosmetics and pharmaceutical industries. Therefore, the aim of this study was to obtain bioactive preparations from Cornelian cherry processing by-products and determine their content of bioactive compounds such as flavonoids, phenolic acids, iridoids and dietary fiber, as well as their antioxidant properties. In addition, the resulting preparations rich in bioactive compounds have been used to fortify model food products.

The by-products of Cornelian cherry processing, including stones, pomace and candied syrup, are products rich in bioactive compounds, particularly anthocyanins, tannins, flavonols, phenolic acids and iridoids with strong antioxidant properties. The preparations obtained also had a high dietary fiber content. Enrichment of selected model foods, such as the gummy bear and white chocolate, with the by-product preparations obtained from Cornelian cherries has contributed to a significant increase in the content of bioactive compounds and an enhancement of antioxidant activity. The addition of preparations obtained from Cornelian cherry processing by-products to selected food products results in changes in water content and activity, color, texture (especially hardness) and, in most cases, an improvement in sensory characteristics. However, in some cases, the addition of preparations obtained from Cornelian cherry by-products caused a deterioration in sensory characteristics, such as the appearance of a bitter taste or darkening of the product.

In conclusion, the study showed that Cornelian cherry by-products are characterized by a high content of bioactive compounds and strong antioxidant properties, making them a promising raw material for the production of functional foods and nutraceuticals.

S-19

Marcin Sypka, Monika Kaczmarek, Iga Jodłowska, Aneta M. Białkowska

Bioprospecting of extremophilic microorganisms for unique bioactive compounds (poster)

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Keywords: extremophiles, extracellular polymeric substances, bioactive compounds

The issue of food security and sustainable nutrition is of paramount importance in ensuring continued support of growing animal and human populations. Climate change, soil erosion, droughts and water contamination, as well as emergence and prevalence of plant diseases in numerous regions worldwide are just a few factors impacting causing crop failure, malnutrition, hunger and biodiversity loss. Moreover, the commercial production of natural bioactive compounds from fruits, seeds, herbs, spices, coffee beans and tea could compete directly with availability of food crops and become one of the causes of rising prices in the global food market. The identification of novel producers of natural compounds with bioactive properties from unconventional sources, such as extremophilic bacteria, may be an alternative approach to overcome this global problem [1]. Extremophiles are microorganisms living in the challenging environmental niches, often experiencing one or several extreme abiotic factors, such as low or high temperature, highly acidic or alkaline pH, high UV-radiation, high pressure, high salt and heavy metals concentrations. Due to their many adaptions to severe environmental conditions, they are regarded as rich source of unique enzymes and bioactive molecules such as alkaloids, terpenes, glycosides, halogenated polyketides, peptides, fatty acids and extracellular polymeric substances (EPS). Some extremophiles, like halophilic *Halomonas* spp., have also gained a status of cell factories for synthesis of novel biochemicals in unsterile conditions [1,2]. In the Institute of Molecular and Industrial Biotechnology, conventional and omics approaches are used for screening and bioprospecting of extremophilic bacteria in the search and sustainable production of novel bioactive molecules, especially with antioxidant and antimicrobial properties with applications in agriculture, food, cosmetic, pharmaceutical and biotechnology industries.

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S-20

Weronika Śliżewska, Katarzyna Struszczyk-Świta, Olga Marchut-Mikołajczyk

Biotechnological potential of halophilic fungi for high-salt fermented foods (poster)

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Keywords: halophilic fungi, secondary metabolites, enzymes

Halophilic fungi are organisms that adapted to high-salinity conditions, therefore they may survive in harsh environments such as seas, salt lakes, saline soils, salterns, and in food products with high salt content. Their adaptive strategies enable them to produce various unique extremozymes, pigments, biosurfactants, and other biomolecules. Thus, these fungi represent a promising source of biologically active compounds with potential for application in food industry. The objective of the study was to investigate both the production of enzymes and secondary metabolites of a halophilic fungal strain *Aspergillus neoniger* FF14 isolated from Italian saline soils. A comprehensive bioinformatic analysis of the isolated strain was perform in order to identify genes encoding salt-tolerant enzymes and pathways involved in biosynthesis of secondary metabolites. Functional annotation focused on hydrolytic enzymes which are known for their roles in food fermentation processes and flavor enhancement. Genes responsible for the synthesis of bioactive compounds, including pigments and antimicrobial agents, were determined. In addition to genomic analysis, enzymatic assays were performed. Chromatographic techniques identified secondary metabolites produced in saline conditions.

The results of the study revealed numerous genes encoding salt-tolerant enzymes and metabolites that may be useful in high-salt food applications. Enzymatic assays and metabolite profiling provided information about metabolomics highlighting their potential for industrial applications which could improve the sensory quality and safety of salted foods. This shows that halophilic fungal strain *A. neoniger* FF14 has significant potential for use in the production of high-salt fermented foods.

This work has been completed while the first author was a doctoral candidate in the Interdisciplinary Doctoral School at the Lodz University of Technology, Poland.
Microorganisms were isolated from saline areas in Poland and Italy, and identified as part of the CANALETTO project (project no. PPN/BIL/2018/2/00038/U/00001 and project no. M03375).

S-21

Iwona Wenio, Damian Kwiatkowski, Dorota Derewiaka

Innovative analytical method for pesticide residue detection in food using mass spectrometry (poster)

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Keywords: Food, LC-MS/MS, Polar pesticide

Polar pesticides are extensively utilized in agriculture due to their cost-effectiveness and high efficacy, contributing to increased crop yields and the production of fruits with desirable foodstuff attributes. The persistence of highly polar chemical residues derived from pesticides, plant growth regulators, and fertilizers raises significant concerns regarding food safety. To ensure consumer protection, robust and reliable chromatographic techniques are essential for their detection. This study developed a validated analytical method for the simultaneous quantification of highly polar analytes, utilizing liquid chromatography-tandem mass spectrometry (LC-MS/MS). Due to their unique physicochemical properties, polar pesticides cannot be integrated into broad-spectrum screening methods commonly employed in food safety analysis. The determination of these residues primarily relies on single-residue analysis methodologies or specialized techniques designed for the quantification of highly polar pesticides, including glyphosate, glufosinate, MPPA, N-acetyl glufosinate, ethephon, fosetyl, HEPA, cyanuric acid, AMPA, and maleic hydrazide. The development of a rapid, sensitive, and efficient analytical method for the detection of glyphosate and related polar pesticides in fruit and vegetable commodities remains a critical need. These compounds pose substantial analytical challenges due to their high hydrophilicity and complex chemical nature, which complicate both industrial detection and the mitigation of matrix effects, particularly given the variability of food matrices within the same commodity group. To address this issue, novel mixed-mode chromatographic separation phases have been successfully implemented to detect highly polar compounds, including polar pesticides. The analytical protocol incorporated modifications in sample extraction, buffer composition, and column specifications compared to the standard QuPPe method. These optimizations significantly reduced detection time while eliminating matrix interferences and retention time inconsistencies. The calibration study demonstrated excellent linearity, confirming the method's suitability for routine monitoring of highly polar pesticide residues in food commodities.

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