University of Belgrade – Faculty of Agriculture

3rd European Symposium on Phytochemicals in Medicine and Food

BOOK OF ABSTRACTS

Belgrade, SERBIA, 1- 4 July 2025

3rd European Symposium on Phytochemicals in Medicine and Food

3-EuSPMF

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WELCOME NOTE

We are delighted to welcome you to the 3rd European Symposium on Phytochemicals in Medicine and Food (3-EuSPMF), which will be held in Belgrade, Serbia, from July 1–4, 2025.

The symposium is organized by the University of Belgrade (Faculty of Agriculture and the Institute for the Application of Nuclear Energy – INEP), and the International Association of Dietetic Nutrition and Safety (IADNS).

The main objectives of the 3rd EuSPMF international scientific conference are:

- To promote the scientific achievements of researchers in the fields of natural products, food production, nutrition, and the medical application of nutrients
- To foster connections between academia and industry
- To provide a platform for the exchange of ideas
- To encourage new research collaborations
- To educate and inspire young researchers

In recent years, there has been a significant rise in interest among researchers in the health benefits of natural products. The production of functional foods, nutritional products, and dietary supplements continues to grow. Moreover, the use of by-products from natural sources is gaining attention as a sustainable approach in agriculture and the food industry-aligning with the principles of environmental protection and waste reduction.

In today's world, university-industry partnerships play a key role in fostering innovation, facilitating knowledge transfer, and delivering societal benefits.

The conference is supported by the Ministry of Science, Technological Development and Innovation of the Republic of Serbia, the Serbian Chemical Society (SCS), and the Phytochemical Society of Europe (PSE).

A number of international journals are supporting the 3-EuSPMF, including:

Phytochemistry Reviews, *Food Frontiers*, *Quality Assurance and Safety of Crops & Foods*, *eFood*, *Chemistry & Biodiversity*, *Journal of the Serbian Chemical Society*, *Future Postharvest and Food.*

Agronomy, *Beverages*, *Horticulturae*, and *Oxygen* are contributing under the multidisciplinary topic: "Plants and Crops as Sources of Phytochemicals for the Development of Functional Foods and Beverages."

The Institute of Food Technology and Biochemistry at the Faculty of Agriculture and the Institute for the Application of Nuclear Energy are honored to host scientists from 23 countries, who will present their research across ten thematic areas. The scientific program includes:

- 1 keynote lecture
- 10 plenary lectures
- 30 invited lectures
- 21 oral presentations
- 21 PhD short oral presentations (PhD Forum)
- 81 poster presentations

This rich program offers an outstanding opportunity to exchange ideas, address challenges, foster new research collaborations, and support the education of early-career researchers.

We hope that the 3rd EuSPMF will meet and exceed participants' expectations and that the EuSPMF conference series will grow into a regular and well-established tradition in the years to come.

Executive Chairman

Prof. Dr Jelena Popović-Djordjević
University of Belgrade-Faculty of Agriculture
Department of Food Technology and Biochemistry
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II Bioactive compounds and human health

III Bee products - treasure trove of bioactivity

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Abbreviations

KN - Keynote lecture; PL - Plenary lecture; IL - Invited lecture; OP - Oral presentation; PhDSO - PhD Short oral presentation; PP - Poster presentation

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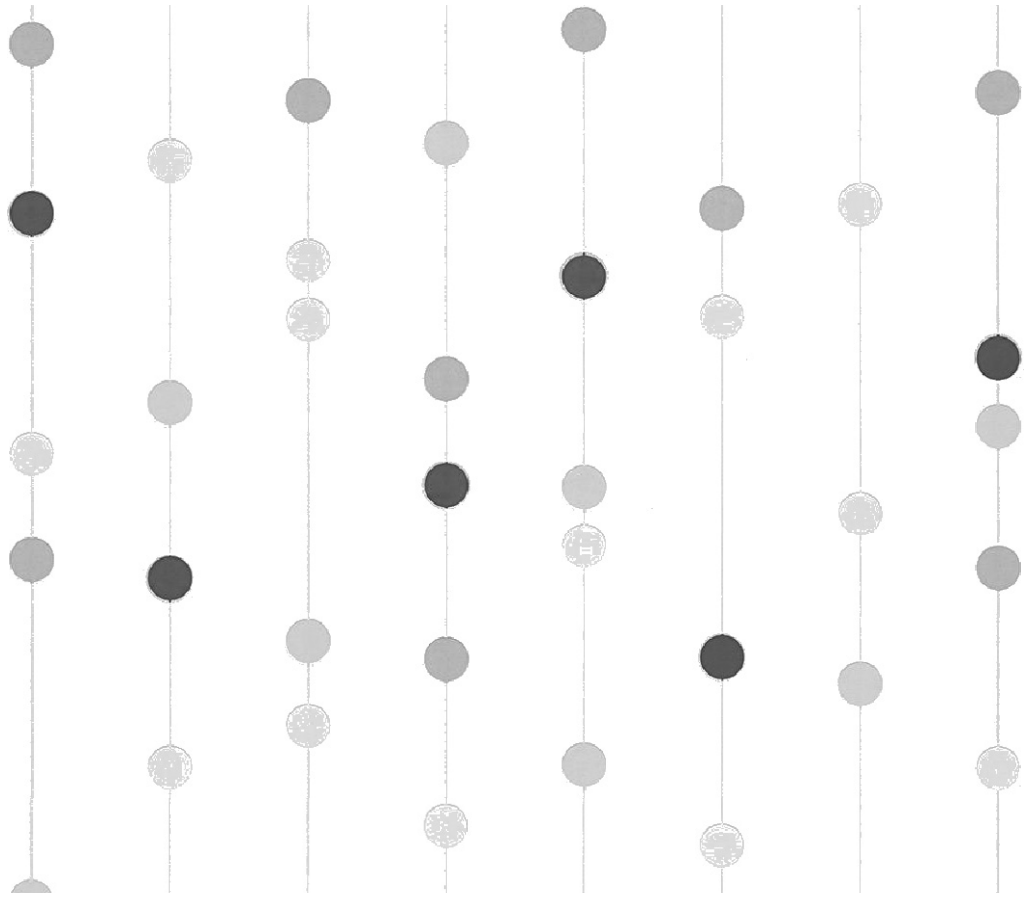
ABSTRACTS



KEYNOTE LECTURE

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After 50+ years in research I want to thank all people that we collaborated with. A list was made, more than 1500 people from MSc students to visiting professors from all over the world. Methods were developed for finding new biologically active compounds, such as bioassay guided fractionation, *in-situ* TLC bioassays, and metabolomics based lead finding. Large scale counter current chromatography was extensively studied for production of pharmaceuticals. Extraction is a major area for applications, e.g. super critical extractions. Natural Deep Eutectic Solvents were developed for extraction of poorly soluble compounds. Our research on alkaloids, as leads for drug development, showed that nature is full of interesting compounds, but sourcing is a major bottleneck. Alternative species or plant cell cultures thus became an important topic. The plant cell biotechnology was shown to be able to produce some compounds in high amounts, though in many cases the target compounds are not produced, e.g. tropane-, and opium-alkaloids. Only for taxol large commercial processes have been developed.
To improve yields the classical trial and error methods are helpful to improve yields. But to really improve yields a better understanding of the biosynthesis is needed. *Catharanthus roseus*, indole alkaloids, grapes, hops, cannabis, vanilla and anthraquinones were interesting examples for studying the regulation of pathways. Elicitors like jasmonate and salicylate became important tools for studying the induction of various biosynthetic pathways. In parallel the biochemistry of the pathways were studied and various enzymes were characterized. Based on protein sequences the corresponding genes could be cloned and overexpressed in the plant itself or in other species or microorganisms, like yeast. For example, we applied for a patent on the production of strictosidine in a yeast that contained overexpressed strictosidine synthase and strictosidine glucosidase. Feeding of tryptamine and sap of *Symphoricarpus alba* berries (rich in sugars and in secologanin) produced high levels of strictosidine, the precursor for different indole alkaloids. The overexpression of various genes in plants is feasible, but in most cases levels are far too low for any application. For establishing biosynthetic pathways retro-synthesis was applied in e.g. the biosynthesis of salicylate in plants. Omics are presently the tools for studying the regulation of biosynthetic pathways. This systems biology approach has resulted in novel strategies for studying traditional medicines, for example by learning more about the role of synergy. Also chemical ecology has rapidly developed as a new area in this context.

PL_I Eco-friendly bioactive natural products: Implications for human health and functional foods

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Bioactive compounds derived from natural sources have gained increasing attention due to their diverse biological activities and broad potential in food and health-related applications. These compounds, found in plants, fungi, marine and freshwater organisms, sponges and insects exhibit significant antimicrobial, antiinflammatory, immunomodulatory, and enzyme-regulating properties, contributing to the prevention and management of a wide range of diseases, including cardiovascular, neurological, metabolic and infectious conditions.

In addition to their therapeutic potential, many natural bioactives serve as functional food ingredients, offering health benefits beyond basic nutrition. Their ability to promote immune function, support gut health, and reduce oxidative stress positions them as key components in the development of nutraceuticals and health-promoting diets.

Crucially, the use of naturally derived compounds aligns with environmentally sustainable principles. Their biodegradability, low toxicity, and the possibility of obtaining them from renewable or underutilized biological sources make them an attractive alternative to synthetic additives and pharmaceuticals, particularly in the context of green chemistry and circular bioeconomy.

This work provides an overview of recent research on bioactive compounds from natural resources, emphasizing their dual role in human health and food systems, as well as their contribution to sustainable and ecofriendly innovation.

PL_II Bioactive compounds, adipocytes and obesity: New frontiers for research?

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Basic research in nutrition is a daily challenge to obtain evidence which may result of interest for possible application in clinical environment to treat pathologies. Obesity as such and overweight-/obesity-driven cancers, for example, need new approaches, in addition to pharmacological treatments, which may synergically improved quality of life as well as life expectation.
One strategy may be represented by the influence exerted by bioactive compounds on the differentiation process which turns pre-adipocytes into mature adipocytes.
There will be discussed models to check the efficacy of bioactive compounds and the relationdship among adipose tissue-released adipokines, their effect on tumor cells and the possible role of some bioactive compounds.

PL_III A journey with honey bees and stingless bees: Chemical diversity and botanical sources of propolis

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Propolis, a plant-derived product sourced from the bee hives, serves as a building material and a protective barrier of the bee colonies against pathogenic microorganisms. For humans, propolis is a treasure trove of health benefits: antimicrobial, anti-inflammatory, antioxidant, etc. The biological and pharmacological activity of propolis is due to various plant metabolites, with its chemical composition being influenced by the plants surrounding the beehives, the bee species and bees' preferences to certain plant species. Therefore, knowledge of the chemical composition of propolis is of primary importance in terms of its efficacy and safety use. Since honey bees, *Apis mellifera* L. (tribe Apini), inhabit almost all ecosystems around the world, most research has focused on the propolis they produce, resulting in several well-established chemical types. However, in recent years, interest in propolis from stingless bees (tribe Meliponini), native bee species for tropical and subtropical regions, has grown significantly. Studies on its chemical profiles show significant variations depending on geographical location and bee species [1], resulting in greater complexity compared to propolis from *A. mellifera*. Stingless bees have been found to select one, two or even three plant sources of resins in each ecosystem, and the question whether species-specific preferences or nearby flora and climate play a dominant role in determining the composition of propolis is still a subject of ongoing debate. This presentation will provide examples of chemical profiles of propolis produced by honey bees and stingless bees, highlighting how floral diversity, geographical factors and bee species influence propolis chemistry. Insights into preferred and new plant sources of propolis will also be shared.

References

[1] Popova, M. et al. *Stingless Bee Nest Cerumen and Propolis* 1, 33-44 (Springer, Cham, 2024)

PL_IV *In vitro* and *in vivo* efficacy and tolerabilityof a *Scutellaria lateriflora* L. and *Cistus* x *incanus* L. extracts - based chewing gum on the symptoms of gingivitis

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Gingivitis is a common, mild periodontal disease causing tenderness, redness, and gum swelling around the teeth. If not promptly handled, gingivitis can cause periodontitis, causing tooth loss. This study aimed to assess the tolerability of a *Cistus x incanus* L. and *Scutellaria lateriflora* L-based chewing gum and its efficacy on gingivitis.
The extracts were chemically characterized using UHPLC coupled with an Orbitrap Mass Spectrometer. Then, the extracts were studied for their bioaccessibility after simulated *in vitro* oral digestion, antimicrobial activity, protective effects against cellular invasion by *P. gingivalis*, and antibiofilm activity. The extracts found rich in polyphenols were stable after *in vitro* simulated oral digestion, exerted antibiofilm activity (80% biofilm reduction), and demonstrated a dose-dependent inhibitory activity against *P. gingivalis* growth. This activity increased with the combination of the two extracts, as well as a reduction in *P. gingivalis* HaCaT invasiveness.
In keeping with previous results, the tolerability and the efficacy of *S. lateriflora* and *C. incanus*-based chewing gum were investigated, employing a monocentric, placebo-controlled, randomized, parallel-group, double-blind trial. 60 Adult subjects with gingivitis in the absence of diagnosed periodontitis were randomized to receive two chewing gums or placebo daily for 3 months. At baseline (t0) and monthly (t1-3), the Quantitative Gingival Bleeding Index (QGBI), the Modified Gingival Index (MGI), and the Oral Health 15 items (OH-15) were employed to assess potential improvements in gingivitis. The pain was self-quantified using the Visual Analogue Scale (VAS), and the Clinical Global Impression Scale for Severity of Illness (CGI-S) helped evaluate general oral conditions. After a 3-month intervention, all parameters decreased, showing a statistically significant improvement of gingival health in the treated but not in the placebo group.
Our results provide suitable treatment for gingivitis, reducing its symptoms and preventing its progression to periodontitis.

PL_V *Cynara cardunculus* as an example in the search of phytochemicals from agricultural by-products

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Cultivated cardoon [*Cynara cardunculus* L.] is an herbaceous plant, native to the Mediterranean Basin, commonly usable as a vegetable from which the flower buds are eaten before they bloom. However, its leaves are an agricultural by-product used as a component of animal feed, as bioenergy crop for the lignocellulosic biomass, biodiesel or biomethane production. Cultivated cardoon leaves are a good source of polyphenols and sesquiterpene lactones. Sesquiterpene lactones (SL) are allelopathic compounds with high expression in cardoon leaves (≈ 95g/kg dry weight) [1]. Its extracts are described as antioxidant, cytotoxic, phytotoxic, antimicrobial, hepatoprotective, choleretic, cholagogue, hypocholesterolemic, etc [2]. For this reason, multiple food supplements are marketed, produced from extracts and concentrates of both the flowers and leaves with multiple medicinal properties described. Our research was focused on obtaining enriched extracts and fractions on SL. For that purpose, several extractions and fractionations techniques were employed. Also, three botanical varieties together with the harvest time were studied to optimize SL production. Seven sesquiterpene lactones were isolated and characterized from their extracts. In addition, an analytical method to quantify these SL on extracts and fractions was optimized using UHPLC-MS/MS. To improve the physico-chemical properties of the compounds, encapsulations techniques were employed. In an effort to scale up the enriched fractions and to avoid the use of harmful solvents, ethanolic ultrasound-assisted extraction and further purification using ultrafiltration membrane technology was proposed, obtaining SL-enriched fractions, with a 98.8% increase in SL purity. In addition, phytotoxic potential and putative modes of action of the enriched fraction was against a panel of nine weed species in pre-emergence, and then on *Portulaca oleracea* L.'s in post-emergency stage. Finally, stability of SL in agricultural conditions was studied *in vitro*. All these results highlight their potential for use in the phytochemical sector for the development of SL-based bioherbicides

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[2] Gominho, J. et al., *Biomass and Bioenergy*, 2018, 109, 255-275

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PL_VI Circular innovations in food systems: Natural ingredients and functional solutions from bio-residues

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The increasing demand for natural, health-promoting, and clean-label ingredients in the food sector, it is driving a paradigm shift toward the use of bioactive compounds derived from natural sources. Simultaneously, the need to improve resource efficiency and reduce environmental impact is reinforcing the transition to circular and zero-waste food systems. In this context, the valorisation of agri-food by-products and bio-residues has emerged as a key strategy for developing functional ingredients, minimizing waste, and promoting sustainability across the agri-food chain.

Our research group has been actively focused on this field, exploring the recovery and application of high-value compounds, such as phenolic compounds, proteins, dietary fibers, carotenoids, vitamins (tocopherols, vitamin C and B complex), and glucosinolates, from a wide variety of agri-food matrices. These compounds have demonstrated strong antioxidant, antimicrobial, anti-inflammatory, and prebiotic properties, allowing their use as natural preservatives, colorants, and health-promoting ingredients in functional foods, nutraceuticals, and cosmetics. Applications include fortified bakery products, plant-based snacks, lentil-based meat extenders, and dietary supplements, among others. To achieve these goals, we have employed and optimized innovative and sustainable extraction processes, including ultrasound-assisted extraction, maceration, pressurized liquid extraction, and microwave-assisted extraction, ensuring maximum yield, while preserving bioactivity and aligning with green chemistry principles. We also assess the stability, bioaccessibility, and bioavailability of these compounds under different processing and storage conditions, reinforcing their potential for real-world application.

Several research initiatives illustrate this integrative and application-driven approach. Examples include projects such as Up4Health (upcycling of olive, grape, and nut by-products), MEDACORNET (promotion of acorns as a traditional Mediterranean superfood), PulpIng (valorisation of pumpkin pulp), VALMEDALM (intercropping strategies for almond production), and the cross-border projects such as NET4FOOD and TRANSCOLAB PLUS, which support innovation networks and green transitions in the agri-food sector.

Together, these efforts demonstrate the potential of biowaste valorisation and natural ingredient development to contribute meaningfully to healthier diets, more sustainable food production, and the broader goals of the European Green Deal and the UN 2030 Agenda.

Acknowledgments

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PL_VII Valorization of tomato processing by-products: Phytochemical recovery and application in functional food systems

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Tomato (*Solanum lycopersicum*), widely consumed for its favorable organoleptic qualities, nutritional richness, and health-promoting properties, is one of the most processed fruits globally. However, industrial tomato processing generates substantial quantities of by-products, including peels, seeds, and pomace, which are often underutilized and pose environmental, economic, and logistical challenges. These by-products are rich in valuable phytochemicals, including lycopene, β-carotene, phenolic compounds, dietary fibers, and essential fatty acids, making them excellent candidates for valorization within a circular bioeconomy framework.

This study presents a case-based examination of tomato waste valorization strategies, emphasizing the recovery, stabilization, and incorporation of bioactive compounds into value-added food products. We explore the integration of tomato-derived by-products into various functional food matrices such as bakery goods (e.g., a traditional bakery product), salad dressings and sauces, extruded snacks, and other cereal-based formulations. The physicochemical, nutritional, and sensory impacts of such incorporations are critically evaluated, with particular attention to the retention of bioactive compounds and enhancement of antioxidant capacity.

Moreover, the work discusses innovative processing techniques such as drying, milling, and encapsulation to optimize the techno-functional and health-related properties of tomato waste fractions. The findings underscore the potential of tomato waste valorization not only as a waste reduction strategy but also as a viable approach to improve the nutritional profile and functional appeal of modern food products.

This contribution aims to support the growing interest in sustainable food system design by providing a practical framework for the integration of phytochemical-rich by-products into consumer-friendly and health-promoting food applications.

PL_VIII Raman Spectroscopy in the quality control of foods

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In this seminar will be presented the fundamentals of inelastic scattering by monochromatic light, also known as Raman effect, and many applications of this analytical technique, mainly based on chemical systems such as food, but it can be also applied to natural products, coordination chemistry, supramolecular chemistry, pharmaceuticals, dyes and pigments, and art and archaeology.

PL_IX Sensory characteristics of Serbian plum spirit

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Plum spirit is Serbian national spirit drink. Due to its importance in the tradition and life of people in Serbia, it has been included in the UNESCO Representative List of the Intangible Cultural Heritage of Humanity since 2022. Serbian plum spirit is characterized by specific sensory characteristics (colour, clarity, typicality, smell and taste) influenced by many factors.

In Serbia, there are several types of plum spirits; the differences in their aromatic profile are mainly determined by the plum varieties used, the production method [1], and market requirements. The assortment of plums in Serbia consists of numerous autochthonous varieties, as well as varieties created through breeding. Monovarietal plum spirits, produced in the same way from different plum varieties, can have a completely different sensory profile and a wide range of sensory quality. Besides monovarietal spirits, bivarietal and multivarietal plum spirits can be obtained by blending compatible monovarietal plum distillates; leading to sensory quality of multivarietal plum spirit exceeded the quality of the component distillates. Orchard locality, fruit ripening stage, harvest year, as well as certain pomo-technical measures (e.g. pruning) can significantly affect the sensory characteristics of plum spirit. Various combinations of pre-distillation steps (pitting, fruits crushing or pulping, enzyme addition, lowering the pH of the plum mash, method of alcoholic fermentation, and length of the fermented mash storage) can also significantly alter the sensory character of plum spirit [2]. The distillation technique also has an influence on the smell and taste of the distillate. The aforementioned factors are the sources of volatile compounds that form the plum body and define its sensory quality. Only in the case of maturing (aging) in wooden barrels, the distillate is enriched not only by volatile, but also with non-volatile compounds that affect the colour and taste of plum spirit.

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PL_X Emerging challenges and strategic responses in global food safety and quality assurance

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Ensuring food safety and quality remains a critical global concern amid evolving challenges driven by climate change, globalization, technological advancements, and the emergence of new contaminants. Rapid shifts in climate are altering the survival patterns of pathogens and the production of mycotoxins, compromising both crop safety and post-harvest stability. The globalization of food supply chains increases the complexity of traceability and risk assessment, often exposing consumers to poorly regulated imports. Additionally, the rise of antimicrobial resistance (AMR), chemical residues, microplastics, and food fraud presents persistent threats to food integrity and public health. While digital technologies such as blockchain, AI, and rapid diagnostics offer potential solutions for real-time monitoring and quality assurance, their implementation faces barriers, including cost, infrastructure, and regulatory harmonization. Addressing these challenges requires integrated strategies that combine scientific innovation, robust policy frameworks, and international collaboration to safeguard consumer trust and ensure the resilience of food systems.

IL_I-1 Anti-obesity and longevity promotion properties of plant natural products

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Obesity presents a significant challenge to the modern society, imposing a substantial burden on health systems and individuals alike. Nowadays, more than a billion people globally are considered obese, a condition that does not solely refer to weight management but rather to mitigating its far-reaching consequences on healthspan and lifespan [1]. Individuals diagnosed with obesity are predisposed to comorbidities including type 2 diabetes, cardiovascular disease, and metabolic complications often referred to as metabolic syndrome. Most importantly, obesity is associated with a reduction in disease-free years, an excess risk of premature death, and accelerated aging [1, 2].

On the other hand, we live in a rapidly aging world, with an expectancy of more than a 2 billion people aged 65 years (or older) by 2050, alongside a rising proportion of age-related diseases. Thus, both obesity and ageing are, *per se*, different sides of the same coin and represent healthcare burden on our society [1, 2]. The development of strategies targeting both of these processes now becomes a challenge for science. Central to this pursuit is the recognition that metabolic health serves as a cornerstone for both healthy weight maintenance and prolonged lifespan [2]. Additionally, key molecular pathways attributed to nutrient signalling that are implicated in obesity progression, intersect with those fundamental to longevity, suggesting potential shared targets for intervention [2].

Utilizing the model organism *Caenorhabditis elegans* (nematode), along with combining omics and molecular pharmacology approaches, our research focuses on the discovery of natural products that target these shared pathways [1, 2]. Through our approach, we aim not only to mitigate the adverse effects of obesity but also to uncover novel strategies for promoting healthy aging and longevity.

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IL_I-2 Pigments in microalgae: Cultivation of biomass, pigment production, characterization, biological activities, and industrial applications

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Natural pigments for food, medicinal, and health applications are gaining popularity. In this context, the pigments from algae have gained industrial importance. Algal industries have assumed a global presence for food and health-related applications such as food, feed, nutraceuticals, and cosmeceuticals. The microalgae are being grown in appropriate environments in open pond systems. The pigments from these sources include chlorophyll, phycocyanin, phycoerythrins, and carotenoids. This author's group has worked extensively on the large-scale production of microalgae viz *Spirulina*, *Dunaliella, and Haematococcus*, with the aspects of downstream processing of phycocyanin, beta-carotene, astaxanthin, and its esters. Aqueous two-phase extraction method was devised for the separation of phycocyanin. Carotenoid extraction has been done using solvents and vegetable oils. These pigments have been evaluated for the antioxidant, anticancer, antiulcer, and hepatoprotective effects and also the utility of beta-carotene from *Dunaliella* for vitamin A supplementation. We have also developed the technologies for the production of biomass, and downstream processing, and elucidated the utility of the pigments for varied applications. The metabolic engineering of *Dunaliella* to produce novel carotenoid-astaxanthin by cloning and expression of delta-6 desaturase gene from *Haematococcus* has been elegantly demonstrated by us. The details of the above results with their implications on industrial potentials will be discussed.

IL_I-3 Exploring the medicinal and environmental potentials of mushrooms: A comprehensive review of a selection of mushrooms and mycelium-based applications

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Mushrooms have long been valued for their medicinal and therapeutic properties, and recent research has expanded their significance by highlighting their role in sustainability. Various mushroom species, including *Ganoderma lucidum* (Reishi), *Grifola frondose* (Maitake), *Trametes versicolor* (Turkey Tail), and *Inonotus obliquus* (Chaga), *Lentinula edodes* (Shiitake Mushroom) and *Hericium erinaceus* (Lion's Mane) have demonstrated a wide range of health benefits due to their rich content of bioactive compounds such as polysaccharides, bioactive alkaloids, nucleosides, steroids, proteins (enzymes), peptides terpenoids, and phenolic compounds. These mushrooms are being intensively studied for their potential in preventing and managing chronic diseases, enhancing immune function, and supporting overall wellness.

Ganoderma lucidum, often referred to as the "mushroom of immortality," is especially noted for its immune-boosting and anticancer properties. *Grifola frondose* mushrooms have shown promise in managing diabetes and cancer, while *Trametes versicolor* is under investigation for its ability to modulate the immune system, particularly in the context of cancer immunotherapy. *Inonotus obliquus* mushrooms, rich in antioxidants, offer potential in reducing oxidative stress and associated diseases. *Lentinula edodes* supports immune function and cardiovascular health due to its rich content of beta-glucans and eritadenine. *Hericium erinaceus* is known for its neuroprotective properties, promoting nerve regeneration and cognitive function through compounds like hericenones and erinacines.

Beyond their medicinal value, some mushrooms also offer innovative solutions to environmental challenges. Mycelium, the vegetative part of mushrooms, is emerging as a sustainable alternative to plastics. Mycelium-based materials are biodegradable and are being developed for use in packaging, construction, and other eco-conscious applications. These developments position mushrooms not only as valuable therapeutic resources, but also as key players in the global push for sustainability.

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IL_II-1 Bioactivities and application of mogroside from *Siraitiae fructus*

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Siraitia grosvenorii, also known as Luo Han Guo or Monk fruit, boasts a significant history in food and medicine in China [1]. Previous studies presented various beneficial effects of mogrosides extract from *S. grosvenorii*, including antioxidant, anti-inflammatory, and anti-diabetic properties [2]. The present study investigated the effect of Mogroside V (MV), one of the main ingredients in mogrosides extract, upon obesity and related hepatic steatosis *in vivo* and *in vitro*. The results showed that MV improved obesity and metabolic disorders and significantly ameliorated hepatic steatosis in high-fat diet (HFD) fed mice and free fatty acid incubated hepatocytes. Furthermore, MV increased uncoupling protein 1 (UCP1) expression in brown adipose tissue in HFD-fed mice and promoted mitochondrial respiration and expression of peroxisome proliferative activated receptor γ co-activator 1α (PGC1α) and UCP1 in differentiated C3H10T1/2 cells. These results indicate that MV could promote brown adipocytes thermogenesis, thus counteracting obesity and related metabolic syndrome, which provides a clue for developing a new therapeutic strategy for counteracting obesity and a new potential application for *S. grosvenorii*.

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IL_II-2 Dietary bioactive compounds in breast cancer: Challenges and opportunities in prevention and treatment

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Breast cancer (BRC) remains one of the leading causes of cancer-related mortality among women worldwide. In recent years, dietary bioactive compounds—naturally occurring constituents in foods such as fruits, vegetables, grains, oils, and spices—have garnered significant attention for their potential roles in cancer prevention and adjunctive therapy. These compounds include polyphenols, flavonoids, carotenoids, glucosinolates, and essential fatty acids such as omega-3 and omega-6 polyunsaturated fatty acids (PUFAs), which have demonstrated anti-inflammatory, antioxidant, and anti-proliferative effects. Fatty acids, in particular, influence membrane fluidity, signal transduction, and gene expression, and may modulate tumor progression and response to treatment. Despite promising preclinical evidence, translating these findings into clinical practice presents notable challenges. Variability in bioavailability, dietary intake, interindividual metabolic differences, and inconsistent outcomes across clinical trials hinder the establishment of standardized recommendations. Additionally, the complex interactions between bioactives, including PUFAs, and conventional therapies require further investigation to avoid unintended consequences or diminished treatment efficacy. Several ongoing clinical trials are addressing these gaps, including our project AID - Anti-inflammatory dietary intervention in breast cancer patients receiving aromatase inhibitors. This project aims to enhance clinical outcomes, quality of life, and survival rates in breast cancer patients undergoing adjuvant endocrine therapy by implementing nutritional interventions with anti-inflammatory PUFAs or polyphenol-rich foods. Addressing these challenges through well-designed clinical trials and personalized nutrition strategies, may unlock the full potential of dietary bioactives as complementary tools in BRC management.

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IL_II-3 Biosynthesis and nutritional mechanisms of fucosylated oligosaccharides

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Fucosylated oligosaccharides are a class of sugar chains formed by the attachment of fucose to oligosaccharide molecules catalysed by fucosyltransferases. These oligosaccharides have a wide range of bioactivities and important physiological functions with benefits for human health, including the promotion of neurodevelopment, the establishment of intestinal barriers, and the maturation of the immune system [1]. Previous studies have shown that lactoyl-*N*-fucoidan I (LNFPI) has a significant antiviral effect on hand-foot-mouth disease caused by enterovirus 71 (EV71) [2]. It not only attenuated the host inflammatory storm triggered by EV71 infection, but also significantly inhibited the proliferation of EV71 in a dose-dependent manner. In addition, EV71 infection leads to abnormal energy metabolism in host cells, which creates a favourable environment for viral replication, and LNFPI treatment was able to effectively reverse EV71-induced aberrant glycolysis in the host and reduce the number of cytopathic lesions. In *in vitro* cellular experiments, when LNFPI reaches a certain concentration, it can significantly inhibit the replication of EV71 capsid protein VP1 and reduce the damage of the virus to cells. LNFPI can be obtained by four ways: biological extraction, enzymatic synthesis, chemical synthesis and biosynthesis. In the previous study, the group isolated an efficient and stable α-1,2-fucosyltransferase (Te2FT) from thermophilic cyanobacteria, and successfully synthesised LNFPI using a highly efficient one-pot multi-enzymatic fucosylation system with lactose-*N*-tetrasaccharide (LNT) and GDP-fucose (GDP-L-Fucose) as the substrates with the yield as high as 94%. In recent years, the group further used *Escherichia coli* as a biosynthetic chassis, and systematically designed and modified the sugar metabolic pathway of the chassis strain using CRISPR-Cpf1 as a gene editing tool to achieve the biosynthesis of the LNFPI precursors LNT and LNTII. At present, the group has successfully constructed the first strain without plasmid to synthesise LNFPI from scratch, which provides a broad prospect for the stable and efficient production of LNFPI.

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IL_II-4 Diabetes mellitus type 2 may reduce the activity of albumin-bound food antioxidants

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Dietary interventions based on antioxidants are a cornerstone in the management of diabetes mellitus type 2 (DM2). Pharmacokinetic factors, such as antioxidant interaction with plasma albumin, however, may influence their activity. Albumin modification due to glycooxidation may additionally affect antioxidant-albumin association [1]. The aim of the study was to examine binding effects of three pronounced antioxidants present in the Mediterranean diet: resveratrol, (dihydro)lipoic acid and oleuropein using albumin isolated from patients with DM2 and healthy persons. Average fluorescence spectra of the isolated albumin from two study groups were similar, whereas relative amounts of advanced glycation endproducts and dityrosines were greater in albumin isolated from patients. Calculated binding constants were similar for two study groups for all three ligands. Kinetic fluorescence measurements revealed more extensive structural change in albumin from patients than from healthy persons, when the protein was exposed to oxidizing agent 2,2'-Azobis(2-amidinopropane) dihydrochloride. Binding of resveratrol or DHLA to albumin prior to oxidative stress reduced protein oxidation in both study groups, but the protection was more efficient in the case of albumin from healthy persons. Samples that remained after kinetic measurements were subjected to native electrophoresis and immunoblotting with anti-albumin antibody. Besides albumin monomer as a major protein species in our isolates, a dimer was present as well. Interaction with resveratrol, but not DHLA, affected albumin in terms of the appearance of additional molecular forms – complexes (signal widening). These findings imply that certain structural changes of albumin due to diabetes modify behaviour of bound antioxidants possibly affecting their physiological role. Although additional confirmations are needed, as well as experiments employing other antioxidants, the results of this study warn that patients with DM2 may have reduced benefits from the consumption of antioxidants compared to healthy persons in respect to their activity.

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IL_II-5 Ocean gold: Exclusive compounds from macroalgae

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Macroalgae represent a reservoir of high-value secondary metabolites—often rare and structurally unique-produced in response to environmental pressures. These "ocean gold" compounds display remarkable bioactivities, including anti-inflammatory, antibacterial, and antiproliferative effects, making them attractive candidates for applications in nutraceuticals, cosmetics, and pharmaceuticals. This study explores three classes of macroalgae components: linear diterpenes, sterols and phlorotannins [1, 2]. The use of green methodologies to recover these key classes of bioactive compounds is also addressed. Advanced extraction methods such as high-pressure-assisted extraction (HPE), microwave-assisted extraction (MAE), accelerated solvent extraction (ASE) and extraction with alternative solvents, such as molecular-base, switchable and eutectic solvents were employed. Extracts were assessed for yield and target compound content by gas chromatography coupled to mass spectrometry (GC-MS) or ultra-high performance liquid chromatography with diode array detection coupled with tandem mass spectrometry (UHPLC-DAD-MS^n). Optimal extraction conditions were established using design of experiments and response surface methodology. The most promising extracts were further evaluated concerning different bioactivities. The findings underscore the potential for the exploitation of these bioactive compounds through innovative sustainable strategies, reinforcing macroalgae as a true source of ocean gold.

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IL_II-6 Plant food supplements: Trends, benefits and risks

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There are rising plant-based supplements on the market, which contain plant foods, culinary, aromatic, and medicinal plants or their products, preparations, a mixture, or isolated phytochemicals. Several factors contribute to the popularity of these products among consumers, including awareness of health and well-being through preventive measures rather than treatment, the perception that natural products are safer, and an understanding of sustainability. Data from mechanistic studies suggest that many phytochemicals, acting through different molecular pathways, may exert beneficial effects in delaying or preventing age-associated declines in physical functioning and mental health. These scientific supports are accompanied by innovation in the food supplement industry, specifically in terms of increasing the bioavailability and stability of phytochemicals. However, the availability and popularity of plant food supplements raise concerns about their quality, efficacy, and safety. There are risks of allergic reactions, adverse effects, and potential interactions with medications. Some of these products are derived from medicinal plants with a long history of use in traditional medicine. However, these plants and their extracts are often present in food supplements in doses that exceed those established in traditional use [1]. A special risk is associated with the inadequate quality and safety control of plant-based supplements, as well as the growing concern of potential contamination with illegal or prohibited pharmaceutical ingredients or unauthorized novel substances [2]. Furthermore, marketing health claims may sometimes be exaggerated and misleading to consumers. Therefore, improved quality control procedures, monitoring programs, and consumer education are necessary to ensure the proper use, quality, and safety of plant-based food supplements.

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IL_III-1 The bee products and the broad-spectrum activities

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The honeybee (*Apis mellifera* L.) products include honey, propolis, royal jelly (RJ), bee venom, bee pollen, and bee bread. These products have been used in traditional medicine for thousands of years, and there is an increasing interest in their applications in modern medicine. For instance, bee pollen has served to prevent and treat many chronic diseases, especially metabolic disorders, and in particular diabetes, obesity, hyper-dyslipidemia, and other cardiovascular disorders. The health and nutritive values of bee pollen was attributed to its physicochemical compositions, i.e. (water, protein, and lipid content) and techno-functional properties (protein solubility, carbohydrate solubility, and emulsifying ability) promoting its wide implications [1].

Bee venom, on the other hand, has attracted a lot of attention due to its wide range of bioactive components such as melittin, and secapin (Fig 1). In the current talk, we will explore the possible antioxidant and apoptotic activities of melittin against paraquat-induced lung injuries in mice. Melittin exerted potentially protective antioxidant effects by increasing superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPx) activities and decreasing lipid peroxidation and nitric oxide (NO) levels. Melittin also exhibited anti-apoptotic effects by increasing B-cell lymphoma-2 (Bcl-2) and survivin expressions. Moreover, it declined the expression level of Ki-67 in the lung tissue.

Recently, beehive air therapy was recognized as a potential remedy for treating asthma, bronchitis, lung fibrosis, and respiratory tract infections. Countries in which beehive air therapy is currently authorized include Germany, Hungary, Slovenia, and Austria. However, scientific evidence of its efficacy is lacking which warrants further chemical and biological analyses as a proof of concept.

Similarly, the synergistic interaction of RJ with commonly used cancer chemotherapy is discussed, either through its ability to ameliorate the adverse effects of the drugs, or through the enhancement of the drug anticancer potential. These unique properties of RJ, besides possessing minimal toxicity, make it the best choice to be combined with anticancer drugs. The significant protection properties of RJ against different types of cancer were also attributed to its active compounds. Equally interesting, RJ alleviates menopausal symptoms by readjusting the hormonal concentration, promoting the reproductive performance in polycystic ovarian syndrome, counteracting infertility, and reducing the oxidative stress of the rats' productive systems [2].

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IL_III-2 Bioactivity of bee-collected pollen - Are phenylamides an important carrier?

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Bee-collected pollen (BCP) is an important bee product with enhanced bioactivity. It is characterized with high diversity of phenolic compounds (both phenolic acids and flavonoids) including glycosides. Their composition is strongly influenced by botanical origin of BCP. Apart from phenolics, in last decade a great attention has been directed to phenylamides, derivatives of polyamines and phenolic acids (in particular hydroxycinnamic acids). This specific group of secondary metabolites has been identified in different BCP samples. In some cases it has been reported as the predominant BCP metabolites [1]. The most recent research has confirmed a great potential of phenylamides as chemotaxonomic markers pointing it out their immense connection with botanical origin of pollen [2]. In addition, some of phenylamides can express a significant bioactivity.

Therefore, this study aimed to point out importance of phenylamides as potential carriers in BCP apart from phenolic compounds. It will be suggested that particular attention should be paid to identify and quantify phenylamides in BCP. However, in order to distinguish bioactivity originating from phenolics and phenylamides a possible separation procedure will be also presented and elaborated.

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IL_III-3 Characterization of non-honey bee products such as propolis, pollen and royal jelly from different regions of Anatolia: Bioactive components, encapsulation & stability

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Non-honey bee products, particularly pollen, propolis, and royal jelly, are attracting significant research and commercial interest because of their valuable bioactive constituents and therapeutic potential. Propolis, a resinous material containing over 300 compounds (flavonoids, phenolic acids, terpenoids, etc.), exhibits antimicrobial, anti-inflammatory, and immunomodulatory properties. Bee pollen serves as a nutrient-dense functional ingredient with demonstrated antibacterial and antifungal effects, while royal jelly, a protein-rich secretion containing unique fatty acids like 10-HDA, offers nutritional and pharmacological benefits. Despite their potential, polyphenolic extracts from these products are highly sensitive to environmental stressors (heat, light, oxygen). To address this, encapsulation technologies such as complex coacervation and liposomal encapsulation have emerged as effective strategies. These physicochemical methods, conducted under mild conditions, enhance the stability and bioavailability of bioactive compounds, facilitating their incorporation into functional foods, beverages, and apitherapy applications. This study highlights the potential of Turkish bee products in functional foods and apitherapy, with encapsulation and MAP offering effective solutions for stability and preservation.The findings underscore the importance of further research to optimize delivery systems and expand their commercial and medical applications.

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IL_III-4 Honey polyphenols and their significance

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Polyphenols are an important group of secondary metabolites. Honey and bee products represent a good source of these biologically active components, which are beneficial both for bees and humans. Although present in relatively low amounts, their impact is enhanced through frequent honey consumption. Polyphenol profile and quantity of individual polyphenols in honey vary depending on its botanical origin. This presentation provides a detailed overview of the polyphenol profiles of several monofloral honey: acacia, sunflower, linden, basil, buckwheat, oilseed rape, and goldenrod, all originating from Serbia [1]. The presence of 43 compounds, mainly flavonoids, was confirmed in all honey samples through characteristic mass spectra and fragmentation pattern. Relatively high amounts of chrysin, pinocembrin and galangin were identified in all honey extracts. *p*-Coumaric acid was absent in basil, buckwheat and goldenrod honey extracts. The profiles and the relative ratios of individual compounds will be discussed in the context of honey consumption as a dietary source, with the aim of contributing to health maintenance and disease prevention. Additionally, the presentation will explore key physicochemical and biological properties of these compounds, including their reactivity, solubility, synergism, and bioavailability, along with strategies to overcome related challenges. In the final part, we introduce our research findings that demonstrated the successful application of polyphenols as a tool for determining the botanical origin of honey in critical cases where the content of nectar-derived pollen particles is significantly lower than those of non-nectar sources [2].

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IL_IV-1 Resveratrol delays aging of *Drosophila* and offspring

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Resveratrol, a natural phenolic compound found in foods like grapes, peanuts, blueberries, and red wine, has been widely studied for its anti-aging properties. It exerts beneficial effects by reducing oxidative stress and inflammation, enhancing mitochondrial function, and regulating apoptosis. Aging is accompanied by changes in epigenetic information, some of which can influence lifespan across generations. While limited, emerging evidence suggests that resveratrol can modulate epigenetic enzyme activity. In this study, we used *Drosophila* melanogaster to investigate resveratrol's anti-aging effects and its potential impact on offspring longevity. Results revealed a dose-dependent and sex-specific response: 50 μg/mL resveratrol significantly extended the lifespan of female flies but had no effect on males, while higher doses were detrimental. Notably, the lifespan of F1 and F2 female offspring was also extended under normal conditions when parental females were treated with resveratrol. Mechanistically, resveratrol upregulated dSir2 and p300 expression and downregulated histone methyltransferases set1 and ash1 in parental females. RNA sequencing further revealed significant changes in circadian rhythm and Toll/Imd signaling pathways in both treated females and their descendants—pathways closely linked to longevity. These findings suggest that resveratrol may extend lifespan via epigenetic regulation of key signaling pathways and transmit these effects across generations. This study provides novel insights into the sex-selective and transgenerational anti-aging potential of resveratrol.

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IL_IV-2 Food-derived products and by-products as source for nutraceuticals driven to neurological diseases

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Phytochemicals derived from foods and food by-products have emerged as promising agents for the prevention and management of age-related diseases, including Alzheimer's disease (AD). As the global population ages, there is increasing interest in identifying sustainable dietary sources of bioactive compounds with neuroprotective properties. Our research has explored a variety of plant matrices-ranging from olive oil and olive leaf extracts to strawberries, honeys, and vegetable and vegetable by-products-demonstrating their ability to counteract key pathological features of AD.

In this context, we investigated the potential of these phytochemicals to modulate oxidative stress, reduce β-amyloid aggregation, prevent tau hyperphosphorylation, and mitigate neurotransmitter toxicity, all of which are crucial hallmarks of AD pathology. Using the *in vivo* model *Caenorhabditis elegans* our studies revealed significant antioxidant activity, inhibition of Aβ fibril formation, protection against mitochondrial dysfunction, and modulation of inflammatory pathways.

The results emphasize the value of agri-food residues and natural products such as honey and berries as affordable, effective sources of neuroprotective agents. These findings support a dual role for food-derived phytochemicals: enhancing healthy aging and providing therapeutic potential against neurodegenerative diseases. Their integration into functional foods or nutraceutical formulations may offer a sustainable strategy to reduce the burden of age-related cognitive decline.

IL_IV-3 Metabolic profile of mycobacteria exposed to antibiotics and piperine

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Piperine, a natural alkaloid, has been shown to enhance the efficacy of certain chemotherapeutic agents by overcoming multidrug resistance mechanisms. For instance, in combination with doxorubicin, piperine increased the sensitivity of cancer cells to the drug [1]. In case of mycobacteria, the combination of piperine with first-line anti-TB drugs has demonstrated synergistic effects against clinical isolates of *Mycobacterium tuberculosis*, including multidrug-resistant strains [2]. This synergy is attributed to piperine's ability to inhibit Rv1258c protein, an efflux pump, thereby increasing the intracellular concentration of antibiotics and enhancing their bactericidal activity [3]. Beyond its role as an adjunct to conventional antibiotics, piperine possesses direct antimicrobial properties. Our studies have indicated that piperine exhibits activity against *M. tuberculosis* in micromolar concentrations, hence inducing metabolic changes in bacterial cells. By applying liquid chromatography–mass spectrometry (LC-MS) metabolomics, we evaluated the metabolic profiles of mycobacteria exposed to rifampicin and its combination with piperine. It allowed for the description of changes in lipid composition and levels of metabolites involved in different metabolic pathways. The results help to understand how tested compounds affect bacterial survival at a metabolic level. The direct activity of piperine, coupled with its ability to enhance the effects of other antimicrobials, makes this molecule a promising compound for the restoration of the activity of antibiotics against resistant strains.

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IL_IV-4 Gegen Qinlian decoction (GQD) mitigates hepatic steatosis and inflammation in metabolic dysfunction-assosiated steatotic liver disease (MASLD) through regulation of chemokine signaling and lipid metabolism

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Gegen Qinlian Decoction (GQD), a traditional Chinese medicine (TCM), has demonstrated significant therapeutic effects in the treatment of Metabolic Dysfunction-associated Steatotic Liver Disease (MASLD). The formula includes *Puerariae lobatae radix* (Gegen), *Scutellariae radix* (Huangqin), *Coptidis rhizoma* (Huanglian), and *Glycyrrhizae radix et rhizoma* (Gancao), typically mixed in an 8:3:3:2 ratio. However, its mechanism of action in ameliorating MASLD has not yet been fully studied. In this study, we evaluated the therapeutic effects of GQD by characterizing its chemical constitution, *in vivo* metabolism, and both *in vitro* and *in vivo* experiments. Using ultra-high performance liquid chromatography-quadrupole time-of-flight mass spectrometry (UPLC-QTOF/MS) technique, a total of 133 components were identified in GQD and the *in vivo* metabolic process of GQD in rats showed a total of 85 prototype compounds and 94 matched metabolites were identified. *In vitro* experiments with HepG2 cells overloaded with free fatty acids (FFAs) and animal studies with C57BL/6J mice induced with MASLD by GAN diet, showed that GQD significantly reduced hepatic fat accumulation and fibrosis, as evidenced by histological staining, reduction in biochemical markers ALT and AST, and improvements in lipid profiles such as TC and TG. The result of RNA-seq indicated that GQD also demonstrated anti-inflammatory effects by regulating chemokine signaling pathways and genes related to inflammatory response pathway. GQD reduced the expression levels of chemokines such as C-C motif ligand (CCL)-2, CCL5, C-C motif receptor (CCR)-2, CCR-5, and C-X-C motif ligand (CXCL)-10 in the liver, suggesting that it exerts immunomodulatory and anti-inflammatory effects through the CCL-CCR signaling axis. GQD also decreased the expression level of inflammatory factors, including interleukin (IL)-6, IL-16, and tumor necrosis factor-α (TNF-α) in the liver, and helped prevent the M1 polarization of macrophages and subsequent inflammation amplification. The anti-inflammatory effect also contributed to the anti-fibrotic action of GQD, the reduction in tumor growth factor-β (TGF-β) indicated de-activation of hepatic stellate cells (HSCs), which play key roles in the synthesis of extracellular matrix (ECM) and collagen production, overall improved the hepatic fibrosis. Lipidomics analysis indicated that GQD also modulated lipid metabolism pathways. These findings suggest that GQD regulates lipid metabolism, alleviates inflammation, and has therapeutic potential in treating MASLD, providing a foundation for further clinical research.

IL_IV-5 Recent insights in phytochemicals-driven impact on cancer microenvironment

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Natural products, primarily the plant secondary metabolites, are known as efficient bioactive compounds used in the prevention and treatment of different disorders and diseases, including cancer. More than 3000 plant species and over 10,000 secondary plant compounds were identified and researched for cancer treatment, including a range of alkaloids, triterpenoids, flavonoids, shikonins lignans, condensed tannins, saponins, stilbenes, and others. Plant products have been recently targeted and researched in the frame of next-generation immunotherapy, namely referring to interactions and impacts on cancer microenvironment. The tumor microenvironment (TME) has an important role in the initiation of various malignancies, as well as progression of tumor and rate of metastasis. TME represents a complex dynamic system consisting of tumor cells, tumor stromal cells and immune cells, and the extracellular matrix. This review looks at the most researched bioactive plant compounds that are able to carry out various anticancer mechanisms, such as inhibition of cancer cell activating factors and inflammatory mediators; up-regulation of antioxidant enzymes and DNA repair systems, apoptosis, autophagy, reduction of the angiogenesis and metastasis ability, etc. Special attention is paid on mechanisms related to TME and immunomodulatory effects of plant drugs. The main results of our recent extensive *in vitro* and *in vivo* studies on the antitumor properties of selected Balkan herbs will be presented, with particular emphasis on the effects of the ethanolic extract of *Alchemilla vulgaris* agg. in mice and human lung, breast, colon, and melanoma cancers [1]. The associated anti-cancer mechanisms were attributed to the blockade of cell division, caspase-dependent apoptosis, and autophagic cell death by downregulation of the PI3K/Akt and MAPK kinase pathways [2]. Finally, in-depth single compound effects in mechanistic studies versus holistic and integrative concepts addressing the cancer microenvironment and complex interactions with the human microbiome, as well as the need for an individual therapy approach, will be considered.

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IL_IV-6 Translational health benefits of antioxidant in neurodevelopmental diseases

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Neurodevelopmental diseases such as autism spectrum disorder (ASD) and Attention-Deficit/Hyperactivity Disorder (ADHD) affect the development of the nervous system. ASD, a growing global concern, is marked by challenges in social communication, interaction, and repetitive behaviors.Increasing evidence suggests that oxidative stress plays a significant role in the pathophysiology of ASD. Elevated levels of reactive oxygen species (ROS) and reduced antioxidant defense mechanisms have been consistently reported in individuals with ASD, potentially contributing to neuronal dysfunction and behavioral abnormalities. Antioxidants, particularly those derived from phytochemicals such as polyphenols, flavonoids, and carotenoids may offer neuroprotective benefits by reducing oxidative damage, modulating inflammation, and supporting mitochondrial function. In this study, we assessed antioxidant nutrient intake and oxidative status in children with ASD. Our findings revealed significantly higher total oxidant levels in children with autism compared to neurotypical controls ($p<0.05$). Furthermore, dietary assessments indicated lower antioxidant nutrient intake among children with ASD ($p<0.05$), alongside insufficient consumption of antioxidant-rich foods such as fruits and vegetables. Antioxidant nutrition may offer therapeutic value in neurodevelopmental disorders by regulating neuroinflammation, oxidative stress and gut microbiota. However, robust experimental data and clinical studies are needed to confirm the efficacy and safety of antioxidant supplements in standard forms. This abstract aims to highlight the therapeutic potential of plant-based antioxidants in neurodevelopmental disease management and encourages further research into specific phytochemicals that may complement conventional therapies.

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IL_V-1 Quality and nutritional value of traditional Serbian pepper stored at different temperature

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Traditional Serbian pepper cultivars (*Capsicum annuum* var. *longum*), such as "Kurtovska ajvaruša," "Grkinja babura," and "Duga bela ljuta," are prized for their nutritional and flavor attributes. However, preserving these qualities post-harvest remains a challenge. This study investigated how different storage conditions (10°C, 4°C, and 4°C with prestorage hot water dipping) influence quality parameters during extended storage (21 days) followed by 3 days of shelf life at 20°C.

Parameters such as BRIX, titratable acidity, glucose, fructose, ascorbic acid, citric acid, total phenolic content, and mineral content were measured. Principal Component Analysis (PCA) was applied to identify correlations among these factors. The cultivar "Duga bela ljuta" maintained high ascorbic acid content at 10°C, reaching 104.4 mg/100g. "Kurtovska ajvaruša" exhibited an increase in phenolic content, up to 191.2 mg/100g under 4°C storage with hot water dipping, which proved effective in preserving both phenolics and citric acid across all cultivars. "Grkinja babura" exhibited high initial sugar content, which declined after shelf life. PCA revealed that sugars and ascorbic acid often correlate, while hot water dipping was shown to enhance phenolic content. These findings provide guidance for optimal storage practices to preserve quality, thereby supporting both the marketability and cultural significance of Serbian peppers - for fresh consumption as well as for technological processing like ajvar.

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IL_V-2 Growing for quality: The role of narrow orchard systems in modern fruit production

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Fruit production has the potential to be highly profitable, but only when supported by modern technologies that enhance both efficiency and sustainability. The automation of essential orchard operations (particularly harvesting) necessitates a transition from traditional systems to more structured and adaptable tree training forms. Concurrently, market expectations are rising regarding the technical, aesthetic, and nutritional quality of fresh fruit. Narrow Orchard Systems (NOS) represent a contemporary approach to orchard design, aimed at intensifying production through optimized use of land, labor, and environmental resources. These systems employ closely spaced trees trained into narrow, planar, light-permeable canopies that promote uniform fruit development and facilitate mechanization. Although the concept is not entirely new, recent technological advancements and the increasing demand for high yields of premium-quality fruit have renewed interest in NOS, especially in regions with limited land availability and high production costs. Research in this field focuses on the influence of modified training structures on fruit quality within the canopy, the potential for complete mechanization, and the adaptability of NOS to hot climates, where excessive heat and radiation may negatively impact fruit quality and tree longevity. This paper presents an overview of recent developments in NOS, complemented by selected original results examining the effects of different training systems on fruit quality. The paper will specifically present the results on fruit quality of different plum cultivars (Stanley, Čačanska Lepotica, and Empress) grown in various innovative training systems (UFO, Bi-axe) in comparison to the traditional spindle system, as well as the influence of harvest timing.

IL_VI-1 Bioactives of fruit by-products: Biological properties of fresh products and their corresponding food grade extracts

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Mediterranean basin generates significant quantities of by-products that hold great potential as sustainable sources of bioactive compounds with different biological properties such as antioxidant, antibacterial and antifungal. These materials, often underutilized, are increasingly being explored for applications across the food, packaging, cosmetic and pharmaceutical sectors. This presentation explores the biological properties of various fruit-derived residues, with a particular focus on their phenolic profile characterized through Ultra-High Performance Liquid Chromatography – Time of Flight – Mass Spectrometry (UHPLC-ToF-MS).

Apples and citrus fruits by-products were selected as the primary focus due to their high global consumption. Industrial citrus juice production leads to the accumulation of large volumes of waste comprising over half of the original fruit mass. Moreover, apples are among the fruits most commonly associated with health benefits, and their numerous cultivars can exhibit considerable differences in bioactive compound composition. In this presentation, by-products of citrus from a Portuguese juice producer and from different cultivars of Portuguese apples were investigated for their antioxidant and antimicrobial properties. Among them, lemon and lime residues showed the highest potential, with notable levels of bioactive compounds such as eriocitrin and hesperidin [1]. Apple by-products found to be particularly rich in phloridzin, chlorogenic acid and quercetin-3-β-D-glucoside [2].

Both raw materials and concentrated food-grade extracts were assessed. The extracts were prepared using solid-liquid extraction followed by rotary evaporation, a process designed to enrich their content in phenolic compounds. The findings contribute to the growing body of evidence supporting the circular economy approach, demonstrating how citrus and apples by-products can be transformed into high-value ingredients for functional foods and releasing active food packaging technologies.

Given the promising biological properties of the studied extracts, future research will focus on their potential to control mycotoxin contamination in cereals. Such studies could pave the way for the development of natural, safe, and sustainable strategies to reduce mycotoxin risk.

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IL_VII-1 Ternary polyphenols-metal-pectin interactions: Mechanisms and promising tools as mediators of polyphenols functionality

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Polyphenolic compounds, which are plant secondary metabolites, are well-known for their potential health benefits arising from a wide range of functionalities, such as antioxidant and anti-inflammatory activities. Many of these compounds are also linked to the sensory quality of foods, including color and astringency. However, many exhibit limited physical and chemical stability in aqueous systems due to autooxidation, enzymatic browning, and aggregation, which compromise both functionality and appearance. Furthermore, owing to their aromatic rings and multiple hydroxyl groups, polyphenols readily engage in hydrogen-bonding, π–π, and hydrophobic interactions, forming non-covalent complexes with various macromolecules. Such interactions may promote negative aspects, such as haze in drinks, while also stabilizing this group of bioactives.

Pectin, a complex biopolymer and polysaccharide found naturally in plants, has been shown to offer modest health benefits, including lowering cholesterol and serum glucose levels. Both pectin and polyphenolic compounds form coordination complexes with iron(III). This presentation will present the concept and mechanism of ternary interactions involving pectin, metal ions, and flavonoids. The affinity and outcome of these interactions are dictated by solution pH, pectin chain length, and, most importantly, specific flavonoid structural motifs—particularly the C2–C3 double bond, the number and position of *ortho*-dihydroxyl groups, and the presence and size of conjugating moieties such as sugars or gallate esters [1].

Finally, the concept will be presented as a potential strategy to enhance the stability and functionality of anthocyanins. Anthocyanin-iron-pectin complexes shift hue toward a stable blue color while minimizing sedimentation hurdles occurring in simple aqueous solutions [2].

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IL_VII-2 The phytochemicals in functional food products for management of anxiety and stress

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The increase in global population and events of the past decade, including the emergence of novel coronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its spread through the human population in early 2020 have accelerated attention to the overall health. After being declared a pandemic, levels of cognitive health declined including the increase in anxiety, depression and overall stress worldwide. Therefore, identifying dietary patterns and specific foods and food ingredients that may promote beneficial effects on cognitive health have become increasingly important.

There is enormous potential for natural compounds to contribute to the prevention and treatment of many diseases and this has become a research focus for many laboratories around the world. Pharmaceutical and food industries have similar interests in purified compounds from various sources in the management of some chronic diseases. However, there are only a few food-focused research groups globally currently exploring how natural compounds can affect mental health. Therefore, the main aim of this presentation is to provide the latest research findings on nutraceuticals and functional foods used for the management of anxiety and stress.

IL_VII-3 Innovative functional foods targeting iron deficiency anemia

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Iron deficiency anemia (IDA) is a condition caused by a lack of iron in the body, leading to decreased hemoglobin production and impaired oxygen transport. Common symptoms of IDA include fatigue, weakness, shortness of breath, and reduced cognitive or physical performance. Pregnant women, women of reproductive age, young children, vegans, and professional athletes are among the most affected groups. According to the World Health Organization, IDA affects approximately 30% of non-pregnant women of reproductive age, 37% of pregnant women, and 40% of preschool-aged children globally. IDA is typically treated with oral iron supplements, which are effective but often cause side effects that reduce patient adherence. An alternative approach involves changes in diet. However, iron-rich plant foods (e.g., spinach, broccoli, raisins, apricots, berries) are often ineffective due to their high levels of iron absorption inhibitors, such as polyphenols and phytic acid. After a thorough review of the literature on the phytochemical composition of plants, we selected those with high iron content and low levels of iron absorption inhibitors. By combining these plants in particular ratios, we developed functional food products (smoothies) and afterwards tested their effectiveness against IDA *in vivo* in anemic rats. The results of the animal study demonstrated significant improvement in IDA-associated blood parameters after 28 days of oral administration. These findings suggest that the selected plants are good sources of bioavailable iron and have the potential to be used in the development of innovative functional food products, whose incorporation into the diet could help prevent or support the treatment of IDA.

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IL_VIII-1 Challenges in chromatographic and effect-directed analyses of phytochemicals in plant and food samples

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Phytochemicals are naturally occurring compounds in plants. Phytochemicals are a vast and diverse group of compounds with a variety of chemical structures and a range of biological activities. Many phytochemicals are still unknown even though many are a part of our daily diet through consumption of e.g. fruits and vegetables. Despite this knowledge gap, many phytochemicals are nowadays used as ingredients of food supplements or functional foods and the growing demand of such products is increasing the demand for new sources of phytochemicals. More research is needed to connect the mode of action with the specific phytonutrient in medicinal plants and foods and to study their possible toxicity and interaction with medicines. This presentation will focus on challenges during the development of methods based on chromatographic (HPTLC, HPLC) and hyphenated techniques as well as effect-directed analysis (EDA) for targeted and non-targeted analyses of phytochemicals in plant and food samples. Examples will cover analyses of phytochemicals in diverse samples such as food supplements, food waste, bee pollen, flower pollen, invasive alien plant species (tree of heaven, Russian vine, Chinese knotweed, Japanese knotweed, giant knotweed, Bohemian knotweed), etc. The main challenges in chromatographic method development are related to lack of commercial standards and standard reference materials, lack of chromophores, isomeric structures and stability of the analytes. Challenges in non-targeted HPTLC–EDA analyses of antioxidants, antimicrobial compounds and enzyme inhibitors in crude extracts prepared from different plant species' parts, flower pollen and bee pollen are mostly related to the influence of the stationary phase, detection reagents, derivatization conditions and detection modes (UV, Vis, FLD). Profiling based on HPTLC–EDA–image analysis has a big potential in studies of phytochemicals. Methods based on complementary chromatographic techniques and EDA are indispensable in discovery of new sources of phytochemicals, development of new food supplements and functional food products, as well as control of food quality and safety.

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IL_VIII-2 An advanced UHPLC Q-ToF MS approach for the comprehensive identification and structural elucidation of phenylamides from plant sources

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Ultra high performance liquid chromatography coupled with quadrupole time-of-flight mass spectrometry (UHPLC Q-ToF MS) is an advanced analytical technique for comprehensive analysis of various bioactive compounds derived from plants or food. Separation ability of UHPLC with the combined application of quadropole and ToF mass analysers contributed to unique performance of this device, like as high resolution (ability to ion differentiation), fast data acquisition, wide mass range and high (improved) ion mobility, which enables its application for targeted and untargeted analysis of secondary metabolites. Manual interpretation of MS/MS spectra combined with ChemDraw software and/or some bioinformatic tool, which is additionally supported by data from available databases (CAS SciFinder-n and/or Pub chem), may be a powerful approach for identification and structure elucidation of unknown biomolecules from multi-compound extracts, in the absence of NMR analysis. In this review the main specifics and aspects of UHPLC Q-ToF MS technique for characterization of phenylamides (phenolic acid-polyamine conjugates) and their recently confirmed glycosylated forms were summarized. These derivatives exhibit a characteristic MS fragmentation in positive ionisation mode, with typical fragments obtained by losses of ammonia or sugar unit(s) (glycosylated polyamines) and cleavage/rearrangement of polyamine core containing the phenolic acid moiety(es). Identification and structural organization of some phenylamides is additionally explained on several representative examples confirmed in pollen grains and/or goji berries. Advantages and limitations of UHPLC Q-ToF MS technique for identification of phenylamides are also discussed, with the aim to facilitate and encourage their future characterization and application in the food sector. Finally, considering the potential health benefits of phenylamides, prediction of their structure can be an important part of *in silico* pharmaceutical studies (molecular docking) which support the formulation of novel dietary supplements.

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IL_IX-1 Multisensory aspects of eating and drinking experience – The influence of tableware

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Eating is not only a necessity of life; it is also a great source of pleasure for man. As eating and drinking activate different human senses, that can bring satisfaction or trigger negative emotions, it is important to better understand this association that people have with different types of food. When interacting with food or drink, the human senses work together to provide an integrated and unified multisensory experience. A typical example is the flavor percept, which combines taste, aroma and trigeminal sensations and can be influenced by tactile, thermal, painful and/or kinesthetic effects. Nevertheless, the same food or drink can be perceived as tasting differently depending on the interaction with the eating/drinking utensils, whereby direct tactile contact seems to be of great importance. In addition to oral-somatosensation, tactile sensations on skin surfaces outside the mouth, such as the hands and lips, can also influence human perception of the sensory properties of food. This perceptual fusion is a key factor that directs food preferences and choices.

In line with the growing interest in studying the interaction between tableware and tasters, the authors conducted a series of research studies in the period 2023-2025 on the influence of different eating and drinking utensils on the perception and/or acceptance and emotional responses to selected food and beverage products. Drinking cups made of different materials influenced the overall acceptability of the soft drink used, with the Styrofoam, paper and white polystyrene having a negative effect in contrast to glass and crystal-clear plastic. The flavor acceptability and the perception of flavor intensity were not affected, suggesting that the overall acceptability of the soft drink was influenced by the cup material itself. Compared to the heavier cups, the soft drink served in lighter cups was perceived as more viscous, which could be explained by interactions between the liquid and the cup material. The use of paper straws with different diameters had no influence on the flavor perception of the soft drink evaluated. The drink was perceived as more viscous when using the narrower straw compared to the larger diameter straws, which could be due to the greater force required to push the liquid through the narrower straw. The emotional map of four types of meals served with different sets of tableware showed that tasting the cold-served meals with wooden and plastic utensils, as opposed to regular tableware, was associated with negative emotions such as ‘unsatisfied’, ‘nervous’, ‘unpleasant’ or ‘irritated’, which presumably influenced participants' liking behavior. The perception of selected flavor attributes, with the exception of ‘atypical flavor’, was not influenced by the tableware made of different materials for the cold-served meals, but only for the meals served warm.

Various published research studies clearly show that the material, shape, size, color, weight, transparency, surface texture, but also the appropriateness of a particular cutlery or dish can significantly influence the sensory-discriminative, as well as hedonic and emotional responses to food and beverages. Foodservice operators and manufacturers, together with R&D experts and scientists, should take more care when selecting materials and consider how the properties of the tableware can be optimized to improve the eating and drinking experience.

IL_X-1 Solutions and challenges in prediction of novel food allergens

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The prevalence of food allergies (FA), a noncommunicable immunological illness that affects a significant proportion of the world's population, ranges from 1 to 10%. Globally, the prevalence of FA varies, and environmental factors possibly in conjunction with genetic sensitivity to environmental changes are the primary cause of the increase. In developed countries, this translates to approximately 8% of children and 10% of adults experiencing food allergies [1].

By 2050, the food supply will need to be increased by 70% in order to satisfy the demand from the global population. In response to this challenge, other plant-based protein sources as well as less common options like algae and insects have been taken into consideration. These novel food options have to be safe for the consuming population in accordance to FOOD 2023 Policy Framework (FITFOOD2030) [2].

Allergenicity assessment of novel food proteins is an important part of the safety assessment of novel foods. Existing methods for *de novo* assessment of allergenicity of new dietary proteins are not validated and have limited predictive value. The ALLPreT project (101072377) within the framework of HORIZON-MSCA-DN, steps up by proposing potential solutions to these challenges. The major focus has been directed on the sensitization phase of IgE-mediated food allergy, but also includes research of the elicitation phase with the goal of creating novel methods to more effectively differentiate between proteins that are non/weakly and severely allergenic.

The main focus of the lecture will be given on the advantages and limitation of the current *in vitro* models for the prediction of sensitization potential of food allergens.

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IL_X-2 Exposure assessment studies in Serbia – Road to improving food safety

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Understanding the dietary habits of a certain population enables deployment of the data into various food safety risk-based scenarios such as exposure assessments [1]. The first task is the development of a structured questionnaire, as outlined in the European Food Safety Authority (EFSA) guidelines. Besides basic demographic data, it collects two types of consumption information - frequency of consuming certain food and quantity of consumed food [2]. The sample of the tested population needs to be convenient, considering the size of a country [1]. Finally, the recall periods play an important role where EFSA recommends the 24-h, the 7-day dietary recall periods, or the use of food-frequency questionnaires. The second task is to analyze food from the market for the presence of selected chemical food contaminants employing valid laboratory methods in accredited laboratories. Based on this raw data, statistical distributions of the contaminants may be assumed.

Exposure of the population to a certain food contaminant is derived from three parameters: (i) consumption data; (ii) concentration of the contaminant in food, and (iii) body weight of the sample population [1]. As a result, different mathematical simulations enable calculation of Estimated Daily Intake as the key indicator of chronic exposure assessment scenarios paving the way for further research in two dimensions: medical research deployed in risk characterization associated with health issues and potential illnesses and food safety research providing feedback on improving food safety throughout the food chain.

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OP_I-1 Novel natural bioactives from *Cytisus multiflorus* and *Cytisus striatus* for dermocosmetic applications

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Wound healing is a complex and dynamic process involving inflammation, cell proliferation, and tissue remodelling to restore skin integrity. Despite advances in therapeutic approaches, the search for novel, safe, and effective natural agents remains crucial for enhancing skin regeneration. *Cytisus striatus* (Hill) Rothm. and *Cytisus multiflorus* (L'Hér.) Sweet are plant species native to Portugal, traditionally used to relieve various skin ailments. However, despite their ethnobotanical relevance, there is limited scientific evidence supporting their biological potential. Therefore, in this study, we investigated the regenerative properties of flower extracts from *C. striatus* and *C. multiflorus*, obtained through traditional extraction methods (infusion, decoction, and maceration). Phenolic compounds, widely recognized for their antioxidant activity, were identified and characterized by high-performance liquid chromatography coupled with diode array detection and electrospray ionization mass spectrometry (HPLC-DAD-ESI-MS). The cytocompatibility of both extracts was evaluated using human keratinocytes (HaCaT cell line) at concentrations ranging from 12.5 to 400 µg/mL, following modified ISO 10993-5:2009 guidelines. The extracts were shown to be cytocompatible at concentrations below 25 µg/mL over a 3-day culture period. The regenerative potential of *C. striatus* and *C. multiflorus* extracts was evaluated using the *in vitro* scratch assays performed with human keratinocytes. While the untreated control group achieved complete wound closure by day 3, all treatments with *Cytisus* extracts promoted full wound closure by day 2, demonstrating superior regenerative efficacy. Among the different extraction methods, both infusion and decoction promoted faster and more complete wound closure than maceration. These findings highlight the potential of *C. striatus* and *C. multiflorus* flowers extracts as promising sources of natural bioactive compounds. Their incorporation into dermocosmetic formulations may offer innovative therapeutic strategies for promoting skin regeneration.

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OP_I-2 *Melittis melissophyllum* L.: Obtaining a natural ingredient with preservative and bioactive potential

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Plants have long been used as powerful allies in the treatment and prevention of symptoms and diseases. However, since each plant has its own unique characteristics, in-depth studies are necessary to fully understand both the potential benefits and the risks associated with their use. Beyond their traditional medicinal applications, it is also important to highlight their potential in the food and nutraceutical sectors, particularly as promising natural ingredients for the development of functional foods [1]. *Melittis melissophyllum* L. (Lamiaceae) is a plant that is popularly recognized, yet there are only few studies available in the scientific literature [2]. In this context, the present study employed an experimental design and response surface methodology (RSM) to optimize a heat-assisted extraction (HAE) process, aiming to obtain an ingredient with preservative and bioactive potential from *M. melissophyllum* L. leaves. The extraction process was optimized by evaluating the combined effects of time (28–69 min), temperature (25–80°C), and ethanol/water ratio (0–100%, v/v) using a central composite rotatable design (CCRD) coupled with RSM. The experimental responses considered for optimization included the extraction yield (determined gravimetrically), the content of phenolic compounds (quantified by ultra-high-performance liquid chromatography), and antioxidant activity. Polynomial models were successfully fitted to the experimental data and used to identify the optimal HAE conditions. Extraction at 37°C for 51 min using a hydroalcoholic solution containing 28% ethanol resulted in a maximum yield of 21.1±0.2 mg of phenolic compounds per gram of extract, validating the predictive model. The *M. melissophyllum* extract obtained under these optimized conditions contained nine phenolic compounds, with luteolin-7-*O*-rutinoside and 5-*O*-caffeoylquinic acid as the most abundant and exhibited promising antioxidant and antimicrobial activities. Considering the potential for developing a natural ingredient suitable for use in the formulation of functional foods, this study highlights the preservative and bioactive potential of *M. melissophyllum* extracts.

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OP_I-3 Valorization of *Lentinula edodes* and *Agaricus bisporus* bioresidues: Gamma irradiation effects on polysaccharide bioactivity

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Mushrooms have been recognized as functional foods due to their rich composition of bioactive compounds, such as polysaccharides, contributing to their health benefits [1]. This work studied the influence of gamma irradiation on the recovery of polysaccharides from *Lentinula edodes* (Berk.) Pegler and *Agaricus bisporus* (J.E. Lange) Imbach bioresidues. These mushroom bioresidues were irradiated both fresh and freeze-dried with different irradiation doses (i.e., 0; 1; 2; and 3 kGy for fresh samples, and 0; 3.2; and 10 kGy for freeze-dried samples). The samples were extracted through aqueous extraction for 6 hours at 100 ºC, and total polysaccharide content was determined using the phenol-sulfuric acid colorimetric method. Antioxidant activity was evaluated through the lipid peroxidation inhibition (TBARS assay), and cytotoxicity was assessed using the resazurin reduction method on gastrointestinal and liver cell lines (Caco-2 and AML12, respectively).
Gamma radiation enhanced polysaccharides recovery, particularly in freeze-dried samples exposed to intermediate irradiation doses (3.2 kGy), likely due to structural modifications in the cell wall. Regarding antioxidant activity, samples irradiated at moderate doses exhibited lower IC_{50} values. Metabolic activity assays demonstrated dose-dependent effects, since higher doses of irradiated extracts reduced cell viability below 70% in both Caco-2 and AML12 cell lines, indicating that gamma irradiation may induce cytotoxic effects.
This work highlights the potential of gamma irradiation as a suitable technology to enhance the recovery of bioactive compounds such as polysaccharides from mushroom bioresidues.

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OP_I-4 Vitamin C prevents myricetin degradation in boiling water by reducing ortho-quinone intermediates

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Myricetin, a bioactive flavonoid, degrades rapidly in boiling water, limiting its use in functional foods and pharmaceuticals [1,2]. This study investigates the protective effect of vitamin C on the thermal degradation of myricetin and its mechanism of action. *O*-phenylenediamine derivatization identified reactive ortho-quinone intermediates, while density functional theory (DFT) calculations (ΔG = −47.74 kcal/mol) confirmed the redox mechanism. Vitamin C (0.8 mM) significantly improved myricetin retention from 32.8 % to 91.4 % in boiling water after 100 min of heating, outperforming nitrogen treatment. Myricetin degradation begins with oxidation to orthoquinones, which further degrades into phenolic acids and aldehydes. Vitamin C not only inhibited this process but also reversed oxidation by reducing ortho-quinones back to myricetin. These findings highlight vitamin C's potential to enhance flavonoid stability and bioavailability in functional heat-processed foods.

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OP_II-1 The current understanding about the biosynthesis of volatile organic compounds

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Plant-derived volatile organic compounds (VOCs) play crucial roles in various ecological interactions, such as plant communication, attracting pollinators, and defending against herbivores. Some VOCs also serve as active ingredients with significant economic and medicinal importance. For instance, monoterpenoids like linalool, geraniol, menthol, camphor, borneol, citral, and thymol are renowned for their flavors and aromas. These monoterpenoids typically have strong scents and physiological activities; compounds like thymoquinone are recognized for their excellent anticancer properties, making them valuable in pharmaceuticals, as well as in food and cosmetics. VOCs include a wide range of chemical classes, such as terpenoids, benzenoids/phenylpropanoids, amino acid derivatives, and fatty acid-derived compounds. With advancements in genomic, transcriptomic, and metabolomic techniques, significant progress has been made in discovering genes responsible for VOC biosynthesis. This discussion [1] focuses on recent advances in the biosynthesis of plant-derived VOCs, particularly benzenoids/phenylpropanoids and monoterpenes. It highlights the discovery of a peroxisomal enzyme, benzaldehyde synthase, in petunias that clarifies the biosynthetic pathway of benzaldehyde, and a bifunctional enzyme, geranyl/farnesyl diphosphate synthase (RcG/FPPS1), in roses (*Rosa chinensis* "Old Blush") that aids in the production of cytosolic geranyl diphosphate. Current insights into canonical and non-canonical pathways for monoterpene formation and various approaches useful for gene discovery are discussed. Open questions and future perspectives in this field are also presented.

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OP_II-2 Sulforaphane regulates lipid metabolism via PXR-mediated mechanism

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Obesity, as a global health issue, is closely related to the mechanism of lipid metabolism disorders. Natural products may regulate lipid metabolism through multi-target and multi-pathway to prevent and treat obesity. As a plant-derived bioactive compound, sulforaphane (SFN) can be found in cruciferous vegetables. SFN has been reported to reduce the accumulation of lipids. However, the underlying mechanism remains unclear. Nuclear receptors have been proved to be important potential targets for food safety and medicinal chemistry. As a member of the nuclear receptor superfamily, the pregnane X receptor (PXR) plays a critical role in regulating drug metabolism and mediating drug-drug interactions. Additionally, PXR is essential for maintaining the homeostasis of numerous endobiotics, including glucose, lipid, steroid, bile acid, and bilirubin. In this study, the potential of SFN to improve lipid metabolism disorders is investigated through altering PXR-mediated pathway. We aimed to explore the mechanisms of SFN in reducing lipid accumulation *in vitro*, *in vivo*, and *in silico*. To begin with, the ability of SFN to inhibit the transcriptional activity of PXR were described using the HepG2 system. Then, we used oleic acid (OA) and palmitic acid (PA) to induce the lipid accumulation in cells and the addition of SFN reduced the intracellular total cholesterol and triglyceride contents. Further, PXR knockdown (transfected with siPXR construct) decreased the expression of the lipid metabolism-related genes and proteins with less repression by SFN compared with the control cells treated with OA and PA. In high-fat diet-fed zebrafish, SFN reduced the lipid accumulation by targeting PXR. Finally, integration of molecular docking and molecular dynamics simulations showed that PXR-SFN complex maintained a stable binding through hydrogen-bonding and hydrophobic interactions. The results indicated that SFN lowered the lipid content probably through activating the PXR signaling pathway, thereby inhibiting lipid synthesis and promoting fat decomposition.

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OP_II-3 Unveiling grape seed extract phytochemical composition, antioxidant, and immunostimulant action mechanisms in *Caenorhabditis elegans* and *Drosophila melanogaster*

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Grape seed, as a byproduct of grape tree has been proposed as a functional ingredient for its excellent antioxidant activity [1-2]. However, few studies have assessed its phytochemical composition and health benefits in grape seed extract (GSE). Here, water was used as a green solvent to extract the bioactive compounds derived from grape seeds. UPLC-MS/MS analysis led to the identification of phytochemical compounds belonging to phenolic acids, proanthocyanidins, flavonoids, flavanol, and stilbenes, with proanthocyanidins most abundant. The results of *in vitro* (DPPH, ABTS, and FRAP assays) and *in vivo* (H_2O_2-induced oxidative stress model in *C. elegans*) studies showed that GSE exerts potential antioxidant activity and can significantly increase the survival rate of *C. elegans* under oxidative stress. Moreover, GSE also rescued the physiological and neurological impairments induced by the intake of excess ethanol in *C. elegans* models. Increase in survival rate was likewise observed in another model of *Drosophila* post GSE administration (12 days) as manifested by improved host defense against *Pseudomonas aeruginosa* PA14 infection. Targeted GC-MS based metabolites analysis revealed that induction of glucose intermediates and amino acids (glycerol 3-phosphate, malate, glutamate) are likely associated with the enhancement of innate immunity.

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OP_III-1 Evaluation of antioxidant capacity and key bioactives in royal jelly from Anatolia

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Royal jelly (RJ), the primary food source for the queen bee throughout her life and for worker bees during the first three days of their lives, is a secretion that is poorly soluble in water and rich in peptides, free amino acids, carbohydrates, lipids, phenolic compounds, vitamins, and minerals. Due to its antioxidants content, royal jelly plays a significant role in promoting human health. Like all natural substances, royal jelly is influenced by the surrounding ecosystem. In this study, the antioxidant and radical scavenging capacities of RJ samples collected from various regions of Anatolia by commercial and local beekeepers were analyzed. The results obtained from the extraction of fresh samples with 80% ethanol are as follows: Across all samples, the average total phenolic content was found to be 96.84 mg GAE/g, and the total flavonoid content was 0.182 mg QE/g. The radical scavenging capacities were 62.08% for the DPPH radical and 8.9% for the ABTS radical cation. Antioxidant activity was found to be directly proportional to the levels of phenolic and flavonoid compounds. Gallic acid was found to be below the detection limit in all samples, while caffeic acid was detected at 0.0568±0.0023 µg/ml in only one sample. The average quercetin content was 0.0056±0.0008 µg/ml.

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OP_IV-1 *Scutellaria lateriflora* L. extract for primary insomnia: A randomized crossover trial

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Primary insomnia is a common sleep disorder significantly impacting quality of life, characterized by persistent difficulties with sleep initiation, duration, or quality [1]. Current pharmacological treatments often come with undesirable side effects, including depression, withdrawal symptoms, and daytime drowsiness, and their long-term efficacy is rarely studied [2]. This single-center, controlled, randomized, crossover, double-blind, placebo-controlled clinical trial investigated the efficacy and tolerability of a chemically characterized *Scutellaria lateriflora* L. extract-based food supplement (400 mg/day) in 66 participants (18-70 years) with mild to moderate primary insomnia. Participants received either the supplement or a placebo for 56 days, with a 28-day washout period. The primary outcome, Pittsburgh Sleep Quality Index (PSQI) scores, showed significant improvement with *S. lateriflora* supplementation compared to placebo, indicating enhanced sleep-wake balance. Secondary outcomes, including sleep onset latency, sleep efficiency, total sleep time, and Visual Analog Scale (VAS) scores, also demonstrated considerable improvements. Importantly, the supplement was well-tolerated, with no reported adverse effects. A notable carry-over effect was observed, suggesting a prolonged benefit even after discontinuation, which highlights the need for longer washout periods in future studies. While the PSQI score reduction did not reach the conventional "good sleep" threshold, these findings collectively suggest that *S. lateriflora* extract is a safe and effective natural intervention for restoring the sleep-wake cycle and improving overall sleep quality in individuals with primary insomnia, offering a promising alternative to conventional treatments. Further large-scale, multi-center trials incorporating objective sleep measures are warranted to validate these encouraging results and inform clinical practice.

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OP_V-1 Nitrogen fertilization differentially affects the nutritional quality of onion (*Allium cepa* L.) depending on production method

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Onion (*Allium cepa* L.) bulbs are consumed daily by a large portion of the global population. To meet the increasing demand, farmers often apply nitrogen (N) fertilizers inadequately, overlooking the specific N requirements of different production methods. This study aimed to evaluate the effect of N rate on the nutritional quality of onion grown using the two most common production methods in Serbia: direct sowing (M1) and planting from sets (M2). A field trial was conducted under open-field conditions in the Vojvodina province (Pannonian environment), Republic of Serbia, using a randomized block design, in three replications. Four N rates were applied: 64 kg N/ha (control, N_{64}), 100 (N_{100}), 150 (N_{150}), and 200 (N_{200}) kg N/ha. Assessed parameters included crude fiber, total acidity, total sugars, protein content, and total N. In onions from M1, N fertilization increased crude fiber content, while no significant changes were observed in M2 onions. The highest total acidity in both M1 and M2 onions was recorded under N_{200}, with an average increase of 19.57% compared to the control. Total sugar content showed opposite trends: it increased significantly with rising N doses in M1 onions but decreased in M2 onions. The highest sugar content was observed under M1 × N_{200} and M2 × N_{64}. The highest protein content was recorded at N_{200} (0.130 ± 0.010 mg/g dry matter), representing a 27.22% increase over the control. Similarly, total nitrogen content was highest in both M1 × N_{200} and M2 × N_{200} treatments. These results indicate that N plays a significant role in shaping the nutritional quality of onion bulbs. Therefore, optimizing N fertilization strategies is essential, regardless of the production method.

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OP_VI-1 From waste to gold: A sustainable pathway to carotenoid recovery from natural sources

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With established and growing markets in human and animal health, lutein and β-carotene are recognized as potent natural antioxidants crucial for functions like vision, brain health, immune response, and disease prevention [1,2]. Nevertheless, the sustainability of their current production models is increasingly questioned. For lutein, the dominant practice of cultivating vast marigold fields imposes significant strain on arable land, a finite resource under intensifying pressure from global population growth and the need for food production. Indeed, 44% of the world's habitable land is already dedicated to agriculture, severely restricting further cropland expansion. This intensive monoculture, combined with energy-intensive extraction methods that often involve environmentally dubious and hazardous solvents, prompts serious concerns about the resilience of existing supply chains. Concurrently, while most industrial β-carotene is chemically synthesized for high yields, there's a discernible shift towards naturally derived alternatives, driven by consumer and industry concerns regarding synthetic food colorants.

In this work, we consider inedible agricultural side streams and discarded material of invasive alien plant species (IAPS) as sustainable sources of lutein and β-carotene. We employed green extraction solvents and energy-efficient extraction techniques to ultimately propose a multifaceted valorisation strategy that enables the acquisition of not only carotenoids but also other plant metabolites (e.g., carbohydrates, phenolic compounds, as well as other plant specific bioactives), further contributing to the zero-waste principle. By simultaneously addressing several sustainability challenges posed by the environmental impact of current carotenoid production, arable land pressure, and the escalating issue of IAPS and agricultural waste, our research proposes an ecologically synergistic alternative.

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OP_VI-2 Exploitation of apple biowaste to produce flour with potential application for innovative bakery products

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Nowadays, consumers are more aware and responsible for their food choices and the direct consequences that these choices have on their health and well-being [1]. In this sense, the food industry must create strategic and innovative alternatives, namely the incorporation of natural ingredients with functional properties in the preparation of new food products [2]. To valorise food industry by-products, flour was produced from apples discarded as bioresidues due to their lack of standard marketing characteristics. After analysing its nutritional, chemical, and bioactive properties, the flour was validated as a natural ingredient for use in the bakery industry. The nutritional evaluation of the flour revealed noteworthy protein and ash content. Three sugars were identified, with fructose being the most abundant (8.9 ± 0.5 g/mg, fw), as well as five organic acids, among which malic acid was the most prevalent (20 ± 1 mg/g, fw). The phenolic profiling of the apple flour revealed the presence of seven phenolic compounds, with phenolic acids being the predominant class. Regarding bioactivity, the antioxidant potential evaluated through four *in vitro* assays demonstrated that apple flour possesses antioxidant and antimicrobial activities, without exhibiting toxicity. After characterization, the flour was incorporated into two different types of bread (wheat bread and cornbread). The addition of apple flour at a reduced level of 10% preserved the texture and traditional nutritional profile, maintaining the original characteristics appreciated by consumers. Moreover, the evaluation of the microbial load suggests that apple flour may inhibit the growth of contaminants in the breads. Overall, the nutritional and chemical composition of the apple flour obtained in this study supports its potential as a viable ingredient for the bakery industry, enabling the development of alternative and health-promoting products. Additionally, the reuse of apple bioresidues allows for the valorization of annually discarded waste, contributing to both economic and environmental benefits.

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OP_VII-1 Cardoon blade-enriched functional smoothie: Formulation and stability study

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The world's population has been growing, and so has the need for nutrition. *Cynara cardunculus* L. var. *altilis*, usually known as cardoon, is a species from the Asteraceae family widely distributed across Mediterranean basin countries. In addition to being widely consumed because of its rich nutritional and chemical composition, this species has been increasingly exploited due to its wide variety of industrial applications. Despite this growing recognition, a significant amount of plant material is discarded yearly [1]. This work studied the potential of cardoon blades as a bioactive and dietary fiber ingredient in a vegetable/fruit-based smoothie within a zero-waste approach. The smoothie formulations were pasteurized by high-pressure processing (550 MPa for 3 min at room temperature, HPP) and thermal pasteurization (90 ºC for 30 s, TP), and stored at 4 ºC for 50 days. The smoothie's stability and quality were studied during the shelf-life period. Several physicochemical (i.e., viscosity, pH, color, total soluble solids), chemical (fiber content, soluble sugars, fatty acids, and phenolic compounds), and bioactive (i.e., antioxidant, NO-production inhibition, hepatotoxicity) properties were analyzed. Cardoon-fortified smoothies exhibited higher viscosity, darker color, increased phenolic compound levels, and greater NO-production inhibition and antioxidant activities. Furthermore, cardoon blades ingredients contributed to a more stable dietary fiber content throughout the smoothies' shelf-life. HPP-processed smoothies did not contain sucrose, suggesting enzymatic activity that resulted in sucrose hydrolysis. In conclusion, the fortification of smoothies with cardoon blades enhanced bioactive properties and quality attributes during their shelf-life, highlighting the potential of this plant material as a functional food ingredient in a circular economy context.

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OP_VII-2 Functional phytonutrients in moringa, stevia, avocados, honey, and palm dates: a multi-targeted approach to health promotion

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The growing prevalence of chronic diseases has driven a global search for plant-based interventions with preventative and therapeutic potential. This abstract summarizes recent multidisciplinary research into the phytonutrients composition and health benefits of five bioactive-rich foods: *Moringa oleifera*, *Stevia rebaudiana*, avocados, honey, and palm dates (*Phoenix dactylifera*). *Moringa oleifera* exhibits a broad spectrum of pharmacological activities, including hypoglycemic and cerebroprotective effects, with bioactive compounds like quercetin and chlorogenic acid contributing to metabolic and neurovascular benefits. *Stevia rebaudiana* has emerged as a natural sweetener with additional anti-inflammatory and cardioprotective properties, offering a healthier alternative to synthetic sugars. Avocados, rich in monounsaturated fatty acids, phytosterols, and micronutrients, are being linked to hormonal regulation and endocrine health. Recent reviews suggest their influence on cortisol and sex hormone pathways. Honey, known for its antioxidant, antimicrobial, and wound-healing effects, continues to be explored for its immunomodulatory properties due to its complex phenolic profile. Lastly, palm dates are gaining recognition for their role in digestive health, particularly in alleviating constipation. Their fiber content, combined with phenolic compounds, may improve gut motility and microbiome composition. Together, these studies emphasize the therapeutic promise of phytonutrient-dense foods as functional agents in preventive health strategies, with implications for diet-based interventions in metabolic, hormonal, neurovascular, and gastrointestinal conditions.

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OP_VII-3 A green approach for obtaining functional food ingredients from medlar (*Mespilus germanica*) by fungal cellulase enzymes

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Fungal cellulase enzymes were used to treat medlar fruit and obtain insoluble dietary fibers (IDF). Dietary fibers are indigestible plant-based components, important for improving digestion, blood sugar regulation, and reducing chronic disease risk. Medlar, despite its nutritional and functional value, is underused fruit, both in consumption and scientific research, particularly regarding its potential as a source of IDF.

In this study, for the first time, lignocellulosic-type IDF from medlar were successfully isolated and characterized. Fungal strains *Aspergillus welwitschiae* and *Aspergillus tubingensis* used in this study have proven to be good producers of the cellulase enzyme complex and at the same time non-toxigenic and safe for use in food production [1]. Dried medlar, after soluble sugars removing, was treated with cellulase enzymes to break down complex polysaccharides, enhancing the characteristics of the obtained IDF, based on previous experience with triticale [2]. The enzymatic treatment improved the medlar's water retention capacity (WRC) and oil retention capacity (ORC), for 15% and 5% respectively, and as well swelling capacity in both water and oil for 48% and 12%, respectively, compared to untreated medlar, highlighting its potential as a valuable ingredient for functional food development and dietary fiber enrichment. Microscopic analysis revealed structural changes in the medlar fibers due to enzymes activity, indicating partial hydrolysis of lignocellulosic components. These changes contribute to improved water and oil retention and swelling, which are directly linked to the material's porosity. This process enhances the nutritional and functional properties of medlar-based IDF, making it a valuable ingredient for fiber-enriched food products.

The study also emphasizes the potential of using non-toxigenic fungal cellulase enzymes as a sustainable and eco-friendly technology. It opens opportunities for commercial applications in food, animal feed, and biotechnology industries while promoting medlar as a high-quality IDF source, offering a simple process that could increase its market value.

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OP_VII -4 UP4HEALTH ingredients for the development of functional foods

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The UP4HEALTH project intends to address some challenges associated with bio-residue streams in the agri-food sector. Its goals include recovering added-value phytochemicals from by-products and converting them into healthy, sustainable, bioactive ingredients [1].
The present work depicts the study of an ISANATUR olive pomace-based ingredient designed as PBF, optimized within the frame of the UP4HEALTH project. This ingredient was characterised in terms of phenolic compounds (HPLC-DAD-(ESI-)HRMS/MS), and phenolics bioaccessibility was evaluated through the INFOGEST consensus protocol [2] at a concentration of 0.025 and 0.08 g/mL (PBF:water, w/v), a ratio established for its incorporation into food prototypes. Afterwards, PBF was incorporated into cereal bars to functionalise this food product. Here, the bioaccessibility assays were replicated, and the bioavailability was studied using a Caco-2 human intestinal cell model.
Twenty-six compounds were tentatively identified and quantified in PBF, with the caffeoyl phenylethanoid glycoside verbascoside and hydroxytyrosol as the major compounds (5.79±0.04 and 2.5±0.1 mg/g dw of the ingredient, respectively). An average of 51% of the ingredient's total extractable phenolic was bioaccessible after simulated digestion. When incorporated into the food prototypes, the bars containing 0.025 and 0.08 g/mL of PBF exhibited bioaccessibility averages of 49 and 62%, respectively. Regarding the bioavailability studies, an average of 25% of the total phenolic content from the PBS ingredient was absorbed. For the cereal bars, 21 and 18% absorption percentages were obtained for the formulation enriched with 0.025 and 0.08 g/mL of PBF, respectively.
Overall, this work aligns with global initiatives for sustainable development and circular economy in the agri-food sector. It provides valuable insights regarding the conversion of by-products into added-value ingredients and proposes new alternatives for developing functional foods, promoting the valorisation of the entire production chain.

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OP_VII-5 Bioactive compounds and antioxidant activity of bean-based "cheese" enriched with spices and microgreens

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Beans or dry beans (*Phaseolus vulgaris* L.) are among mostly consumed legumes. They contain considerable amount of proteins; up to 25 % in dry weight and around 8% after cooking. Due to a specific protein profile, beans are highly recommended in vegetarian and vegan diets, and are suitable for individuals with celiac disease and those following gluten-free nutritional protocols [1,2]. Beans are well known for their nutritional potential and bioactive compounds, which makes them an ideal raw material for development of various functional and innovative products.

The study aimed to evaluate phytochemical composition and antioxidant properties of fermented bean-based product (so-called cheese - BBC) boosted with spices and different microgreens (as coating). In that respect, five samples of BBC were prepared using red chili pepper and chive microgreens (BRpC), radish microgreens (BR), saffron and radish microgreens (BSR), basil microgreens (BB), and pea microgreens (BP). The sample of fermented BBC with no microgreens and spices (B) was used as control. The samples were analyzed for total phenolic content (TPC), total flavonoid content (TFC), total carotenoid content (TCC), and antioxidant activity measured *via* different assays (TAC – *in vitro* phosphomolybdenum Total Antioxidant Capacity, CUPRAC - Cupric Reducing Antioxidant Capacity, and DPPH$^{\bullet}$ - Free Radical Scavenging Activity).

Results of the experiments indicated that samples differed significantly from the control (B) in all measured bioactive compounds, with exception of TPC in BR and BP. The highest TPC and TCC (FW) were measured in BSR (1.18 mg/g GAE and 47.56 μg/g total carotenoids, respectively), whereas TFC was highest in BP (5.24 mg/g RE, FW). Antioxidant activity of BR measured in all assays was not significantly different form control (B), whereas other samples differed significantly from the control sample in all three assays. Exceptions were BP (TAC and DPPH$^{\bullet}$ assays) and BSR (CUPRAC assay). The highest antioxidant activity exhibited samples BRpC (1.97 mg/g AAE FW), BP (2.16 mg/g AAE FW) and BSR and BB (2.67 and 2.66 μmol/g TE, FW) in TAC, CUPRAC and DPPH$^{\bullet}$, respectively. Based on the obtained results spices and microgreens could be useful adds-on for the development of innovative functional bean-based products.

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OP_VII-6 Development of dry pasta with improved nutritional and biological value using duckweed powder

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The family Lemnaceae, commonly known as the duckweed, is a worldwide distributed group of five genera and 37 species of monocotyledonous aquatic plants. It has one of the fastest biomass production rates and is used for industrial and wastewater treatment. Its high protein, antioxidant and vitamin content makes it a potential material for the food industry, complementing traditional plant protein sources. Furthermore, the use of innovative protein sources can reduce the ecological footprint and can complement or replace traditional animal proteins as well.
Our aim was to develop dry pasta with good biological value by the use of duckweed powder. The experimental samples were made from millet flour, plantain seed coat flour, duckweed powder with egg and without egg (in the latter case egg was replaced with tap water). The products have been prepared with different proportions of duckweed (0%, 5%, 10%, 15%, 20%) on the base of millet flour. The physical and chemical parameters of raw, dry and cooked pastas were analysed such as colour, water activity and moisture content, total polyphenol content, antioxidant capacity, water soluble protein content. The volatile compounds of the pastas were analysed by gas chromatography-mass spectrometry-olfactometry (GC-MS-O). Furthermore, products were submitted under *in vitro* digestion, then the effect of digestion on the bioaccessible components were monitored. Statistical evaluation was performed by one-factor analysis of variance (ANOVA) using PAST software, and variances are checked by Levene's test.
The antioxidant capacity, polyphenol content, and water-soluble protein content of raw /dry/cooked/digested cooked pastas, cooking water samples increased proportionally with the increase in the amount of duckweed. The use of duckweed in the pastas was detected by analysis of the volatile fraction, resulting in the presence of numerous odor-active compounds. According to our opinion, duckweed can be an excellent source of new functional products.

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OP_VIII-1 Raman spectroscopy in carotenoid analysis: Current state and future perspectives

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Carotenoids are natural pigments found in plants, algae, and bacteria, responsible for yellow, orange, and red coloration. They are widely used in the cosmetic and pharmaceutical industries due to their significant effects on human health, including photoprotection, anti-aging properties, and potential benefits for the gastrointestinal tract. Carotenoids exhibit strong responses in Raman spectroscopy because of their polyene chain structure, particularly the vibrations of their conjugated double bonds [1].
The study of carotenoids using Raman spectroscopy began to intensify in the 1970s [2]. Over the past 50 years, numerous advancements have taken place, including enhancements in instrument performance, increases in computational power, and the development of novel Raman techniques such as Surface-Enhanced Raman Spectroscopy (SERS), Coherent anti-Stokes Raman scattering spectroscopy (CARS), and Stimulated Raman spectroscopy (SRS) [1].
Furthermore, the integration of Raman spectroscopy with microscopes and portable instruments allows for the localization of carotenoids within tissues and enables *in situ* measurements. More recently, the application of machine learning and artificial intelligence has enabled the development of precise and reliable classification (discrimination) and regression (quantification) models.

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OP_X-1 Food safety and health implications: Understanding modern challenges and solutions

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Food safety remains a critical concern in modern society, with increasing attention being given to the risks posed by chemicals, contaminants, and food processing methods. The body of work presented explores the multi-faceted challenges surrounding food safety and health. From heavy metals in food crops to the dangers of ultra-processed foods and harmful chemicals like acrylamide, these studies highlight the need for a more nuanced understanding of food safety that transcends conventional regulatory measures. One area of focus is the impact of emerging technologies, such as plasma-functionalized water, on antimicrobial properties and seed germination, which could lead to novel methods for improving food safety and sustainability. In parallel, concerns about nitrosamines and their potential carcinogenic effects in food underscore the importance of better monitoring and regulation to protect consumers from long-term health risks. Additionally, the prevalence of microplastics in food supplies and the toxicological risks associated with various pollutants have raised alarms about the unseen dangers lurking in our daily diet. The work also delves into the health implications of food choices, examining the allure of ultra-processed foods and their hidden risks. In contrast, the natural benefits of washing fruits and vegetables, as well as the sustainable practice of reducing food waste, are explored as viable solutions to mitigate health risks and promote safer food consumption habits. This body of research emphasizes the urgent need for updated food safety regulations, better consumer education, and innovative solutions to address the hidden risks of food contaminants, ultimately striving for a safer and healthier global food system.

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OP_X-2 Diet based on the different fish species from the Adriatic Sea – Statistical and *in silico* profiling of consumers' health risk

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Fish are widely recommended as part of a healthy diet due to their high content of beneficial omega-3 fatty acids. They can also accumulate environmental pollutants, posing potential health risks to consumers. This study presents a comprehensive assessment of the nutritional benefits and toxicological risks associated with six pelagic fish species (horse mackerel, sardine, round sardinella, anchovy, chub mackerel and garfish) from the Adriatic Sea (Croatia), focusing on persistent organic pollutants (POPs; organochlorine pesticides - OCPs and polychlorinated biphenyls - PCBs), macro- and micro-elements, and fatty acid (FA) content. The data were used to assess the human health risk by applying models of Risk Assessment Information System (RAIS). In addition, combining genetic algorithm and multiple linear regression, Hansen's solubility theory, and toxicokinetic analyses, potential clinical outcomes were predicted, including the absorption and distribution of pollutants in human tissues. The results showed that diet based on chub mackerel and round sardinella provided the highest intake of essential omega-3 FA with lower POP intake, while anchovy based diet minimized toxic element intake compared the other investigated species. Although non-carcinogenic or carcinogenic risks were not observed from POPs (HI 1; CR 1×10^{-6}), element-based assessments highlighted inorganic arsenic (As) as the major contributor to hazard index (HI > 1) and cancer risks, particularly in horse mackerel and anchovy [1]. Nevertheless, OPERA toxicokinetic modeling showed that both OCPs and PCBs, even in trace concentrations, may accumulate in the human intestine and liver and fetal modeling indicates that they notably affect thyroid toxicity risk, especially PCB 170. HSP confirmed that the investigated POPs are mainly absorbed in the small intestine over 4–9 hours. These results highlight the importance of considering both adult and fetal compartments in risk assessment and provide computational support for refining *in vitro* gastrointestinal bioaccessibility simulations.

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PhDSO_I-1 LC-MS and GC-MS analyses reveal that amino acid-induced ammoniation of EGCG in tea enhances its structural stability

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Epigallocatechin gallate (EGCG) is one of the most abundant polyphenols in tea. Its transformation mechanism during the fermentation process has an important influence on the quality of tea and the formation of functional components.

First, based on LC-MS full scan analysis, it was determined that the content of EGCG in the aqueous extracts of green tea, white tea, oolong tea and black tea decreased with the deepening of fermentation. GC-MS full spectrum scanning identification found that N-EGCG was metabolized by EGCG in fermented tea samples.

The characteristic ions and retention times of N-EGCG were confirmed by LC-MS and GC-MS dual platforms, and the SIM mode was used to achieve its specific quantification in different tea samples. It was found that it was significantly negatively correlated with EGCG in content. Further, the change trend of N-EGCG in methanol extract was consistent with the water extraction data, excluding the possibility of its thermal induction, and verifying that its generation was mainly driven by the fermentation process. Correlation analysis with free amino acids in tea leaves showed that L-Serine and L-Threonine were positively correlated with N-EGCG content and negatively correlated with EGCG, suggesting that they may participate in the C-N bond formation reaction of N-EGCG as nitrogen donors.

This study combined multi-platform mass spectrometry to reveal the EGCG metabolic pathway in tea leaves, verified the formation of the stable product N-EGCG, and proposed a "polyphenol-amino acid" synergistic mechanism induced by fermentation, providing a theoretical basis for the study of the transformation mechanism of functional tea polyphenols and the development of metabolic markers for the degree of tea fermentation.

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PhDSO_I-2 Efficacy mechanism for synergistic amelioration of *Dendrobium Officinale* polysaccharides and *Sacha Inchi* leaf flavonoids concerning arecoline neurotoxicity

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It is highly necessary to address dysfunctions like reduced oral tone in humans caused by betel nut consumption. In this study, we found that arecoline at 2 mg/mL significantly reduced nematode locomotor and learning abilities, which may be related to the increase in oxidative stress, decrease in mitochondrial number and mitochondrial dysfunction, neuronal damage, and decrease in neurotransmitters in *C. elegans* caused by stimulation of arecoline. The polysaccharides extracted from *Dendrobium officinale* (DOP) and the flavonoids extracted from the leaves of *Sacha Inchi* (SF) significantly ameliorated the neurotoxicity by arecoline, both in combination and individually. DOP, which mainly acts in conjunction with increasing energy metabolism and ameliorating mitochondrial dysfunction in the *C. elegans*, and SF which was more focused on ameliorating the oxidative stress and neurological damage of the *C. elegans*, resulted to be significantly superior to them when used in combination than when they were used individually. In order to further explore the key targets of DOP and SF in ameliorating the neurotoxicity of arecoline, we analyzed the differentially expressed genes by transcriptome sequencing, and enriched the key signaling pathways related to neural effects. GO functional enrichment analysis and KEGG signaling pathway analysis indicated that the key targets of DOP and SF in ameliorating the neurotoxicity of arecoline may be related to the gene expression of G-protein-coupled family receptors in the neuroactive ligand-receptor interaction signaling pathway in neural activity. Among them, dopamine, acetylcholine and γ-aminobutyric acid neurotransmitter receptor gene expression was significantly increased by DOP and SF.

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PhDSO_II-1 Protopanaxadiol triggers G0/G1 cell cycle arrest and apoptosis in human cervical cancer HeLa cells through the PPER pathway

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Protopanaxadiol (PPD) is considered to be the most active pharmacological element in ginseng and has been widely studied for its anticancer effects [1]. However, the detailed anticancer mechanism of this compound in cervical cancer (CC) HeLa cells has yet to be thoroughly understood [2]. In this research, we discovered that PPD effectively inhibits CC HeLa cell proliferation and cause morphological changes, with an IC_{50} measured at 34.18 μM. Based on mRNA-seq analysis, we revealed the mechanism by which PPD inhibits HeLa cell proliferation. The results from Gene Ontology and Kyoto Encyclopedia of Genes and Genomes enrichment analysis indicated significant enrichment of DGEs in the cell cycle and protein processing in the endoplasmic reticulum (PPER) pathway. By inducing DNA damage, PPD resulted in G0/G1 phase cell cycle arrest, inhibited Bcl-2 to cause ROS production, upregulated cytochrome c (Cyto-c) expression, thereby further reducing mitochondrial membrane potential (Δψm), activated the caspase family, and induced cell apoptosis. In addition, PPD promoted Ca^{2+} leakage, downregulated the PPER pathway (PERK, ATF6, and IRE1α), increased Chop expression levels, and mediated programmed cell death. These observations imply that PPD can induce apoptosis in HeLa cells, highlighting its potential as a novel natural therapeutic for cervical cancer.

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PhDSO_II-2 *Paeonia lactiflora* root extract attenuates LPS-induced skin inflammation through TRPV1, MMPs, and cytokines pathways: *In silico* and *in vitro* research

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Skin inflammation is a protective biological mechanism against tissue destruction, mediated by various inflammatory factors, such as transient receptor potential vanilloid (TRPV) channels and matrix metalloproteinases (MMPs), and characterized by the dysfunction of both immune and non-immune cells [1,2]. Due to this fact, the development of drugs that inhibit TRPV1 and MMPs activity is one of the topical areas of pharmaceuticals in the context of skin inflammatory diseases.
Paeonia lactiflora Pall. is a rich source of bioactive compounds, including the terpene glycoside paeoniflorin, providing antioxidant and analgesic effects. The aim of this study was to evaluate the effects of *Paeonia lactiflora* extract against LPS-induced inflammation on skin keratinocytes through *silico* and *in vitro* methods. Molecular docking predicted the targeted action of paeoniflorin on the transmembrane domain of TRPV1 channels and the active site of MMP-9, both implicated in the pathogenesis of LPS-induced inflammation. The *Paeonia lactiflora* root extract had been standardized for 50-55% paeoniflorin using HPLC-MS. The maximum tolerated concentration of the extract was evaluated on keratinocytes as 0.5 mg/mL through an MTT assay. The anti-inflammatory effect of the extract was attributed to a dose-dependent reduction in TRPV1 channel amount and pro-inflammatory cytokines of TNF-α, IL-6, IL-13 in primary keratinocytes HaCaT. At a concentration of 0.05 mg/mL, the extract significantly decreased excessive levels of TNF-α, IL-6, and IL-13 by 148.82%, 37.78%, and 68.63%, respectively (p<0.01) in comparison to control. The analgesic effect may be linked to a reduction in the TRPV1 channel by 113.47% (p<0.01) up to basal control. Moreover, the extract demonstrated a protective effect on tissue destruction by reducing MMP-9 production by 70.27% in dermal fibroblasts (p<0.001) and restoring collagen I amount to the initial level in dermal fibroblasts, compared to the LPS negative control.
Thus, *Paeonia lactiflora* root extract standardized for paeoniflorin has promising anti-inflammatory potential for the prophylaxis and treatment of skin inflammation.

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PhDSO_II-3 The novel targeted peptidosome system for deep transdermal delivery of copper tripeptide and dermal regeneration

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Copper stimulates the proliferation of dermal fibroblasts and enhances the synthesis of collagen as well as elastin. The age-related decline in copper concentration in the skin has been demonstrated to delay cellular differentiation across all skin layers [1]. One of the more prevalent forms of copper is chelated copper, in the form of copper tripeptide-1 (GHK-Cu). This highly hydrophilic peptide co possesses the ability to bind copper cations and deliver them into skin cells. Due to their hydrophilic nature, peptides exhibit poor permeability through the skin's outer layer. Thus it is necessary to develop specialized transdermal delivery systems.

A promising approach involves the use of peptidosomes, which are modified liposomes engineered with cargo peptides to enhance the targeted delivery of bioactive molecules up to the dermis. The aim of the research was to develop a novel targeted peptidosome system and investigate its regeneration effects on the skin.

The study of the cytotoxic potential of peptidosomes through MTT assay revealed that concentrations ranging from 0.03 to 30 mg/mL exhibited a good safety profile in human fibroblasts. Stability testing revealed that the peptidosomes containing liposomal and chelated copper forms maintained a rounded morphology with a double-layered structure and consistent particle size of 10-100 nm. This contrasts with conventional copper tripeptide-loaded liposomes that exhibited an irregular structure, lacking spherical morphology, and a single lipid layer.

Using the Franz diffusion cell system model (OECD 429) and ICP-MS method, it was established that the peptidosomes revealed significant penetration and copper recovery in the dermis by 3 times more in comparison to copper tripeptide alone and standard liposomes (p<0.01, ANOVA). Utilizing ELISA assay, it was demonstrated that the peptidosomes stimulated collagen I synthesis by 2 times as the synthetic retinol (p<0.01), but with improved dermatological tolerance. Thus, the novel targeted peptidosome system has promising potential for skin regeneration and aging prophylaxis.

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PhDSO_II-4 Intergenerational inheritance of quercetin-induced abnormal immunity in mice

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Quercetin, belonging to dietary flavonoids enrich in the human diet, has been reported to regulate immune-related models by epigenetic modifications in many organisms [1]. However, few studies were reported to explore its transmission of regulatory effects across generations to progeny. Here, we selected *Escherichia coli*, which is a conditional pathogen capable of causing gastrointestinal infections or various localized tissue and organ infections under specific conditions, as the pathogenic strain to infect mice [2]. We firstly provide evidence that Quercetin can not only induce responsiveness changes against systemic *Escherichia coli* infection in the directly exposed organisms, but rather in subsequent generations through the transgenerational inheritance of epigenetic traits. Both parental male mice and progeny exhibited cellular and phenotypic changes associated with metabolic alterations. Surprisingly, the male and female progeny of mice treated with Quercetin (200 mg/kg) for 6 weeks negatively enhanced the survival rate under systemic *E. coli* (1×108 CFUs/mL) infection, concurrent with an increase in bacterial loads of liver and spleen were also observed. Serum TNF-α, and IL-1β levels were significantly increased post-infection in the progeny. Our results provide the first evidence for the inheritance of immunity driven by Quercetin in mammals, and attenuating protection against bacterial infection.

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PhDSO_II-5 Transgenerational immunosuppression induced by sodium glutamate in *Caenorhabditis elegans*

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Monosodium glutamate (MSG), a widely used flavor enhancer, represents one of the most common forms of glutamate found in foods [1]. Despite its extensive application in the food industry to augment umami taste, accumulating evidence suggests that MSG exerts a range of adverse effects on human health, including metabolic syndrome, neurotoxicity, infertility, fetal developmental abnormalities, and immune dysfunction [2]. However, whether MSG-induced immunosuppressive effects can be inherited across generations remains unclear. *Caenorhabditis elegans*, with its high degree of genetic conservation with humans and rapid reproductive cycle, has been demonstrated to be a powerful model to investigate innate immunity and transgenerational inheritance. In this study, we systematically explored the transgenerational immunosuppressive effects of MSG using *C. elegans* as a model organism. MSG was supplemented into the worms' standard diet, followed by infection with *Pseudomonas aeruginosa* PA14 to evaluate innate immune responses in both the parental generation (F0) and their offspring. Surprisingly, MSG significantly impaired host defense against pathogens, and this immunosuppressive effect continued to be appeared in the F2 generation. MSG exposure also compromised the worms' ability to avoid PA14 and disrupted pathogen-induced aversive learning behavior, suggesting potential neurotoxic effects. Moreover, developmental delays and reduced fecundity were observed in MSG-treated worms during early larval stages as well. Overall, our findings demonstrate that MSG exposure leads to heritable impairments in innate immunity, neural function, and development in *C. elegans*. These transgenerational effects, observed up to the F2 generation, may be mediated by epigenetic mechanisms. This study highlights the need for greater caution regarding the widespread use of MSG in food, given its potential long-term biological consequences.

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PhDSO_IV-1 EGCG alleviates premature aging caused by excessive methionine intake via the formation of N-EGCG

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Excessive nutrient intake is a key driver of metabolic stress and aging. Here, we show that methionine (MET) overload induces a progeria phenotype in *Caenorhabditis elegans* manifested by accelerated development, lipid accumulation, redox imbalance, and shortened lifespan. Excess MET was found to disrupt one-carbon (C1) metabolism, causing S-adenosylhomocysteine (SAH) accumulation concurrent with methylation imbalance. Epigallocatechin gallate (EGCG) as a chief polyphenol in tea was found to bind MET yielding N-EGCG, as confirmed by LC-MS/MS. This conjugate lowered MET bioavailability and mitigated its toxicity. The generation of N-EGCG restored the expression of key metabolic genes (daf-16, set-2, met-2, sod-3, gst-4, hsp-16.2) and MET adenosyltransferases (MAT1A, MAT2A), suggesting that it can play a synergistic role in both substrate scavenging and upstream methyl donor regulation. This study proposed a novel metabolic buffering mechanism of polyphenol-amino acid combination, which alleviates the metabolic toxicity caused by excessive MET production, leading to systemic metabolic repair mediated via DAF-16 pathway. This discovery offers both a theoretical and practical basis for applying bioactive compounds in nutritional toxicity intervention and multi-target metabolic regulation.

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PhDSO_V-1 The effect of ripening period on sugar content in medlar (*Mespilus germanica* L.) fruits grown in Serbia

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The common medlar (*Mespilus germanica* L.) belongs to the Mespilus genus (Maloideae subfamily). The plant has a wide array of traditional uses in both gastronomy and medicine. The medlar fruit is round or pear-shaped, depending on the variety, yellow-green to dark brown color, sweet and tasty. It ripens very late, at the beginning of November, after the first frosts. The fruits are edible throughout the winter and can be stored in ordinary storage for up to two months. Besides being consumed as a fresh, fruits can be eaten in the form of snacks, appetizers, combined with wine, or prepared in different ways: in cakes and pastries, as jam, marmalade, jelly, wine, vinegar, juice, refreshing pizzas, sweets, tarts and compotes [1].

In this work the sugar profile was analyzed in medlar fruits in two ripening periods. Fruits (obtained from a local producer) were harvested as technologically ripe (hard fruits) and then left in a home cellar until become soft and edible (an uncontrolled atmosphere, at temperature of 10 °C for 34 days). The sugar profile was determined by HPAEC-PAD (high-performance anion-exchange chromatography with pulsed amperometric detection) method [2].

The results of analysis showed that fructose and glucose were the dominant sugars in both ripe (fructose 4.07 g: glucose 2.60 g/100 g) and unripe (fructose 3.54 g: glucose 2.24 g/100 g) fruits, whereas the presence of other sugars such as arabinose (ripe 0.79 g: unripe 0.96 g/100 g), raffinose (ripe 1.79 g: unripe 0.19 g/100 g), sucrose (ripe 0.45 g: unripe 0.28 g/100 g) and maltose (ripe 1.36 g: unripe 2.56 g/100 g) was notable. Apart from the dominant sugars, disaccharides including isomaltose (ripe 0.50 g: unripe 0.09 g/100 g), turanose (ripe 0.47 g: unripe 0.66 g/100 g) and melibiose (ripe 0.33 g: unripe 0.70 g/100 g) were measured. Among sugar alcohols (polyols), the most abundant in the medlar fruit were sorbitol (ripe 0.34 g: unripe 0.59 g/100 g) and erythritol (ripe 0.23 g: unripe 0.13 g/100 g). The results of the study revealed that the content of the main sugars gradually changed in the post-harvest period. The content of fructose, glucose, sucrose, raffinose, isomaltose and erythritol increased whereas the content of arabinose, maltose, turanose, melibiose and sorbitol decreased during the ripening process.

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PhDSO_VI-1 Microbial approach for the production of a new fermented functional food or ingredient from olive pâté by-products

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The valorisation of agro-food by-products requires economically viable and innovative approaches to develop new products with high added value. The by-products from olive oil production are of particular interest due to their richness in bioactive molecules, whose health-promoting properties have been recognised by the European Food Safety Authority. In recent years, increasing attention has been given to pâté olive cake (POC), a by-product obtained from olive oil extraction using a multiphase decanter (DMF). POC, characterised by high moisture content, absence of kernel, and presence of bioactive compounds, represents a suitable matrix for the formulation of new functional foods or ingredients. Therefore, in this study, POC was fermented in a bioreactor using three microbial strains, *Lactiplantibacillus plantarum*, *Wickerhamomyces anomalus* and *Candida boidinii*, previously isolated from brines of fermented table olives. Chemical, microbiological, and molecular analyses were performed at the beginning and end of the fermentation process. The results showed that the lowest pH value (4.09) was observed after 10 days in the sample inoculated with *C. boidinii*. Microbiological analyses showed a persistent dominance of yeasts throughout fermentation (ranging from 5.5 to 7.80 Log_{10} CFU/g), as confirmed by molecular analysis. The microbial strains influenced both the phenolic profiles and the volatile organic compound composition of the samples. Regarding the biological assays, the sample fermented with *W. anomalus* showed the most promising results, including the fastest transepithelial transport rate across Caco-2 cells, the strongest inhibitory activity against the tested cyclooxygenases, and the highest antioxidant activity. In conclusion, the results of this study provide valuable insights into the role of specific microbial strains in enhancing the nutraceutical properties of complex agro-industrial by-products.

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PhDSO_VI-2 From agrowastes to functional food ingredients using fungal xylanases

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The growing accumulation of agro-industrial waste presents both an environmental challenge and an opportunity to develop sustainable bioprocesses. Lignocellulosic residues such as corn cobs, wheat straw, and chamomile processing by-products are rich in complex polysaccharides, particularly xylan, yet are often discarded or underutilised. In this study, these agrowastes were valorised as renewable raw materials for producing xylooligosaccharides (XOS), a class of emerging functional food ingredients with prebiotic and antioxidant properties. Xylan was isolated from the processed biomass using alkali extraction and hydrolysed using xylanase-rich crude enzyme extract from the fermentation liquid of *Aspergillus tubingensis* FAT 35. Enzymatic hydrolysis yielded a mixture of XOS with varying degrees of polymerisation. Structural characterisation by thin-layer chromatography (TLC) and high-performance liquid chromatography (HPLC) confirmed the presence of xylobiose, xylotriose, and longer chain oligosaccharides, indicating a broad spectrum of XOS products. Antioxidant activity of the hydrolysates was assessed using DPPH and FRAP assays, both of which demonstrated potent radical scavenging and ferric-reducing capacities. These results emphasise the dual environmental and nutritional value of converting agricultural residues into bioactive ingredients via enzymatic bioconversion, offering a sustainable pathway toward developing health-promoting food products.

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PhDSO_VI-3 From waste to resource – apple seeds as a functional raw material

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Apple seeds, a notable byproduct of fruit processing, hold great potential for diverse applications. Given that apples are the second most produced fruit globally, the large volume of seeds generated annually holds considerable potential for sustainable resource utiliazation. Often discarded as waste, this byproduct ends up in landfills, contributing to greenhouse gas emissions and climate change. This study aimed to evaluate the oil content, fatty acid profile, and tocopherol composition of seeds from 11 apple cultivars grown organically across five locations in Norway, assessing their potential as a source of high-value substitute for conventional oils. Oil was extracted using cold extraction with petroleum ether. Fatty acid composition and tocopherol content were determined by GC and HPLC, respectively. The oil content varied significantly among the examined cultivars, ranging from 6.74% ('Holsteiner Cox', Ullensvang) to 13.55% ('Red Aroma', Telemark). Variability due to location was less pronounced than that among cultivars, indicating genotype as the main factor influencing oil yield. Fatty acid profiling showed a dominance of unsaturated fatty acids, with an average unsaturated-to-saturated ratio of ~9:1. Linoleic (58.83%), oleic (31.06%), and palmitic acid (7.25%), were the most abundant, together accounting for over 95% of the total fatty acid content. In addition to fatty acids, all four tocopherol isomers (α-, β-, γ-, and δ-tocopherol) were detected, which, together with tocotrienols, constitute vitamin E. The predominant tocopherols were β- and α-tocopherol, averaging 22.57 mg/100g and 20.30 mg/100g, respectively, while γ- and δ-tocopherol were present in significantly lower amounts (6.23 mg/100g and 3.59 mg/100g, respectively). These findings indicate that seed oil is rich in unsaturated fatty acids and vitamin E compounds, which is a key indicator of the quality of vegetable oils, providing significant health benefits. Cultivars such as 'Red Aroma' and 'Rubinstep' showed particularly high oil potential, highlighting their suitability for future research.

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PhDSO_VI-4 Nutritional characterization and antioxidant application of sunflower by-products in biscuit formulations

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The recovery of bioactive compounds from agroindustrial by-products is an increasingly relevant topic in the context of sustainability and innovation in the food sector. With increasing environmental concerns and the need to use resources more efficiently, this strategy has proven to be a promising alternative both for reducing waste and for the development of functional foods [1]. This study aimed to evaluated the nutritional composition of sunflower (*Helianthus annuus* L.) leaves (FOG) and flowers (FLG) commonly discarded by the industry after seed collection, as well as, the antioxidant activity of their ethanolic extracts, and their application in biscuit formulations using a sustainable flour blend.
The proximate composition (total proteins, fat, carbohydrates and ash) were determined using the AOAC official food analysis methodologies; while the antioxidant activity was evaluated using two *in vitro* assays: TBARS and DPPH. Biscuits were prepared with a 50:50 mixture of wheat flour and stale bread flour (a bakery by-product), promoting valorization of waste in both the base and functional components. The results showed emphasis on the protein and carbohydrate content, with protein values of 20.94±1.51 g/100 g dw (FOG) and 10.49±0.14 g/100 g dw (FLG), and carbohydrate amount of 11.51±1.57 g/100 g dw and 9.55±0.08 g/100 g dw, respectively. The EC_{50} values obtained in TBARS assay were 0.39±0.01 mg/mL for the FOG extract and 0.226±0.003 mg/mL for the FLG extract. For the incorporation study, the extract amounts introduced into biscuits were based on these values to ensure equivalent antioxidant potential. Three formulations were developed: control (no extract), FOG-enriched, and FLG-enriched biscuits. TBARS analysis of biscuits demonstrated improved oxidative stability in both enriched versions, with the FOG formulation showing the highest antioxidant effectiveness. These findings confirm the viability of incorporating sunflower leaf and flower extracts as natural antioxidants in bakery products formulated with upcycled flours. This dual valorization strategy enhances nutritional functionality and supports circular economy practices, contributing to Sustainable Development Goals (SDGs) 3 (Good Health and Well-being), 12 (Responsible Consumption and Production), and 13 (Climate Action).

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PhDSO_VI-5 UHPLC-ESI-MS/MS-based chemometric approach for investigating effect of conventional versus modern extraction methods on polyphenols recovery of grape seed wastes

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Grape seed wastes are valuable sources of bioactive polyphenols. This study compares the efficiency of maceration extraction (ME) with modern techniques—ultrasound-assisted (UAE), microwave-assisted (MAE), and accelerated solvent extraction (ASE)—for polyphenol recovery. Using UPLC-ESI-MS/MS, 24 polyphenols were identified and quantified. ASE showed superior recovery of phenolic acids (e.g., gallic acid, 231.75 μg/g) and proanthocyanidins (e.g., procyanidin B1, 126.18 μg/g), while MAE favored flavonoid extraction (e.g., myricetin, 41.52 μg/g). Chemometric analysis revealed co-extraction patterns among structurally related compounds. Findings suggest that MAE/ASE are optimal for antioxidant-rich nutraceuticals, whereas ME suits thermally sensitive pharmaceuticals. This work supports sustainable valorization of grape seed by-products.

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PhDSO_VII-1 Interfacial assembly mechanism of whey protein isolate and taxifolin non-covalent complexes and their applications in yogurt

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This study prepared whey protein isolate (WPI)-taxifolin (Tax) non-covalent complexes with a range of Tax concentrations (0-60 μM), elucidated their interaction mechanisms, and explored their effects on the structure of WPI. The complexes were subsequently incorporated into yogurt, and the yogurts were evaluated for both rheological properties and biofunctional characteristics. The results demonstrated that the WPI-Tax complexes generated granular aggregates with zeta potentials ranging from -16.71 to -25.89 mV and average particle sizes between 184.57 and 287.03 nm. Multi-spectral analysis indicated that the fluorescence peak decreased and the ultraviolet-visible absorption peak increased as the concentration of Tax increased. Fluorescence quenching studies revealed static quenching between WPI and Tax, with negative values of ΔG, ΔH, and ΔS. The non-covalent binding to Tax caused the β-turn to decrease and the α-helix to rise. In molecular docking and molecular dynamics simulations, it was discovered that the predominant mechanism between WPI and Tax was hydrogen binding. Furthermore, the addition of WPI and WPI-Tax complexes improved the apparent viscosity and storage modulus of yogurt compared with the control. Antioxidant activity tests conducted in vitro showed that WPI and WPI-Tax complexes significantly increase the yogurt's antioxidant capacity. Additionally, it enhanced the inhibition of α-amylase and α-glucosidase, indicating that it might be able to regulate blood sugar levels. This study provides a theoretical foundation for the application of WPI-Tax non-covalent complexes as functional ingredients of yogurt.

PhDSO_VII-2 Enhancement of phytochemical profile, antioxidant, and antimicrobial potential in *Brassica juncea* cv. Frizzy Joe through sustainable foliar biofortification strategies

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Brassica juncea (L.) Czern., commonly known as Indian mustard, is a leafy vegetable from the Brassicaceae family valued for its nutritional and medicinal properties. This study investigates the potential of foliar biofortification using mineral-based fertilizers and a seaweed-derived biostimulant to enhance the phytochemical composition, antioxidant activity, and antimicrobial properties of *B. juncea* cv. Frizzy Joe. Plants were treated with an iron and potassium dominant foliar fertilizer (*HaifaStim Wall-Up S* and *Wuxal K40*, respectively), as well as a seaweed-based biostimulant Kelpak, (derived from *Ecklonia maxima* (Osbeck) Papenfuss), with an untreated group serving as the control. Spectrophotometric assays quantified key bioactive compounds—plant pigments (chlorophyll *a* and *b*, carotenoids), phenolics (TPC), flavonoids (TFC), and hydroxycinnamic acid derivates (HCAs), while antioxidant capacity was assessed through DPPH•, $ABTS^{\bullet+}$, *in vitro* phosphomolybdenum total antioxidant capacity (TAC), ferric reducing power (FRP), and cupric ion reducing antioxidant capacity (CUPRAC) assays. Additionally, HPTLC bioautography was employed to assess the antibacterial activity in response to the applied treatments, targeting *Bacillus cereus* and *Salmonella typhimurium*.
Results revealed that Kelpak significantly increased pigment content (chlorophylls and carotenoids), while the potassium treatment enhanced TPC, total flavonoid content TFC, and HCAs levels. Antioxidant responses were assay-dependent: the iron treatment exhibited the highest TAC and FRP values, Kelpak significantly enhanced CUPRAC and $ABTS^{\bullet+}$ activity, while DPPH• activity remained relatively high in the control. Antimicrobial evaluation demonstrated moderate to strong activity across all extracts, with variations attributed to treatment-specific phytochemical profiles. These findings indicate that foliar application of biofortifying agents can selectively enhance the nutritional and functional quality of Indian mustard leaves. The study supports the integration of sustainable inputs, such as biostimulants, with conventional fertilizers to promote plant health, improve food quality, and contribute to the development of functional foods.

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PhDSO_VII-3 Novel Insights into the anti-obesity potential of myricetin using a Drosophila model

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Obesity is a growing global health issue linked to metabolic syndromes, including type 2 diabetes and cardiovascular diseases. Excessive energy intake contributes significantly to weight gain and systemic metabolic disruption. Flavonoids exert anti-obesity effects by modulating lipid metabolism, reducing oxidative stress, and suppressing chronic inflammation [1]. Myricetin, a flavonoid found in fruits such as bayberry (*Myrica rubra*), has been shown to possess antioxidant, anti-inflammatory, and anti-obesity properties in both *in vitro* and mammalian models [2].
In this study, we established a high-sugar diet (HSD) induced obesity model in *Drosophila melanogaster* to further evaluate the anti-obesity potential of myricetin. Fed a standard diet, HSD, or HSD supplemented with myricetin, flies of separate genders exhibited different behaviour. Behaviour assays and expression of genes related to lipid metabolism were tested. Myricetin-treated flies showed significantly reduced fat accumulation, and improved physical activity compared to the HSD group. RT-qPCR results also suggested that myricetin may enhance lipolysis and inhibit lipogenesis by regulating genes.
Together, our data suggest that myricetin effectively alleviates diet-induced obesity in Drosophila, and this is consistent with its systemic metabolic benefits observed in mammals. These results highlight potential of myricetin as a natural therapeutic candidate for obesity management.

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PhDSO_VII-4 Unlocking the functional potential of *Rhus coriaria* L.

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Rhus coriarua L.*,* commonly known as sumac, is a shrub traditionally used as a spice, particularly in Middle Eastern cuisine [1]. This study aimed to characterize the nutritional and chemical composition of the fruit and evaluate the bioactive potential of hydroethanolic extracts from the fruits, leaves, and stems of the shrub collected in the Foz Côa, Portugal. AOAC procedures and spectrophotometric and chromatographic techniques were used to determine the fruits' nutritional value and chemical profile. The phenolic compounds and bioactive properties (through in vitro assays of antioxidant, cytotoxicity, and antimicrobial activities) of hydroethanolic extracts from the fruits, leaves, and stems were also evaluated. The fruit contained 13.9 g/100 g dry weight (dw) of lipids, 3.6 g/100 g dw of proteins, 49 g/100 g dw of fiber, and an energy value of 365 kcal/100 g dw. It also presented 17.9 mg/100 g dw of β-carotene, 2.1 mg/100 g dw of tocopherols, 29% saturated fatty acids, 38% monounsaturated, and 33% polyunsaturated. The total phenolic compounds were 23.6, 22.7, and 19.3 mg/g extract for fruits, leaves, and stems, respectively. Among the samples, leaf extracts exhibited the highest antioxidant activity, with EC_{50} values of 1.63 µg/mL for DPPH, 5.47 µg/mL for reducing power, and 2.02 µg/mL for TBARS, outperforming both stem and fruit extracts. Leaf extracts also demonstrated the most effective antimicrobial activity, with MICs as low as 0.15 mg/mL against *Salmonella enterica*. In contrast, stem and fruit extracts exhibited moderate activity, with MICs ranging from 0.3 to 5 mg/mL. No toxicity was observed in any of the hydroethanolic extracts tested. The characterization of different parts of sumac expands scientific knowledge about this shrub and paves the way for its sustainable and innovative use in the food industry, adding economic value and promoting the development of new functional and healthy products.

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PhDSO_VII-5 Nutritional profile of bean-based formulation enriched with microgreens and spices

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Beans (*Phaseolus vulgaris* L.) are a significant source of plant-based proteins (18-31% in dry matter), dietary fibers, and bioactive compounds including anthocyanins, flavonols, phenolic acids, saponins and carotenoids [1]. Consumption of beans has been associated with a range of health benefits, including antidiabetic, antioxidant, anti-inflammatory, and anti-hypercholesterolemic effects, as well as modulation of gut microbiota and body weight regulation [2]. Due to its low allergenic potential and gluten-free properties, it is suitable for specialized dietary regimes. While traditional thermal processing and fermentation enhance their nutritional value, the addition of microgreens presents an opportunity to further improve nutritional and functional properties of this product.

The aim of the study was to assess the nutritional properties (proximate composition and soluble sugars and phytates content) of fermented bean-based formulation enriched with different types of microgreens and spices. Five samples were prepared and labeled as follows: with red chili pepper and chive microgreens (BRpC), with radish microgreens (BR), with saffron and radish microgreens (BSR), with basil microgreens (BB), and with pea microgreens (BP). The content of following parameters were analyzed: total lipid, protein, and sugar, moisture, ash, soluble sugars and phytates. Results for total protein, sugar, lipid and ash as well as moisture content are expressed as %, soluble sugars in mg/g glucose, and phytates in mg/g Na-phytate based on fresh weight (FW) of samples.

Among the samples, BRpC exhibited the highest content of ash (4.69%), lipids (3.02%), and proteins (18.70%) and the lowest total sugar content (73.58%), BR sample had the highest soluble sugars (22.91 mg/g glucose) and the lowest moisture (15.68%), BB sample had the highest total sugar (76.86%) and moisture (23.05%), but the lowest amounts of ash (3.86%), lipids (2.73%), and proteins (16.55%). BP sample had the lowest soluble sugars (17.57 mg/g glucose). The content of phytates was in the range 33.58-34.73 mg/g Na-phytate (FW) in BP and BSR, respectively.

The obtained results indicate variability in the nutritional composition among the studied samples. Further evaluation of the fermented bean-based product enriched with microgreens and/or spices may contribute to the development of innovative plant-based products which can be of special interest in diets with specific requirements.

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PhDSO_X-1 Effects of the aspartame on growth, development, immunity and neurological function of *Caenorhabditis elegans*

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The rising global obesity rates and increasing prevalence of diabetes have led to the widespread use of artificial sweeteners as sugar substitutes. Artificial sweeteners provide sweetness with minimal or no caloric intake, making them popular in sugar-free beverages, low-calorie foods, and dietary management for individuals with diabetes. However, concerns regarding their potential impacts on metabolic health, gastrointestinal disorders, and carcinogenesis have sparked extensive discussion [1, 2]. In this study, we investigated the effects of aspartame (ASP), one of the commonly used artificial sweeteners, on the growth, immune function, and neurological responses of *C.elegans*.

Morphological analysis indicated that ASP exposure significantly increased both body length and body width most of the time from the L4 stage to adulthood. In addition, the results of oil red O staining showed no significant difference in lipid accumulation between ASP and CON worms on the first day of adulthood. Therefore, the results suggest that ASP, as a non-caloric sweetener, has less risk of causing obesity after ingestion. Still, the increase in body length and width may be related to promoting the growth and development of worms.

Additionally, ASP intake during the larval stage significantly reduced the survival rate of *C. elegans* when exposed to *Pseudomonas aeruginosa* (PA14) and exacerbated intestinal damage. These results suggested that ASP consumption impairs the resistance of worms to pathogenic bacteria, likely due to impaired intestinal barrier. In addition, ASP exposure significantly impaired both the ability to avoid PA14 and the learned pathogenic avoidance of PA14, suggesting a potential neurotoxic effect.

Overall, we are further investigating the underlying mechanisms of these effects. Our preliminary findings suggest that some negative effects may be transmitted to offspring through epigenetic mechanisms, which will make people more cautious about the addition of artificial sweeteners in food.

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PhDSO_X-2 Innovative radiofrequency solution for pest control in infested chestnuts

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Infestations by *Curculio elephas* and *Cydia splendana* in chestnuts pose a significant challenge to the food industry, affecting product quality and causing economic losses [1]. Conventional disinfestation methods, such as prolonged thermal treatments, involve high water and energy consumption [2], driving the search for more efficient alternatives. In this study, we evaluated the efficacy of a radiofrequency system specifically designed for pest elimination in chestnuts, developed in collaboration with our project partners. Based on a preliminary screening analysis, an augmented central composite design (augmented CCD) was applied, considering two factors: power (793-2500 W) and conveyor speed (190-281 kg/h), with 18 experimental runs, including eight central points. Temperature increases in the fruit, larval survival rate after treatment, and cooking percentage were measured. Numerical optimization (Nelder-Mead algorithm) was performed to minimize larval survival rate and cooking rate, identifying optimal conditions at 1500 W and 190 kg/h conveyor speed. Under these parameters, the observed mean values were ΔT=34.7°C, survival rate=11.6%, and cooking rate=3.4%, all falling within the 90% confidence interval of the predicted values. Further refinements of the model are planned, incorporating more realistic environmental factors beyond the controlled experimental conditions, aiming to adapt the model to real-world chestnut processing and storage conditions. Results suggest that increasing power and conveyor speed significantly influence the temperature reached by chestnuts, affecting treatment efficacy, making it essential to determine the optimum operating point of the process. Radiofrequency could represent an efficient and sustainable solution for improving the disinfestation of chestnuts and become an innovative strategy for pest control in the food industry.

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PP_I-1 A beta-carotene rich maize line as a resource of bioactive compounds

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Maize is one of the major sources of provitamin A for humans. Thus, the improvement of provitamin A carotenoids in maize varieties through breeding or biofortification is a promising strategy to alleviate Vitamin A deficiency. Maize Research Institute Zemun Polje has a breeding program aimed to create beta-carotene rich (BCR) maize, using the integrated conventional and molecular breeding approach. One commercial standard maize (SM) inbred line was converted to its BCR counterpart with the aid of gene-specific molecular marker *crtRB1*-3 TE through marker assisted backcross breeding. The aim of this study was chemical evaluation of the improved line. Relevant bioactive compounds, such as carotenoids, tocopherols and free phenolic acids content were analysed, and quality index (tryptophan to protein ratio) was determined. Beta carotene content (BC) was significantly higher ($p<0.05$) in BCR line compared to the SM line. This increase of 49.11% has confirmed the success of the conversion process. Among tocopherols, alpha-tocopherol (α-T) content was significantly higher ($p<0.05$) in comparison with SM. Out of free phenolic acids, content of caffeic acid (CA) and ferulic acid (FA) were significantly higher ($p<0.01$), as well as gallic acid (GA) ($p<0.05$), while increase of *p*-coumaric acid (*p*-CoumA) content was not significant. Quality index (QI) was also elevated for 9.28% in BCR line, which implies improved nutritional quality of the protein. Furthermore, significant correlations ($p<0.05$) were identified between QI and GA, between BC and α-T, CA, *p*-CoumA, FA and protein content, as well as between α-T and CA and FA, indicating the possibility of simultaneous selection and improvement of these traits in our breeding material. Chemical evaluation has identified this BCR maize line as a good resource of bioactive compounds with beneficial effects on human health. Therefore, it will serve as an important breeding material for developing maize hybrids with improved nutritional value.

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PP_I-2 Phytochemical profile and biological activities of roots of *Cynanchum acutum* L.

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Cynanchum acutum L. is a plant species belonging to the genus *Cynanchum,* which comprises approximately 200 species in the Asclepiadaceae family and is distributed worldwide. *C. acutum* is a highly toxic plant with limited medical applications.

The methanol (MeOH) extract of roots of *C. acutum* was separated using chromatographic methods with various adsorbents, such as Diaion HP-20, Sephadex LH-20, and silica gel. The results from TLC and LC-MS studies of the isolated fractions indicated the presence of terpenes, flavonoids, C21 glycosides, and cardenolide glycosides. Seven known compounds (3 cardenolide glycosides - lanatoside A, lanatoside C and corchorusoside C, 2 flavonoids - kaempferol 3-*O*-β-D rutinoside and quercetin 7-*O*-β-D-glucopyranoside, 2 pregnans – atratosides A and atratoside D) were isolated from the underground parts of *C. acutum.* The structure of the natural compounds was determined using modern physicochemical methods (HPLC, MS, NMR spectroscopy) by comparing their spectral data with literature references. Cardenolide glycosides, a new class identified for the *Cynanchum* genus, are particularly interesting.

Recent studies have shown promising cytotoxic activity of the methanol (MeOH) extract from roots of *C. acutum*. When tested on various cell lines, including murine cells, the extract exhibited significant activity, particularly at higher concentrations. These findings suggest that *C. acutum* contains bioactive compounds capable of inhibiting cell growth and inducing cell death in a controlled manner.

PP_I-3 Under-research natural resources from the Asteraceae family of plants as potential antioxidant agents

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Under-researched natural resources of bioactive compounds with antioxidant activity from plants which belongs to the Asteraceae family exist. The main goal of this research was to investigate the antioxidant potential of less researched plants from the Asteraceae family. Three different assays were performed to express the antioxidant potential: 2,2-diphenyl-1-picrylhydrazyl (DPPH$^{\bullet}$), 2,2'-azino-bis-(-3-ethylbenzothiazoline-6-sulfonic acid) diammonium salt (ABTS$^{\bullet+}$) and reducing capacity of Fe^{3+} ions (FRAP) assays. Teen different samples were obtained from: *Eupatorium cannabinum* herb, *Tanacetum parthenium* herb, *Tragopogon pratensis* herb, *Silybum marianum* seed, *Artemisia absinthium* herb, *Cichorium endivia* leaves, *Sonchus arvensis* herb, *Inula oculus-christi* herb, and *Tanacetum macrophyllum* herb. Nine different plant genera were examined, with *Tanacetum* genus represented by two plant varieties. Conventional solid/liquid extraction was performed with following extraction parameters: solid/liquid ratio 1:20 m/v, solvent for extraction 60% ethanol, room temperature, constant shaking (180 rpm) and time of extraction 24 h. Antioxidant activity for DPPH$^{\bullet}$ assay was ranged from 55.3083 to 127.2424 μM Trolox/g DW. Among teen different samples, the Asteraceae plants such as *E.cannabinum* (127.2424±9.5386 μM Trolox/g DW) and *T. pratensis* (123.1873±3.2129 μM Trolox/g DW) expressed the highest ability to neutralize DPPH radicals. For ABTS$^{\bullet+}$ assay, antioxidant capacity was ranged between 161.6776 to 335.7753 μM Trolox/g DW. *T. parthenium, E. cannabinum*, and *T. pratensis* stood out as a plants with highest ability to neutralize ABTS radical cations with 335.7753±10.278 μM Trolox/g DW, 323.1386±15.911 μM Trolox/g DW and 315.7973±5.3063 μM Trolox/g DW, respectively. The range for FRAP assay was from 127.5352 to 292.5945 μM Fe^{2+}/g DW by ten different samples. Two plants showed significantly high ability to reduce Fe^{3+} ions, *E. cannabinum* (292.5945±10.2868 μM Fe^{2+}/g DW) and *T. pratensis* (289.6463±5.0416 μM Fe^{2+}/g DW). In general, for all three assays the lowest antioxidant capacity was observed in seed of *Silybum marianum* and herb of *Artemisia absinthium.* Due to under-researched the Asteraceae plants present the rich natural resources of bioactive compounds with significant antioxidant activity further implementation in various products as non-synthetic preservatives may be enabled.

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PP_I-4 Under-explored Asteraceae plants as a valuable source of bioactive compounds with enzyme inhibitory activity

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Natural resources of bioactive compounds with enzyme inhibitory activity from plants which belong to Asteraceae family are under-explored. The main goal of this research was to determine the chemical profile of Asteraceae plants extracts and ability to inhibit the activity of enzymes. Teen different plants were investigated: *Solidago virgaurea*, *Tanacetum vulgare, Tussilago farfara, Cota tinctoria, Inula ensifolia, Eupatorium cannabinum, Cichorium intybus*, *Tanacetum parthenium, Tragopogon pratensis*, and *Cichorium endivia.* All plants belong to the Asteraceae family and nine different genera (two plant varieties were researched within genus *Tanacetum*). Conventional maceration with 60% ethanol, 1:20 m/v solid/liquid ratio, at room temperature, for 24 h and with constant shaking (180 rpm) was performed for obtaining the Asteraceae plant extracts. Extracts inhibitory activity was investigated against four enzymes: α-amylase, α-glucosidase, acetylcholinesterase, and tyrosinase. Chemical profile of plant extracts was defined by LC-MS. *Tanacetum vulgare* expressed the highest ability to inhibit α-amylase (317.23 μM ACAE/g), while *Eupatorium cannabinum* showed the lowest inhibitory activity (188.60 μM ACAE/g). In term of ability to inhibit the α-glucosidase, *Solidago virgaurea* (245.12 μM ACAE/g) possessed the highest value and *Tragopogon pratensis* (102.79 μM ACAE/g) the lowest. For enzyme inhibitory activity against acetylcholinesterase *Solidago virgaurea* (0.12 μM GALAE/g) had significantly high inhibitory potential in comparison to the other plants. By analyzing the enzyme inhibitory activity against tyrosinase, *Inula ensifolia* (203.52 μM KAE/g) stood out as the best. According to LC-MS analysis 130 compounds were identified and quinic, fumaric, dihydroxybenzoic, quercetin 3-*O*-hexoside, kaempferol 3-*O*-hexoside, luteolin, quercetin, apigenin and kaempferol were present in *Solidago virgaurea*, *Tanacetum vulgare, Tussilago farfara, Cota tinctoria* and *Inula ensifolia*. Exploring and implementing less-known Asteraceae plants rich in bioactive compounds with enzyme inhibitory activity in form of functional food or dietary supplements may fight with today's global diseases such as Alzheimer diseases, diabetes type two and skin pigmentation.

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PP_I-5 Antioxidant potential of capsule and pressed-cake of blue poppy (*Papaver somniferum*)

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Papaver somniferum known for its nutritional and therapeutic benefits is widely utilized in the pharmaceutical, cosmetic, and food industries. Its rich bioactive composition (including polyphenols, tocopherols, and vitamins) also makes it a valuable material in alternative medicine. Alkaloids are the most prevalent and are predominantly found in the capsule. Pressed cake, which is produced during the cold-pressing of poppy seed oil, is a by-product that represents a rich source of bioactive compounds with potential antioxidant activity. This study aimed to evaluate the antioxidant potential of bioactive compounds found in different poppy parts, including the capsule, pressed-cake (PC), and defatted pressed-cake (DPC).

Solid-liquid extraction (SLE) was used to obtain extracts from poppy. During this process, different concentrations of ethanol (0, 20, 40, 60, 80, and 96% w/v) were used. The extraction conditions were: room temperature for 24 h, with a shaking speed of 180 rpm, and a molar ratio of 1:10 m/v. PC was obtained from seed during the cold-pressing oil process as a by-product. One portion of PC was defatted using Soxhlet extraction with methylene-chloride as a solvent, and then extracted by SLE. Three *in vitro* tests: 1,1-diphenyl-2-picrylhydrazyl (DPPH), 2,20-azinobis-(3-ethylbenzothiazoline-6-sulfonic) cation (ABTS) and ferric reducing antioxidant power (FRAP) were used to determine antioxidant activity of obtained extracts.

According to DPPH assay, 60% ethanol for capsule extract showed the greatest ability to remove free radicals, while in case of PC and DPC, water extracted the most antioxidant compounds. In the case of the ABTS and FRAP assays, the extracts from the capsule and DPC obtained with water showed the best antioxidant activity, while for the PC, due to interference, it was not possible to obtain. According to the results, the used waste showed good antioxidant activity and, as such, can be utilized in the production of functional food.

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PP_I-6 Chemical profile and enzyme-inhibitory activity from different parts of blue poppy (*Papaver somniferum*)

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Due to the significant side effects associated with synthetic drugs, there has been a growing interest in natural agents in recent years. In an effort to prevent numerous diseases, plant-based natural therapeutics are receiving increasing scientific attention. Poppy (*Papaver somniferum*) is one of the oldest plants used in traditional and alternative medicine, primarily due to its rich chemical composition. In this study, different parts of the poppy were examined, namely: stems, leaves, root, capsule, pressed-cake (PC) and defatted pressed-cake (DPC). The main focus of this research was to determine the chemical profile and potential enzyme-inhibitory activity of extracts obtained from different parts of poppy. Chemical composition of obtained extracts was determined by liquid chromatography/mass spectroscopy (LC-MS). Enzyme inhibitory effect was investigated against α-amylase, α-glucosidase, tyrosinase and acetylcholinesterase.

To obtain extracts from different parts of poppy, conventional extraction (CE) was used, where different percentages of ethanol (0, 20, 40, 60, 80, and 96% w/v) were used. The extraction lasted for 24 hours, at room temperature, and the shaking speed was 180 rpm. One portion of PC was defatted using Soxhlet extraction with methylene-chloride as a solvent, and then extracted by CE.

According to LC-MS analysis, 62 compounds were identified in different parts of the poppy. Some of the compounds which are present in all parts of the plant were: glutaric acid, malic acid, *p*-coumaric acid, narcein. As a result, for α-amylase and α-glucosidase, the extracts from PC and leaves showed the greatest inhibitory power on these enzymes. Tyrosinase was most effectively inhibited by the extract from the DPC, while the capsule exhibited the best activity in the case of acetylcholinesterase. It can be concluded that poppy represents a plant rich in bioactive compounds, and as such can be used as an alternative to synthetic drugs.

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PP_I-7 Phytochemical profiling of *Euterpe oleracea* leaves: Influence of phenological stages on composition and antioxidant activity

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Euterpe oleracea (EO) is a palm tree endemic to the South and Central America, widely recognized for the nutritional and health-promoting properties of its berries, often referred to as "superfruits" [1]. While Brazil remains the world's leading producer and exporter, the cultivation of EO in French Guiana has grown significantly in recent years. Despite the extensive research and valorization of its fruit, little is known about the composition and biological potential of other parts of the plant, particularly its leaves. Previous studies highlighted the polyphenol richness and antioxidant activity of mature leaves [2].
This study aimed to evaluate the evolution of antioxidant activity and polyphenol composition in EO leaves throughout their development. Leaves at five different developmental stages were harvested, dried, and ground before undergoing ultrasonic-assisted extraction using either water or aqueous acetone. The resulting extracts were subjected to various phytochemical assays. Total polyphenol content ranged from 2.6 to 84.8 mg GAE/g dry matter, depending on the stage and extraction solvent. Antioxidant activity, assessed by ORAC and DPPH• assays, showed substantial variation. ORAC values ranged from 237 to 1665 µmol Trolox equivalent/g dry matter, while DPPH• values ranged from 2 to 202 mg Trolox equivalent/g dry matter.
Phenolic profiling using high-performance liquid chromatography coupled with high-resolution tandem mass spectrometry (HPLC-MS²) led to the identification of 51 distinct compounds. These included chlorogenic acids, condensed tannins, and a wide range of glycosylated flavonoid derivatives, some of which are reported for the first time in EO leaves.
Beyond expanding fundamental knowledge of the leaf phenolic composition, this study provides new insights into the biological properties of EO leaves and their evolution during development. These findings open up promising avenues for the valorization of this underutilized co-product, particularly in the cosmetics and pharmaceutical industries.

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PP_I-8 Phytochemical diversity of the fruit of autochthonous plum cultivar 'Crvena Ranka' from different growing sites

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Autochthonous plum 'Crvena Ranka' is an important cultivar traditionally used for the production of high-quality brandy in Serbia, with increasing potential for export. 'Crvena Ranka' which contains a high amount of sugars, quinic, shikimic, fumaric acids, hydroxycinnamic acids, flavonols, flavanols and anthocyanins can be recommended as a source of germplasm for developing new plum cultivars with a high nutritional value and for processing into high nutritional quality products [1]. This study aimed to evaluate the variability in the phytochemical composition of fruits of 'Crvena Ranka' collected from six geographically distinct growing sites. These locations were selected to represent a range of altitudes, from 184 to 1200 m above sea level (a.s.l.). Primary (sugars and organic acids) and secondary metabolites (phenolic compounds) in the fruits were analyzed using high-performance liquid chromatography (HPLC). Phenolic compounds were identified by coupling HPLC with mass spectrometry (HPLC-MS). The growing location had a highly significant influence on the composition of primary metabolites, while the variability in secondary metabolites was less pronounced. The highest levels of both individual and total sugars were detected in fruits from Gornja Gorevnica (Čačak, 358 m a.s.l.), while the most favorable organic acids profile was observed in fruits from Teočin (Gornji Milanovac, 642 m a.s.l.). In total, 45 individual phenolic compounds were identified, including both non-anthocyanins and anthocyanins. Across all sites, non-anthocyanin phenolics were consistently present in higher amounts than anthocyanins. The lowest concentrations of both phenolic groups were recorded in fruits from Gledić (Kraljevo, 509 m a.s.l.), whereas the most favorable sugar-to-acid ratio and the highest total phenolic content were found in fruits from Karan (Užice, 562 m a.s.l.). These results indicate that growing sites at altitudes between 400 and 600 meters are particularly favourable for enhancing both the taste and health-promoting properties of 'Crvena Ranka', highlighting the importance of site selection for optimizing fruit quality.

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PP_I-9 Blackberry extract as a stabilizing agent in the synthesis of silver nanoparticles

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Plants and medicinal plant products represent important resources for the treatment of diseases. Biomolecules found in plants and plant extracts contribute significantly to this [1]. Plant extracts used as reducing agents in the synthesis and stabilization of nanoparticles. Plants, by reducing ionic forms in various organs and tissues, away from the site of ion penetration, accumulate specific metals, in the form of nano-sized particles [2].

Silver nanoparticles (AgNPs) were synthesized at boiling temperature using an aqueous extract of wild blackberry leaves obtained by reflux extraction as a stabilizing agent. The resulting nanoparticles were characterized using zeta potential analysis, dynamic light scattering (DLS), X-ray diffraction (XRD), scanning electron microscopy (SEM), and energy-dispersive X-ray spectroscopy (EDX).

The average value of zeta potential was -0.1766 mV, while the average value of the nanoparticle size was 74.48 nm. The mean mobility and conductivity were 0.0173 μmcm/Vs and 0.0118 mS/cm, respectively. DLS determines the size of the entire nanoparticles, the dimensions of the agents that act as encapsulation and stabilization agents, and the metal core of the nanoparticles. The crystallite sizes within the nanoparticles were determined by XRD analysis. The XRD peaks of the synthesized nanoparticles with 2θ at about 38.2°, 44.4°, 64.6°, 77.5° and 81.8° correspond to the reflection planes (111), (200), (220), (311) (311) and (212) respectively, with (212) as the most intense. The obtained average crystal size of the green-synthesized nanoparticles was 15.7±2 nm. Spherical and square-shaped nanoparticles were characterized using SEM micrography. Energy dispersive X-ray spectroscopy (EDS) showed the presence of peaks at around 3 keV, which proves the presence of silver. In addition to elemental silver, which has the highest intensity peak, other signals show the presence of C, N, O, and Mg, which originate from the extracted phytoelements. The obtained silver nanoparticles can be tested for cosmetic preparations.

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PP_I-10 The characterization of piperine and its inclusion complex with β-cyclodextrin using DSC analysis

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Piperine, the main alkaloid in black pepper, exhibits various pharmacological effects such as antimicrobial, antioxidant, immunomodulatory, and antitumor activity [1]. However, its poor solubility in the water and low bioavailability limit its therapeutic use. The formation of inclusion complexes with cyclodextrins (β-cyclodextrin and its derivative 2-hydroxypropyl-β-cyclodextrin), offers a promising approach to improve piperine's solubility, stability, and overall bioavailability. The complexes of piperine and cyclodextrins (β-cyclodextrin and 2-hydroxypropyl-β-cyclodextrin), were prepared by kneading method in a 1:1 molar ratio using an ethanol–water (1:1 v/v) mixture, followed by drying to constant mass at room temperature. The thermal properties of piperine (PIP), β-cyclodextrin (β-CD), 2-hydroxypropyl-β-cyclodextrin (HP-β-CD) their inclusion complexes, and physical mixtures were investigated by differential scanning calorimetry (DSC) by using a DSC Q20 instrument (TA Instruments, New Castle, USA). The DSC thermograms of the PIP-β-CD and PIP-HP-β-CD inclusion complexes showed thermal transitions that differed significantly from those of pure piperine and the corresponding cyclodextrins, indicating the formation of new supramolecular structures. For the PIP- β-CD complex, new peaks appeared at 123.05°C and 206.85°C, and the melting enthalpy of piperine decreased from 109.8 J/g to 7.243 J/g. Similarly, for the PIP-HP-β-CD complex, peaks were observed at 117.53°C and 232.31°C, along with a reduction in piperine's melting enthalpy to 10.18J/g. These changes confirm the successful formation of both inclusion complexes, characterized by altered thermal behavior and disrupted crystalline structure of piperine.
Future research will focus on the further characterization of the obtained cyclodextrin inclusion complexes and the evaluation of their biological activities to assess their potential mainly for pharmaceutical applications.

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PP_I-11 Polyphenol profile and antioxidant activity of *Salvia pratensis* L. aqueous extracts: A rich source of rosmarinic acid and its derivatives for medicinal and dietary use

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This study presents a comparative phenolic profiling and antioxidant potential of aqueous extracts of the aerial parts (SPA) and root (SPR) of *Salvia pratensis* L. (meadow sage), collected in central Serbia. The leaves and flowers of meadow sage as aromatic ingredients have traditionally been used in cooking and as a tea to treat abdominal pains or skin diseases [1]. Both extracts were rich in phenolic compounds, but SPA possessed higher total phenolic content (239.66 mg GAE/g) and flavonoid content (87.68 mg QUE/g) compared to SPR (195.06 mg GAE/g and 26.65 mg QUE/g, respectively). Using UHPLC–MS^4 Orbitrap analysis, a total of 51 phenolic acids and 27 flavonoids were identified in the extracts. Hydroxycinnamic acids, particularly rosmarinic acid, salvianolic acids K, A, C1, and lithospermic acid, are dominant compounds in both extracts. Although most hydroxycinnamic acids were more abundant in SPR, SPA contained a higher amount of rosmarinic acid. Moreover, SPA exhibited greater diversity and abundance of flavonoid glycosides, especially derivatives of luteolin and apigenin, with 18 glycosides identified compared with only six flavonoid compounds in SPR. Antioxidant activity was assessed using $DPPH^{\bullet}$ and $ABTS^{\bullet+}$ radical scavenging assays. SPA demonstrated stronger antioxidant potential [1], with IC_{50} values of 101.18 µg/mL (DPPH) and 42.62 µg/mL (ABTS), compared to SPR with IC_{50} values of 130.19 µg/mL and 192.44 µg/mL, respectively. The lower antioxidant activity of SPR correlates with its lower total phenolic and flavonoid content. This is the first comprehensive study on aqueous extracts of *S. pratensis* using UHPLC–MS^4. The results highlight that *S. pratensis* aqueous extracts, corresponding to herbal infusions, the most consumed form of herbal preparations in humans, may represent a significant source of rosmarinic acid, its derivatives, and antioxidants. Furthermore, the aerial parts appear to be a more promising source of bioactive compounds and antioxidants than the root.

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PP_II-1 Toward safer and sustainable ingredients: Cytocompatibility of bioactive olive pomace extracts for dermocosmetic formulations

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The cosmetic industry is increasingly focused on developing products containing bioactive compounds from natural matrices, particularly those aligned with eco-friendly principles. Olive pomace (OP), a by-product of olive oil production, is rich in phenolic compounds known for their antioxidant, anti-inflammatory, and antimicrobial properties. This study aimed to evaluate the cytocompatibility and bioactivity of OP extracts, obtained by various extraction methodologies, on relevant human skin cells to assess their safety for topical use. Seven OP extracts were prepared using either aqueous or hydroethanolic solvents through three optimized extraction techniques: heat-assisted, ultrasound-assisted, and forced-percolation. To evaluate cytocompatibility, the OP extracts were tested at different concentrations (6.25-400 µg/mL) on keratinocytes (HaCaT cell line), fibroblasts (HFF-1 cell line), and macrophages (THP-1 cell line), following modified ISO 10993-5:2009 guidelines. Cell viability was assessed 1, 2, and 3 days after treatment, based on three indicators: metabolic activity, total protein, and morphology. Furthermore, the ability of OP extracts to reduce lipid peroxidation was assessed using the thiobarbituric acid reactive substances (TBARS) assay, which quantifies malondialdehyde (MDA) levels as a marker of oxidative damage. Results showed that all OP extracts were cytocompatible with keratinocytes, fibroblasts, and macrophages, at concentrations up to 200 µg/mL, as determined by metabolic activity and total protein analysis. Moreover, cell morphology was not affected at cytocompatible concentrations throughout the entire culture period. All extracts effectively reduced MDA levels (IC_{50}: 20–50 µg/mL), demonstrating a strong ability to inhibit lipid peroxidation. Notably, extracts obtained through heat-assisted and forced-percolation methods were the most effective. In conclusion, this study demonstrated the safety of OP extracts, a valuable by-product of olive oil production, supporting their potential as natural, sustainable, and effective ingredients for the development of innovative and promising dermocosmetic formulations to improve skin health.

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PP_II-2 Oxorhenium(V)-flavonoid conjugates: Rational design, evaluation and anticancer activity

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Apigenin is a natural flavone found in many plants, and it is abundantly present in common fruits and vegetables, including parsley, onions, oranges, tea, chamomile, and wheat sprouts, among others. It has been shown to possess significant anti-inflammatory, antioxidant, and anticarcinogenic properties. [1] Many rhenium compounds have been tested for their anticancer activity, and some of the most promising candidates have been studied clinically [2]. In light of the abovementioned, the chemistry of oxorhenium(V) complexes has been receiving increasing attention.Three rhenium complexes with apigenin and it's derivatives were synthesized (Complex 1 - $C_{37}H_{29}Cl_2O_9PRe$, Complex 2 - $C_{37}H_{37}Cl_2O_9PReSi_2$, Complex 3 - $C_{34}H_{29}Cl_2O_7PRe$ and acetylated $C_{19}H_{14}O_7$ and silylated apigenin $C_{27}H_{38}O_4Si_2$), fully characterized, and used for biological studies. Cytotoxicity assessments were conducted using the resazurin reduction assay across multiple cancer cell lines, including HT29 (colorectal adenocarcinoma), Jurkat (T-cell leukemia), LNCaP (prostate cancer), and MCF7 (breast cancer). Cisplatin was used as a standard of care for this experiment. All three complexes exhibited notable cytotoxic effects against the Jurkat cell line and moderate activity against other cell lines. The IC_{50} values for all complexes were below 5 μM, showing stronger cytotoxicity than the parent ligands, especially in leukemia cells (Jurkat). In contrast, responses in solid tumor cell lines varied. Additionally, two Re compounds were chosen for further studies in specific anti-migration and anti-invasion assays. Taking everything into consideration, rhenium plays a crucial role in disrupting leukemia cell biology. On the other hand, isolated ligands have milder effects, suggesting the complexes' bioactivity is enhanced by rhenium coordination. These findings will elucidate the molecular mechanisms and identify potential biomarkers. This comprehensive assessment of their physicochemical properties and cytotoxicity has provided valuable data to support the continued development of rhenium compounds as potential anti-cancer agents.

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PP_II-3 *In silico* screening of bioactive compounds from wild berries as potential neuroprotective agents for Alzheimer's disease

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Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by synaptic loss, neuroinflammation, oxidative stress, and accumulation of β-amyloid plaques [1]. Given the limited efficacy of current pharmacological treatments, natural products have gained increasing attention as potential sources of neuroprotective agents. This study investigates key bioactive compounds found in wild berries: ellagic acid (from wild blackberries and rosehip) and quercetin (from black currant), using *in silico* approaches [2]. Donepezil and rivastigmine were used as reference drugs to assess the potential of ellagic acid and quercetin in preventing Alzheimer's disease. Initially, all structures underwent geometry optimization using Density Functional Theory (DFT) calculations to obtain the most stable conformations. Subsequently, molecular docking simulations were performed to evaluate the binding affinities of the optimized compounds toward acetylcholinesterase (AChE), a key enzyme associated with the pathogenesis of Alzheimer's disease. The docking studies utilized AutoDock 4.2 software, employing the Lamarckian genetic algorithm to optimize binding poses and evaluate interaction energies. The protein structure of AChE was sourced from the Protein Data Bank (PDB code: 4EY7). The provided results imply that ellagic acid and quercetin exhibit favourable binding affinities (-8.46 kcal/mol and -8.44 kcal/mol, respectively) and form stable hydrogen bonds with key active site residues of AChE. Their inhibiting effects suggested that these natural compounds may help prevent or slow the progression of targeting disorder. Further, molecular docking simulations for AChE-ellagic acid and AChE-quercetin complexes resulted in lower values of ΔG_{bind} than for the examined protein-ligand complex with rivastigmine (-7.70 kcal/mol), but higher than for the examined AChE-donepezil complex (-11.42 kcal/mol). These findings suggested that bioactive molecules from native fruit species may serve as promising lead compounds in the development of novel therapeutic agents for Alzheimer's disease. Further *in vitro* and *in vivo* validation is warranted.

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PP_II-4 Myricetin as a molecular brake: Dynamic simulation of its binding to the α-synuclein monomer in the context of Parkinson's disease

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The conversion of α-synuclein (α-Syn) from a dynamic monomer to insoluble aggregates via liquid–liquid phase separation (LLPS) underlies the molecular pathogenesis of Parkinson's disease. Differential behavior of α-Syn splice variants in LLPS and aggregation highlights the structural complexity of its conformational landscape [1]. Concurrently, myricetin has been identified as a potent inhibitor of α-Syn aggregation by modulating LLPS kinetics [2]. In the present study, a 100 ns molecular dynamics simulation was carried out on full-length α-Syn in complex with myricetin to identify residue-level interaction signatures. Strong interaction fractions were observed with Lys10 (0.54), Ala18 (0.54), Lys32 (1.10), Asp119 (0.45), Asp135 (0.55), Tyr136 (1.05), and Glu137 (1.61). Notably, hydrogen bonds with Tyr136 and Glu137, along with a stable ionic interaction with Lys32, suggest a multi-site binding mechanism. These interactions appear to reinforce C-terminal repulsion and may restrict NAC domain exposure, thereby delaying fibril nucleation. The findings support the hypothesis that myricetin impairs α-Syn pathogenic condensation by anchoring critical residues, thus functioning as a molecular brake in early-stage aggregation.

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PP_II-5 Phytochemical oleuropein aglycone targets N-terminal anchors of $A\beta_{1-42}$: Molecular dynamics insights into early inhibition in Alzheimer's disease

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The aggregation of amyloid-β ($A\beta_{1-42}$) peptides into neurotoxic fibrils is a hallmark of Alzheimer's disease, and growing evidence supports the therapeutic relevance of targeting early monomeric or low-order conformations. Oleuropein aglycone (OA), a phenolic compound abundant in extra virgin olive oil, has demonstrated potent anti-aggregation effects through modulating Aβ self-assembly pathways [1]. In the present study, a 100-nanosecond molecular dynamics simulation was conducted to characterize residue-level interaction signatures between full-length $A\beta_{1-42}$ and OA. The highest interaction fractions were observed with His6 (0.45), Asp7 (0.38), Gly9 (0.32), and Glu11 (0.46), all located within the N-terminal domain implicated in the nucleation phase of aggregation. OA engages these residues primarily via hydrogen bonds and water-mediated bridges involving its hydroxyl and ester moieties. These interactions are consistent with previously proposed mechanisms involving (pro)electrophilic reactivity and polar binding surfaces [2], and suggest that OA anchors critical early aggregation sites, potentially stabilizing non-toxic conformations. The findings reinforce the notion that the N-terminal Aβ landscape constitutes a viable pharmacophore for intervention and underscore OA as a structurally privileged natural compound capable of delaying Aβ nucleation at the atomic level.

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PP_II-6 Skin-beneficial effects of *Lavandula angustifolia* post-distillation residue

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Lavandula angustifolia L. (lavender), an aromatic herb belonging to the Lamiaceae family is widely distributed throughout the Mediterranean region. The aerial parts and especially the inflorescences of this plant are used in herbal medicine, in culinary applications and for the isolation of essential oil, which is widely used in cosmetics, perfumery and aromatherapy [1]. In addition to the crude extracts, the plant material remaining after distillation of the essential oils of Lamiaceae plants is known to be a rich source of bioactive components [2]. The aim of this study was to investigate the antioxidant and skin enzymes' inhibitory activity of extracts obtained from *L. angustifolia* post-distillation residue. The material used in this study was supplied by Sanicula d.o.o., extracted with 96% ethanol, 50% ethanol and 30% ethanol and the content of phenolics and flavonoids were determined. The antioxidant activity was evaluated using three spectrophotometric assays, while enzyme inhibition effects were evaluated against collagenase, elastase, hyaluronidase and tyrosinase. The 30% ethanolic extract was the richest in total phenolics (152.83 mg GAE/g), while the 50% ethanolic extract had the highest quantity of flavonoids (22.83 mg QE/g). The 50% ethanolic extract showed the strongest antioxidant activity in the DPPH (IC_{50} value=243.77 µg/mL), the total reducing power (116.90 µmol AAE/g at a concentration of 1 mg/mL) and the *β*-carotene bleaching assays (IC_{50}=203.64 µg/mL). The 50% ethanolic extract also showed the strongest enzyme inhibitory effect (843.50 µg/mL for collagenase, 528.09 µg/mL for elastase, 1108.38 for hyaluronidase and 1098.62 µg/mL for tyrosinase). The results indicate that the lavender material remaining after distillation is suitable for producing polyphenolic extracts rich in bioactive compounds beneficial to the skin. Against this background, the remaining plant material of lavender and other aromatic plants should be further analysed for its bioactivity and possible use in biocosmetics.

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PP_II-7 Antidepressant effect of bioactive compounds of St. John's wort extract

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Hypericum perforatum L., Hypericaceae, is commonly known as St. John's Wort. The drug consists of the dried flowering tops of the plant. Its phytochemical profile includes trace amounts of essential oil, hydrocarbons, alcohols (notably *n*-alkanes and *n*-alkanols), triterpenes, and sterols. Furthermore, the herb contains glycosides of flavonoids (such as rutin, hyperin, and isoquercetin) and phenolic acids. Additional constituents include condensed tannins and xanthone compounds of the mangiferin type, as well as phloroglucinol derivatives, notably hyperforin. Anthraquinone derivatives-hypericin, protohypericin, protopseudohypericin, and pseudohypericin are localized within the dark spots and streaks of the leaves [1,2].

The oil extract of *H. perforatum* is used in the treatment of mild to moderate depression. The primary contributors to its antidepressant activity are xanthone constituents, acting as monoamine oxidase (MAO) inhibitors, in combination with flavonoid and phloroglucinol derivatives. Although hypericin was initially believed to be the key active compound, current evidence attributes the therapeutic effects mainly to the xanthone complex present in the plant [1].

St. John's Wort has also shown efficacy in the treatment of Seasonal Affective Disorder (SAD), a type of depression occurring during the winter months due to reduced sunlight exposure. Its mood-enhancing properties are particularly effective when used in combination with phototherapy. Moreover, it has demonstrated beneficial effects in patients with Obsessive-Compulsive Disorder (OCD), where administration of 450 mg twice daily for twelve weeks has led to symptom improvement. It may also alleviate symptoms of fibromyalgia, a condition associated with low serotonin levels. In such cases, *H. perforatum* may act synergistically with 5-hydroxytryptophan (5-HTP) and magnesium to elevate serotonin levels [1].

Concomitant use of St. John's Wort with conventional antidepressants is contraindicated due to its similar mechanism of action-namely, the elevation of serotonin levels in the brain-which poses a significant risk for the development of serotonin syndrome [2].

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PP_III-1 Investigation of phenolic compounds of honey from French Guiana: Discrimination of geographical origin through metabolomics

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Honey is a delicious sweet natural matrix produced by honeybees from flower nectar or honeydew, and has been consumed by humans for centuries. This functional food is known for its advantageous effects on health such as antioxidant, anti-inflammatory or wound healing properties, thanks to its phenolic content and bioactive agents [1]. These compounds are mainly linked to the botanical and geographical origin of the nectar sources [2]. Previous work showed a high content in phenolic compounds in French Guiana honeys. Our study is the first to identify phenolic compounds of French Guiana honeys. For this purpose, 28 samples of honey from different areas were extracted by dispersive liquid-liquid microextraction (DLLME), and then analyzed by high-resolution mass spectrometry (HRMS) to obtain phenolic profiles. Results showed a high content of total phenols (between 30 and 90 mg GAE/100 g honey). In addition, comparison with MS library and honey compounds database led to 16 compounds such as *p*-coumaric acid, pinobanksin, pinocembrin, and chrysin. Dereplication highlighted abscisic acid derivatives as the four major peaks. Finally, 10 markers related to honey geographical origin were determined through untargeted screening and chemometric tools allowing to distinguish two groups: seaside forest honey and savanna forest honey. With this study, we have showed that metabolomics tools are reliable to assess honey authenticity and marker of geographical origin.

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PP_III-2 Bioassay-guided evaluation of antibacterial activity of *Cichorium intybus* L. bee-collected pollen extracts using high performance thin-layer chromatography

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Chicory (*Cichorium intybus* L.) is a perennial herbaceous plant widely recognized for its medicinal and nutritional properties. While its root, stem, leaves, and flowers have been shown to contain a diverse array of bioactive metabolites [1], data on the chemical composition of chicory pollen remain limited. Given the known therapeutic potential of bee-collected (BC) pollen, this study aimed to evaluate the antibacterial activity of metabolites extracted from chicory BC pollen against *Escherichia coli* ATCC 35218 and *Staphylococcus aureus* ATCC 6538 using high-performance thin-layer chromatography coupled with direct bioautography (HPTLC-DB). Pollen was extracted using methanol, ethanol, acetone and ethyl acetate, while separation of extracts' components was performed on silica gel plates using a mobile phase of toluene/ethyl acetate/acetone/acetic acid (70/20/10/1, *v/v/v/v*). The chromatograms were visualized before derivatization under UV light (254 nm and 366 nm) and after derivatization with *p*-anisaldehyde/sulfuric acid (ASA) reagent under daylight and UV light. According to zone coloration, flavonoids were observed at lower hR_F values, while higher hR_F values indicated the presence of phytosterols and triterpenoids. HPTLC-DB revealed antibacterial zones in all extracts, with the most pronounced activity observed at hR_F 65. The characteristic coloration of this zone, observed before and after ASA derivatization, indicates the presence of triterpenoid derivatives as the most probable antibacterial constituents. Quantification of activity as milligrams of streptomycin equivalents per milliliter of extract (mg StrptE/mL) was performed by image analysis of chromatograms using ImageJ software, according to calibration curves constructed from streptomycin standard and confirmed by linear regression. The methanol extract showed the strongest activity: 4.9 ± 0.4 mg StrptE/mL against *S. aureus* and 4.0 ± 0.3 mg StrptE/mL against *E. coli*, while acetone extract was the least effective. These results offer new insights into the bioactive profile of chicory BC pollen and support its potential use in functional and therapeutic applications.

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PP_III-3 Plant origin and phytochemical characterization of polyfloral bee pollen from Türkiye

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Bee products serve as valuable sources of nutrients and bioactive phytochemicals. The quality and antioxidant potential of bee pollen are significantly influenced by various factors, including the geographical location of collection, time of harvest, climatic conditions, and plant origin. This study aimed to investigate the chemical composition of polyfloral bee pollen, focusing on its general phytochemical profile, fatty acid composition, and phenolic content as well as antioxidant activity. Identifying the botanical origin of bee pollen is crucial, as it provides insights into its phytochemical composition. In this study, palynological analysis and DNA barcoding were employed to trace the plant sources of the pollen grains. The fatty acid profile was characterized by notable short-chain and medium-chain fatty acids, including butyric acid (1.079%), caproic acid (0.171%), caprylic acid (0.0995%), and capric acid (0.2305%). Alpha-linolenic acid and palmitic acid were detected as major components at 20.75% and 25.01%, respectively. The phenolic analysis identified hyperoside, quercetin, and quercitrin as the predominant phenolic compounds, indicating substantial phenolics content. Antioxidant capacity was assessed using multiple assays, including CUPRAC, ABTS, DPPH, and CERAC. The average antioxidant values were recorded as follows: CUPRAC - 21.40 mg/g, $ABTS^{\bullet+}$ - 20.40 mg/g, $DPPH^{\bullet}$ - 9.96 mg/g, and CERAC - 114.49 mg/g. Additionally, the proanthocyanidin content was quantified at 3.50 mg/g, contributing significantly to the overall antioxidant potential. Physicochemical analysis revealed a lipid content of 7.53%, a moisture content of 9.75%, and an ash content of 1.08%.

These findings show the potential of polyfloral bee pollen as a functional food ingredient, rich in bioactive compounds such as phenolics and fatty acids, which contribute to its antioxidant capacity. The integration of these results highlights its potential application as a nutraceutical or dietary supplement with significant health-promoting properties.

PP_III-4 Physicochemical and phytochemical profile of *Rhododendron* bee pollen

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Bee pollen is a highly nutritious and bioactive beekeeping product widely recognized for its antioxidant, anti-inflammatory, and antimicrobial properties. These biological activities are primarily attributed to its rich composition of phenolic compounds (including flavonoids), proteins, and essential nutrients. In this study, the physicochemical properties and detailed phenolic profile of bee pollen obtained from a single-flowered *Rhododendron* species were investigated using spectrophotometric and chromatographic analyses.

The total phenolic content (TPC) was measured as 2.605±0.128 mg GAE/g FW, while the total flavonoid content (TFC) was found to be 1.619±0.074 mg QE/g FW, indicating that bioactive phenolic compounds are present at moderate levels but in significant amounts. Anthocyanin and proanthocyanidin levels were measured as 0.049 µg CE/g FW and 0.632±0.019 mg CE/g FW, respectively. Antioxidant capacity was evaluated using three standard *in vitro* tests: CUPRAC, DPPH, and ABTS. The CUPRAC value was 1.662±0.033 mg TE/g FW, DPPH radical scavenging activity was 2.201±0.084 mg TE/g FW, and ABTS radical cation inhibition was 1.889±0.027 mg TE/g FW. These results indicate that *Rhododendron* bee pollen possesses significant antioxidant potential from both hydrophilic and lipophilic antioxidant systems. From a nutritional perspective, the pollen exhibited a high carbohydrate content (77.314±0.821%) and hydro-soluble protein content (3.162±0.3 mg BSA/g), making it a valuable energy-dense food source. Moisture content was at acceptable levels (14.399± 0.58%), indicating good stability and shelf life when properly stored. An important component of the study was the detailed analysis of the phenolic profile using high-resolution identification techniques. The most abundant compound was quercitrin (1003.115±33.696 µg/g), a flavonoid glycoside known for its strong antioxidant and anti-inflammatory effects. Other dominant phenolics included neochlorogenic acid (127.831±2.872 µg/g), pinocembrin (126.689±0.671 µg/g), and pinobanksin (82.992±0.636 µg/g). These compounds are widely recognized for their ability to modulate enzymatic antioxidant systems and reduce oxidative stress in biological systems.

Additional phenolic acids such as protocatechuic acid (46.311±1.185 µg/g), or flavonoids such as quercetin (11.702±0.062 µg/g), and rutin (24.798±0.973 µg/g) were also present, further diversifying the pollen's antioxidant matrix.

In conclusion, *Rhododendron* bee pollen exhibits a rich and diverse phenolic profile with antioxidant capacity. The abundance of quercitrin and other flavonoids makes this pollen type a promising candidate for nutraceutical applications. These findings enhance our understanding of the health-promoting potential of bee pollen derived from *Rhododendron* species and support its inclusion in dietary supplements and functional food formulations.

PP_III-5 Aroma profiling of linden (*Tilia*) flowers and honeys using HS-SPME-GC-MS-O

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Linden (*Tilia*) trees are widespread in many countries and provide highly fragrant flowers that serve as an abundant nectar source for honey bees (*Apis mellifera*). Nevertheless, *Tilia* pollen is usually under-represented in honeys, which makes the botanical identification difficult [1]. The International Honey Commission recommends a minimum of 23% linden pollen ratio for monoflorality declaration. However, authentication is usually further complicated by the simultaneous presence of pollens from over-represented species, such as phacelia (*Phacelia tanacetifloia*) or chestnut (*Castanea sativa*) [2]. Consequently, sensory and/or chemical tests are of particular importance for the botanical authentication of linden honeys. Their aroma usually resembles to the scent of linden flowers, probably as a result of shared volatiles that may serve as floral markers.

In our work, the volatile profile of *T. cordata*, *T. platyphyllos*, and *T. tomentosa* flowers, as well as five Hungarian linden honeys have been analyzed by gas-chromatography-mass spectrometry. Aroma-active components have also been identified using olfactometry. Sampling was conducted by headspace solid-phase microextraction using 50/30 µm divinylbenzene–carboxen–polydimethylsiloxane (DVB/CAR/PDMS) fiber of 20 mm in length. Our results suggest that linden flowers are abundant in terpenes and terpenoids, of which *cis*-*β*-ocimene, D-limonene, p-cymene, and *α*-terpinolene showed peak area ratios greater than 5% for each species. On the other hand, linden honeys were rich in both terpenoids and benzene-ring compounds. Dimethylstyrene showed exceptionally high peak area ratios (27-45%) in each honey, followed by *trans*-3(10)-caren-2-ol (3-24%), cumene (1-8%), and 2-caren-10-al (1-5%). Based on our results, the unique combination of volatiles, including 1,6-dimethylhepta-1,3,5-triene, *trans*-3(10)-caren-2-ol, *trans*-rose oxide, menthofuran, 2-caren-10-al, and damascenone, play a key role in the formation of the distinct aroma of linden honeys. Most of the perceived odours were characterised with herbal, floral, spicy or fruity notes. Flowers and honeys shared some odour-active volatiles, although, their overall aroma profile showed large differences.

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PP_IV-1 Protective effects of *Isodon suzhouensis* extract and glaucocalyxin A on chronic obstructive pulmonary disease through SOCS3–JAKs/STATs pathway

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Chronic obstructive pulmonary disease (COPD) is an irreversible disease with the leading causes of morbidity, mortality, and several physical limitations [1]. *Isodon suzhouensis* is a unique Chinese medicinal plant used for both medicine and food [2]. It possesses strong anti-inflammatory effects that may treat COPD. This study aimed to investigate the effects of *I. suzhouensis* extract (WZZE) and glaucocalyxin A (GLA) against COPD and its underlying mechanistic pathway in COPD model rats or CSE-induced NR8383 cells. The results showed that WZZE significantly increased the expression of SOCS3 and inhibited the expression of JAKs/STATs pathway-related proteins in COPD rats. In addition, GLA can also upregulate the expression of SOCS3 protein, inhibit the JAKs/STATs pathway, inhibit the expression level of MUC5AC, upregulate the expression level of immunoglobulin, and downregulate the expression level of proinflammatory factors in NR8383 cells induced by CSE. Present study findings suggest that WZZE and GLA may ameliorate the progression of COPD via the SOCS3–JAKs/STATs pathway in COPD rats or CSE-induced NR8383.

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PP_IV-2 Potential of standardized aronia extract in managing reproductive and metabolic disturbances in a rat model of polycystic ovary syndrome

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Polycystic Ovary Syndrome (PCOS) is a common and heterogeneous endocrine-metabolic disorder affecting 6–21% of women of reproductive age and is a leading cause of anovulatory infertility. Alongside reproductive dysfunction, PCOS is frequently associated with insulin resistance, obesity, dyslipidemia, low-grade inflammation, and an increased risk of cardiovascular disease. Although metformin is widely used to manage PCOS as well as metabolic symptoms, its gastrointestinal side effects reduce patient adherence, prompting growing interest in plant-based alternatives. Aronia melanocarpa represents the fruit known for its potent antioxidant and potential insulin-sensitizing effects. The aim of this study was to evaluate the therapeutic potential of standardized Aronia melanocarpa extract, alone and in combination with metformin, in alleviating reproductive and metabolic disturbances in a rat model of PCOS. Adult female Wistar rats were used to establish a DHEA-induced PCOS model, after which they were treated with metformin (MET), standardized Aronia melanocarpa extract (SAE), or their combination. Reproductive and metabolic parameters were evaluated using vaginal cytology, hormonal and biochemical assays, OGTT, ultrasound, and histological analysis. Oxidative stress markers and antioxidant enzyme activities were assessed in plasma, erythrocytes, and ovarian tissue, with all procedures performed in accordance with ethical and laboratory standards. SAE treatment improved both metabolic and reproductive disturbances in PCOS animals. Notably, co-treatment with SAE and MET resulted in a synergistic effect, enhancing therapeutic outcomes without compromising the action of MET. Our findings suggest that SAE could serve as an effective adjunct in PCOS therapy, particularly in individuals with the obese phenotype. The data support further investigation into SAE's clinical applicability for improving metabolic and reproductive health in women with PCOS.

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PP_IV-3 Effect of lemon extract on morphometric and hormonal characteristics of pituitary adrenal axes in old rats

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Citrus flavanones belong to the subclass of flavonoids, and many studies have shown that they have anti-inflammatory, anti-cancer, anti-arthritic, antioxidant and anti-mutagenic properties [1, 2]. These beneficial effects recommend them for alleviating the ailments caused by aging. The focus of this research was to examine the effects of lemon flavonoid extract Eriomin® (LE) on the morphometric and hormonal characteristics of the pituitary-adrenal axis of aged rats. Two-year-old Wistar rats divided into two groups (6 per group) were used in the experiment. A first group of rats, a control group (C), received sunflower oil *per os*. In the second group, the animals were fed with LE mixed with sunflower oil at a dose of 40 mg/kg body weight, for 4 weeks. A volume of the mixture was 0.3 mL per animal/day and was administered by injection directly into the oral cavity. Adrenocorticotropic hormone (ACTH) and aldosterone levels were determined by commercial immunoassays. Serum sodium and potassium concentrations were measured using ion-selective electrodes. The absolute and relative pituitary weight, as well as the relative weight of the right adrenal gland in animals treated with LE were not significantly different ($p>0.05$) compared to C. The right adrenal gland absolute weight and volume, as well as the aldosterone and sodium levels in LE group were significantly ($p<0.05$) lower compared to C. There was no significant difference ($p>0.05$) in ACTH and potassium concentrations between LE and C group. Based on the obtained results, it can be concluded that lemon extract affects the pituitary-adrenocortical axis by reducing the morphometric parameters of the adrenal gland, as well as the aldosterone and sodium levels. Taken together, these results suggest that citrus flavanones have a beneficial effect alleviating ailment in the physiological aging process.

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PP_IV-4 Unveiling the potential of (poly)phenols in treatment of diabetes: From effects to mechanisms of action

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The impact of a healthy diet on diabetes is crucial, with recent interest in the health-promoting effects of (poly)phenols (PP). Evidence indicates that dietary factors can influence β-cell identity, aiding in the improvement of β-cell performance and insulin production. These dietary compounds exert their effects through modulating nutri(epi)genomic processes, which include interactions with proteins, receptors, and transcription factors. Nonetheless, the mechanisms by which PP metabolites, formed during digestion and colonic microbiota metabolism, exert their effects is still largely unexplored. Elucidating the link between PP' bioactivity and diabetes-associated mechanisms can provide new perspectives on the potential of these molecules in diabetes management. This study sought to explore the multigenomic effects of PP and their metabolites to identify modulatory networks and disease mechanisms as possible molecular targets of these compounds. Data from published studies examining alterations in gene and protein expression modulated by PP in human, animal, and β-cell line models of diabetes were collected and analyzed. Differentially expressed genes and proteins underwent in dept bioinformatic analyses. Functional analyses revealed differentially expressed genes with important roles in several cellular functions including cell signaling (e.g. FoxO, AMPK, p53, PI3K-Akt, among others), endocrine resistance, immune system pathways, and other cellular processes (e.g. apoptosis and cellular senescence). Several transcription factors such as FOXO1, PPARG, SIRT1, and MAFA have emerged as potential regulators of the observed changes. *In silico* 3D docking revealed potential interactions between the transcription factors and PP such as apigenin, luteolin, naringenin, with the glucuronide forms presenting the most significant binding affinity for SIRT1. Our comprehensive integrative study hints at important pathways within β-cell molecular functions as potential targets of PPs. These molecules may affect the expression of protein-coding genes, control the activity of miRNAs, and directly interact with transcription factors, influencing various cellular activities. This underscores the potential of these molecules for nutraceutical/pharmaceutical development.

PP_IV-5 Effects of anthraquinones from aqueous extracts of *Cassia angustifolia* and *Rhamnus frangula* on embryonic hematopoiesis in the chick model

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Cassia angustifolia Vahl. (Fabaceae) and *Rhamnus frangula* L. (Rhamnaceae) are widely used in traditional medicine and everyday consumption, primarily as herbal teas with laxative properties. Due to their frequent application and the presence of biologically active anthraquinones, this study aimed to evaluate their potential effects on hematopoietic processes during embryonic development. Fertilized eggs were incubated until the day five of development, when extracts, at concentrations of 0.0625, 0.125, and 0.25 mg/ml were applied to the chorioallantoic membrane. High-performance liquid chromatography (HPLC) analysis confirmed the presence of major anthraquinone constituents, including sennosides, emodin, and glucofrangulins. On embryonic day 12, a quantitative assessment of hematopoietic foci in the yolk sac and liver was conducted. A statistically significant reduction in the surface area of hepatic hematopoietic islets was observed (control: 530.1 μm²; in the presence of *C. angustifolia* extract: 127.2 μm²; in the presence of *R. frangula* extract: 127.8 μm²), accompanied by a proportional decrease in the number of erythroid and myeloid lineage cells in both examined tissues. These findings indicate a pronounced inhibitory effect of anthraquinones on hematopoietic activity during critical stages of embryonic development.

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PP_IV-6 Evaluation of antibacterial potential of *Inula helenium* L. root tincture against *Pseudomonas aeruginosa*: An HPTLC-bioassay and molecular docking approach

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Pseudomonas aeruginosa is an opportunistic pathogen frequently associated with hospital-acquired infections, particularly in immunocompromised individuals, capable to cause a broad spectrum of infections, including those of the respiratory and urinary tracts, wounds, and bloodstream [1]. Due to its resistance to multiple antibiotics and capacity to form biofilms, there is an urgent need for novel therapeutic approaches. The root of *Inula helenium* L. (elecampane), traditionally recognized for its health-benefitial properties, contains bioactive sesquiterpene lactones that are contribute to its antimicrobial efficacy [2]. This study aimed to assess the antibacterial activity of *I. helenium* root tincture against *P. aeruginosa* ATCC 10145 and identify compounds with potential quorum sensing inhibitory effects. The tincture was prepared by seven-day maceration in 70% ethanol and analyzed using high-performance thin-layer chromatography coupled with direct bioautography (HPTLC-DB). Separation was performed on silica gel plates with toluene/ethyl acetate (60/40, v/v) as the mobile phase. Antibacterial activity was visualized using *P. aeruginosa* cultivated in Luria-Bertani broth. A distinct zone at hR_F 85 exhibited pronounced antibacterial activity. Compounds from this spot were isolated by preparative TLC and identified via ultra-high-performance liquid chromatography coupled with quadrupole time-of-flight mass spectrometry (UHPLC-QToF-MS), confirming the presence of alantolactone, isoalantolactone, and structurally related sesquiterpenes. Molecular docking targeting quorum sensing regulators LasR (PDB ID: 6V7X), RhlR (PDB ID: 4Y15), and PqsA (PDB ID: 5OE3) revealed strong binding affinities, with alantolactone showing the highest affinity for LasR (-8.7 kcal/mol), a key transcriptional receptor responsible for activating virulence gene expression in *P. aeruginosa*. These results indicate that sesquiterpene lactones from *I. helenium* may inhibit quorum sensing mechanisms, thereby attenuating virulence and biofilm formation. This integrative approach, combining HPTLC-DB, MS, and *in silico* analysis, highlights the potential of natural products as a valuable source of novel antibacterial agents and represents a rapid screening tool in early-stage drug discovery.

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PP_IV-7 A novel, glucosamine-based water-soluble cannabidiol complex and a water-soluble hemp extract

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Cannabidiol (CBD), the main non-psychoactive cannabinoid extracted from *Cannabis sativa*, has garnered significant interest in oncology for its potential to complement conventional chemotherapeutic regimens. Extensive research suggests that CBD can induce apoptosis, inhibit cancer proliferation, and reduce metastasis across various cancer models, including breast, lung, colon, and prostate cancers [1]. CBD has also shown the ability to enhance the efficacy of standard chemotherapeutic agents while simultaneously reducing their toxic side effects, positioning it as a promising adjuvant in cancer therapy [2]. Besides the field of oncology, CBD has many potential benefits also for other medical disorders, like diabetes and various skin conditions.

One of the key limitations of CBD is its low water solubility, leading to poor bioavailability when administered orally. To overcome this, water-soluble CBD formulations have been developed, which improve absorption and increase therapeutic efficacy. In studies involving colorectal cancer cells, water-soluble CBD formulations have been shown to induce apoptosis at a higher rate than traditional lipid-soluble CBD, with a 55% increase in apoptotic cells. In breast cancer models, water-soluble CBD was found to be effective in targeting cancer stem cells, which are crucial in the recurrence and metastasis of the disease [1].

In order to obtain better bioavalability, also a radically different strategy was employed for water solubilisation of CBD, namely by complexing it with glucosamine. It was the aim of the presented study to characterise the new water-soluble CBD complex with physical, chemical and biochemical methodologies in order to evaluate its solubility, cell membrane permeabilty, and consequently its therapeutic potential. Testing was also performed on water-soluble hemp extracts produced by using the same technical approach.

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PP_IV-8 Synergistic nephroprotective effects of the polyherbal mixture extract and glimepiride in diabetic rat model

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Diabetic kidney disease (DKD) is a common secondary complication of diabetes mellitus, characterized by structural and functional kidney abnormalities that are often detectable even in the early stages of diabetes and tend to progress gradually, frequently culminating in end-stage kidney disease. Our previous research indicated that the "anti-diabetic" polyherbal mixture extract (PME), consisting of *Rubus fruticosus* (L., Rosaceae) and *Vaccinium myrtillus* (L., Ericaceae) leaves, *Potentilla erecta* ((L.) Räuschel, Rosaceae) rhizomes, *Geum urbanum* (L., Rosaceae) aerial parts, and *Phaseolus vulgaris* (L., Fabaceae) pods, exhibited stronger hypoglycemic, hypolipidemic, antioxidant, hepatoprotective, nephroprotective, and osteoprotective effects than standard antidiabetic drugs [1,2]. However, the potential nephroprotective effects of combining PME with antidiabetic pharmaceuticals have not yet been evaluated. DKD was induced in female Wistar rats using streptozotocin. Subsequently, diabetic rats were co-treated with PME and glimepiride for 14 days. Diabetic animals treated with PME alone, glimepiride alone, as well as untreated diabetic (DC) and non-diabetic (N-DC) animals, served as controls. Histological analysis of hematoxylin-eosin and PAS-stained renal tissue revealed a decrease in glomerular and proximal tubule areas, along with an increase in PAS-positive areas in the DC group compared to the N-DC group (p<0.001). Treatments with PME and PME+ glimepiride fully restored glomerular and proximal tubule areas compared to the DC group (p<0.001). All treatments, including the combination, significantly reduced PAS-positive areas compared to the DC group (p < 0.001), although not to the levels observed in the N-DC group. Interestingly, treatment with PME alone resulted in lower PAS-positive area values than the PME+ glimepiride combination. It can be concluded that both PME treatment and PME+ glimepiride co-treatment improved kidney damage and may serve as potential nephroprotective remedies for early-discovered nephropathy in diabetes mellitus.

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PP_IV-9 The polyherbal decoction and conventional antidiabetic drugs co-treatments: Glycemia and body weight regulation in streptozotocin-induced diabetes in rats

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Diabetes mellitus is an increasingly prevalent global health concern. Although conventional antidiabetic therapy shows relatively good success in maintaining normoglycemia, most individuals with diabetes still experience fluctuations in blood glucose levels and body weight. At the same time, medicinal plants contain phytochemicals that have beneficial effects on multiple levels. Thus, the number of diabetics who combine standard pharmacotherapy with medicinal herbs is increasing [1]. However, co-treatments with medicinal plants are not yet recognized as standardized treatment options in clinical practice. As we previously evaluated the antidiabetic effect of a polyherbal decoction made from *Rubus fruticosus* L. and *Vaccinium myrtillus* L. leaves, *Phaseolus vulgaris* L. pods, *Geum urbanum* L. aerial parts, and *Potentilla erecta* L. rhizomes [2], we aimed to examine the effects of the polyherbal decoction in combination with standard antidiabetic medicines, i.e., insulin, metformin, glimepiride, and dapagliflozin. STZ-induced diabetic female Wistar rats were co-treated with the polyherbal decoction and standard pharmaceuticals. Control groups included diabetic animals treated with pharmaceuticals alone, as well as untreated diabetic (DC) and non-diabetic control animals (NDC). By the end of the experiment, all treatments reduced blood glucose levels compared to the DC group ($p < 0.001$), while insulin, dapagliflozin, and metformin co-treatments with the Polyherbal Mixture managed to completely normalize glycemia. At the same time, the most profound effect in preventing body mass loss was observed in groups co-treated with the Polyherbal Mixture and insulin or dapagliflozin, as well as in the group treated with insulin alone ($p < 0.001$). Thus, we may conclude that the Polyherbal Mixture can be beneficial as a co-treatment with insulin and dapagliflozin in treating primary diabetic complications; however, further research is needed.

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PP_V-1 Can biostimulants improve the nutritional quality of onion (*Allium cepa* L.) produced from direct sowing and from sets?

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The onion (*Allium cepa* L.) is an important vegetable crop consumed worldwide in various forms, including fresh, cooked, or processed. Improving the nutritional quality of onion bulbs is a key priority for both consumers and farmers. This study aimed to evaluate the effects of different biostimulants on the nutritional quality of onion bulbs grown through direct sowing (DS) and from sets (FS). A field experiment was conducted in the Vojvodina province, Republic of Serbia, using a randomized block design, in three replications. The treatments included: control (C), biostimulant B1 based on seaweed extract, B2 containing humic and fulvic acids, and B3 formulated with *Trichoderma* spp. Key quality parameters were assessed, including crude fiber content, total acidity, sugar content, protein content, and total nitrogen. B1 and B2 applications reduced crude fiber content (↓ 5.78% and ↓ 16.56%, respectively), while B3 increased it by 4.35%. Total acidity was significantly higher in DS onions (↑ 43.26%) than in FS onions. Biostimulants did not significantly affect sugar content in DS onions; however, they significantly increased sugar levels in FS onions. DS onions showed higher protein content (0.116 ± 0.005 mg/g dry matter (DM)) compared to FS onions (0.108 ± 0.003 mg/g DM). B3 significantly increased protein content in both DS and FS onions. Total nitrogen content was also elevated in both DS and FS onions following B3 treatment. These results suggest that the B3, based on *Trichoderma* spp., efficiently enhances the nutritional quality of onion bulbs grown by both DS and FS. It is therefore recommended production method for farmers aiming to improve quality of onion bulbs.

Key words: Bulb, seaweeds, humic acids, *Trichoderma* spp., food quality

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PP_V-2 Soil protection and improvement of maize cultivation through the introduction of cover crops

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Cover crops are important agroecological practices that enhance the sustainability of agricultural production. They help mitigate the negative impacts of long-term conventional farming, such as soil degradation, reduced fertility, and erosion. However, their effectiveness varies depending on species-specific traits, including physiological characteristics and biomass composition. This study aimed to evaluate the effects of different cover crops on weed density and biomass during maize growth, as well as on grain yield and quality of two maize genotypes from different FAO maturity groups. In addition, changes in soil chemical composition were analyzed before and after the maize growing season. The experiment included four individual cover crop species—rye (*Secale cereale*), oats (*Avena sativa*), Perko (*Raphanus sativus* × *Brassica rapa*), and forage pea (*Pisum sativum* ssp*. arvense*)—along with two mixtures: Perko + rye and forage pea + oats. It was conducted at the Maize Research Institute Zemun Polje in Belgrade, Serbia, beginning in autumn 2021 and continuing until the autumn 2025. The study examines a crop rotation system consisting of winter wheat, followed by cover crops, and then maize, with maize serving as the primary crop. This paper presents the results from the first crop rotation cycle. Statistically significant differences were observed among treatments regarding maize yield, weed presence and biomass, and soil nutrient content. The application of different cover crops did not result in statistically significant differences in nitrogen and phosphorus content in maize grain. The oats treatment was the most effective in suppressing weeds, reducing weed presence to less than one plant per square meter. However, this treatment also resulted in the lowest maize yield—3.6 t/ha in the FAO1 group and 1.88 t/ha in the FAO2 group. In contrast, the highest maize yield was recorded in the forage pea treatment (approximately 6.5 t/ha in both FAO groups), although this variant had higher weed biomass (25.9 g/m² for FAO1; 17.3 g/m² for FAO2) and weed density (29.3 and 20.2 plants/m², respectively). The overall low yield is attributed to the extreme drought during the summer of 2023. These findings suggest that there is no universally optimal cover crop; rather, species selection should be tailored to specific agroecological conditions and production goals—from hybrid selection and yield targets to soil fertility and conservation needs.

PP_V-3 Mitigation of nanoplastics and arsenic toxicity in wheat using green magnetic nanocomposites

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The increasing contamination of soil and water systems by toxic elements and nanoplastics presents significant threats to agricultural productivity and food safety. As wheat (*Triticum aestivum* L.) serves as a primary food source for nearly 40% of the global population, this study examined a green-synthesized nanocomposite (Ag/Zn/Fe, 50 mg/L) potential to mitigate combined arsenic (As, 100 mg/L) and polymethyl methacrylate nanoplastics (PMMANPs, 500 mg/L) toxicity in wheat. Employing a randomized complete block design with three replications, plants were exposed to various combinations of these treatments. Results demonstrated that both PMMANPs and Ag/Zn/Fe reduced As uptake. Moreover As and PMMANPs exposure significantly decreased root and shoot biomass (both dry and fresh weight), plant height, and photosynthetic efficiency. Oxidative stress was evident through reduced chlorophyll a and b content, alongside elevated catalase (CAT) and peroxidase (POD) activities, indicating activated antioxidant defenses. The Ag/Zn/Fe nanocomposite application notably improved growth parameters, enhanced chlorophyll content, and strengthened the enzymatic antioxidant defense system. These findings establish that Ag/Zn/Fe nanocomposites provide an effective and environmentally sustainable solution for alleviating combined toxic elements and nanoplastic stress in crops, offering important applications for agricultural production in contaminated environments.

PP_V-4 The effect of biochar and biofertilizers on corn (*Zea mays* L.) grains under wastewater stress

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Stress induced by toxic elements represents a critical abiotic constraint that adversely impacts plant physiology, agricultural productivity, and ultimately human health. This study examined the responses of corn (*Zea mays* L.), a globally vital C4 cereal crop, to wastewater irrigation and bio-organic fertilization through a factorial randomized complete block design with three replications. A controlled pot experiment was conducted using soil. The experimental design evaluated: (1) fertilization regimes (control, NPK bacterial biofertilizers (1 g per pot), arbuscular mycorrhizal fungi (50 g per pot), *Trichoderma harzianum* (1 g per pot), biochar (200 g per pot), and their combinations) and (2) two irrigation treatments (conventional water vs wastewater). The planting took place on June 19, 2020, and June 5, 2021, with harvesting occurring in the first week of October (at the maturity stage). All fertilizers were applied to the target pots prior to seed sowing. The first irrigation was done with wastewater and regular water after planting, with subsequent irrigations carried out according to environmental conditions and the crop's water needs. Results demonstrated that wastewater irrigation significantly enhanced grain oil and protein content while reducing grain nitrogen levels. Application of biological and organic fertilizers effectively mitigated these alterations, with the combined treatment of bacterial-fungal biofertilizers and biochar under wastewater conditions producing the highest seed concentrations of phenolic compounds (gallic acid: 19.81 mg/g DW; caffeic acid: 12.17 mg/g DW). These findings indicate that integrated biofertilizer-biochar systems can enhance corn's tolerance to wastewater-induced stresses while improving nutritional quality parameters, thereby offering a sustainable strategy for safer crop production under challenging growing conditions.

PP_V-5 Cold plasma and green magnetic nanocomposite mitigate arsenic and nanoplastic toxicity in wheat plants

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The synergistic toxicity of heavy metals and nanoplastics in agroecosystems jeopardizes global food security, particularly for wheat (*Triticum aestivum* L.)—a nutritionally vital crop rich in proteins, carbohydrates, and essential micronutrients (Zn, Fe). This study evaluated dual mitigation strategies—wheat seed (Pishgam variety) priming with cold plasma (DBD, Aluminum electrodes (45×6.5×0.2 cm), mica dielectric sheets (60×12×0.1 cm), 1 mm plexiglass gap, Ar/Ne gas flow (2 L/min), 5 kV at 8 kHz, 60 s) and green-synthesized Ag/Zn/Fe nanocomposite (50 mg/L, root exposure)—against combined arsenic (As, Na_2HAsO_4, Sigma-Aldrich, 50 mg/L) and polymethyl methacrylate nanoplastics (PMMANPs, 50 mg/L) To ensure controlled environmental conditions, the experiment was organized into randomized complete blocks with three replications, with each block representing a separate growth chamber. This design minimized variability in factors such as light intensity, temperature, and humidity across treatments. Within each block (growth chamber), all treatment combinations (control, PMMANP, As, CP and their various combination) were included. Plasma priming enhanced germination rates by 5% versus controls, while As-PMMANPs co-exposure reduced root/shoot biomass (both fresh weight by 45%/35% and dry weight by 55%/42%) and chlorophyll a 38% and b 22% compared to control. Oxidative stress markers were elevated including catalase and peroxidase activity, yet synergistic application of nanocomposites and primed seeds restored growth parameters (root fresh and dry weight by 46% and 60%, shoot fresh and dry weight by 30% and 42%), and chlorophyll a 50% and b 25% compared to As-PMMANPs. Furthermore, the treatment enhanced overall antioxidant defense mechanisms. The combined treatment's efficacy stems from: (1) plasma-induced metabolic activation during germination, and (2) nanocomposite-mediated ROS scavenging and metal immobilization. This dual approach specifically addresses the synergistic toxicity of heavy metals and nanoplastics—the core focus of this study—by restoring growth parameters, photosynthetic pigments, and antioxidant defenses, offering a targeted solution for wheat cultivation in co-contaminated agroecosystems. While our study demonstrated the short-term efficacy of the green-synthesized Ag/Zn/Fe nanocomposite in alleviating As-PMMANPs toxicity in wheat, further investigations are needed to assess its long-term environmental fate and ecotoxicological impacts.

PP_V-6 The effect of soil tillage and nitrogen fertilization on yield and quality of the winter bread wheat (*Triticum aestivum* L.)

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In field experiments on the chernozem luvic soil type at Faculty of Agriculture Belgrade-Zemun Experimental field trial "Radmilovac", the yield and quality of winter bread wheat were evaluated in conventional tillage (CT), mulch tillage (MT) and no-tillage (NT) systems. The field experiment was conducted in the years 2022/23–2023/24. Winter wheat cultivar (NS Futura) was fertilized with two nitrogen (N) rates: rational level (60 kg N ha^{-1}) and high level (120 kg N ha^{-1}). In the CT system, shallow ploughing and pre-sowing ploughing were performed after harvest; in MT – the shallow ploughing and pre-sowing ploughing were replaced by chisel; and in NT – seeds were sown directly into nonploughed soil, with the complete maize crop residues left on the surface. Based on the study, it was found that the application of conventional tillage and the addition of 120 kg N ha^{-1} in top dressing significantly increased winter wheat grain yield. Also, more spikes per m^2 the grain weight per spike and the 1000 grain weight were higher in the crops from the CT than from the MT and NT systems. Higher contents of total protein, wet gluten and starch were determined in wheat grains harvested from the CT plots than from the MT and NT plots. Fertilization with 120 kg N ha^{-1} causes more grain yield and more content of total protein and similar content of wet gluten and starch in the grain of winter wheat in high and rational level of N. In conservation tillage systems (MT and NT) smaller differences in the investigated parameters were obtained between the applied higher and rational N rates.

PP_V-7 Effect of seeding density on yield and nutritional potential of lemon balm (*Melissa officinalis* L.) microgreens

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The rising demand for fresh, functional foods has positioned microgreens as a new category of nutrient-rich crops with short production cycles. *Melissa officinalis* L. (lemon balm), known for its rich phytochemical profile and therapeutic effects, presents significant potential as a functional food in human nutrition. Its young leaves are abundant in flavonoids, phenolic acids, and essential oils, while also containing potassium, calcium, and vitamin C, contributing to its antioxidant and calming properties. This study aimed to evaluate the effect of different seeding densities (1.5 g/m² – control; 2.5 g/m² – T1; 3.5 g/m² – T2) on the growth, yield, and morphological traits of *M. officinalis* microgreens under controlled conditions. The experiment was conducted in a greenhouse environment in November, using standardized light and temperature regimes. Parameters such as germination rate, plant height, leaf area, and fresh yield were monitored over an 18-day growth period. The highest seeding density (3.5 g/m²) resulted in the highest fresh yield (68.3 ± 5.7 g/m²), while the control treatment (1.5 g/m²) produced the greatest individual biomass but the lowest total yield (31.2 ± 3.4 g/m²). The intermediate treatment (2.5 g/m²) offered a balanced outcome in terms of yield and morphology.
Based on the results, it can be concluded that increasing seeding density positively affects the total yield of lemon balm microgreens without compromising quality. This confirms *M. officinalis* as a suitable candidate for fresh consumption in early growth stages, particularly in modern dietary and therapeutic nutrition models. Further research about potential influence on grown bioactivity should be performed.

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PP_V-8 The effect of the growing medium on the content of pigments in microgreens

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Microgreens are a new class of edible vegetables rich in vitamins, minerals, and phytochemicals, including carotenoids and phenolic compounds, which act as antioxidants in the human body. Pre-harvest interventions, such as lighting, salinity stress, nutrient enrichment, and natural substrates, affect the photosynthetic and metabolic activities of microgreens, enhancing their nutritional quality with effects varying among species [1].

In this study, five microgreen species – broccoli, radish, mustard, pea, and garden rocket – were cultivated on two substrates: soil (S) and the cellulose-based substrate Arbocell FT 400 (A). The content of β-carotene, lycopene, chlorophylls *a* and *b* were analyzed and determined by spectrophotometric assays.

In S-cultivated microgreens, the highest β-carotene content was found in radish, lycopene in garden rocket, chlorophyll *a* in pea and garden rocket, and chlorophyll *b* in pea. For A-cultivated microgreens, the highest content of β-carotene and chlorophyll *b* were observed in garden rocket, whereas the content of chlorophyll *a* and lycopen were highest in pea.

Statistical analysis indicated significant differences in β-carotene content between radish and other species grown in soil, with β-carotene below the limit of detection in pea. On the Arbocell substrate, only pea showed significant differences from the others. Lycopene content showed statistically significant differences among all species on the Arbocell substrate, while the largest significant difference on soil was observed in garden rocket. Chlorophyll *a* concentrations were highest in pea and garden rocket on both substrates, while chlorophyll *b* was the highest in pea.

Comparative analysis between substrates indicated no statistically significant differences in β-carotene content for any microgreens species. Chlorophyll *a* levels were the highest in pea and garden rocket, while pea exhibited the highest chlorophyll *b* level. No differences were observed for mustard. For all other species, significant differences were observed between plant species grown on different substrates, with the highest values found in species grown in soil, except for the lycopene content in pea.

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PP_V-9 Evaluating of nutritional traits in maize inbred lines

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Modern maize hybrids, which are primarily bred for high yields, often do not meet human nutritional requirements. Inbred lines (ILs), which serves as parental components in hybrid development, represent a valuable reservoir of nutritional traits. Bioactive compounds naturally present in maize—carotenoids and tocols (including tocopherols (T) and tocotrienols (T3))—possess antioxidative properties hat have a positive effect on human health. In this study, 85 ILs from the Maize Research Institute "Zemun Polje" gene bank were evaluated and compared to five commercial lines (SLs). The content of carotenoids (including lutein + zeaxanthin, β-carotene, and β-cryptoxanthin) and tocols (comprising *α*-T, *β*+*γ*-T, *δ*-T, *α*-T3, *β*+*γ*-T3, and *δ*-T3) was quantified using high-performance liquid chromatography with diode array and fluorescence detection (HPLC-DAD/FLD). The content of quantified phytochemicals was expressed as the mean value of three independent injections, and the obtained results were subjected to one-way ANOVA. The carotenoid content in ILs ranged from 10.80 to 40.13 µg/g dry weight (dw), whereas SLs showed a range of 27.35 to 44.74 µg/g dw. The tocols content in ILs varied between 44.71 and 129.05 µg/g dw, while SLs had values ranging from 39.26 to 82.48 µg/g dw. Among all lines tested, IL-29 exhibited the highest total carotenoid content (40.13 µg/g dw), while IL-13 displayed the highest *β*-carotene content (3.16 µg/g dw). Similarly, IL-66 had the highest total tocols content (129.05 µg/g dw), and IL-34 recorded the highest *α*-tocopherol content (18.11 µg/g dw). These results underscore the gene bank's role as a rich source of nutritional diversity. Notably, IL-13 and IL-34 stand out as promising candidates for breeding maize hybrids with enhanced *β*-carotene and *α*-tocopherol content, respectively. However, possible incomplete gene bank's germplasm coverage could be overcome by expanding germplasm screening and assessing broader agronomic impacts to ensure stable, effective nutrient improvements in maize.

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PP_VI-1 Chemical characteristics and *in vitro* antioxidant properties of pectin-type polysaccharides of soy hulls prepared by two different extraction methods

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As biopolymers, pectins demonstrate various beneficial effects, including anticancer, immunoenhancing, and radical scavenging properties. Soy hulls are a significant byproduct of the soybean processing industry. About 30% of the insoluble carbohydrates of soy hulls are pectin-type polysaccharides. Therefore, soy hulls are a potential source of this type of polysaccharide. In this study, we investigated the impact of two different extraction methods on the chemical composition and antioxidant properties of pectin-type polysaccharides derived from soy hulls. Pectin-type polysaccharides were isolated from commercial toasted hulls using microwave- and ultrasound-assisted extraction. Hulls were extracted with a hot (75-80ºC) 0.6% solution of ammonium oxalate using a microwave oven (5 min at 450W) or by ultrasound (30 min., 40 kHz, at 40 ºC). Polysaccharides were precipitated from supernatants with ethanol (96%), filtered, and dried at 65 ºC. Also, polysaccharides obtained by US-assisted extraction were precipitated with ethanol extracts of black mulberry pulp. Prepared polysaccharides were characterized by FT-IR, their total saccharide, protein, galacturonic acid, phenol, and flavonoid contents. Their antioxidant potential was characterized by the Fe(II) chelating ability, the ABTS and DPPH radical scavenging activity, and the FRP, CUPRAC, and TAC methods. The results of this investigation clearly showed that the choice of extraction method significantly affected the chemical characteristics and antioxidant properties of pectin-type polysaccharides of soy hulls. US-extracted samples had lower total saccharide (83.50-84.20%) but higher uronic acid content (24.58-26.25%) compared to MW-extracted samples (86.40%%, 21.98%). Also, the US-extracted pectin-like polysaccharides had a higher content of total flavonoids and almost twice the total phenolic compounds content. Generally, the best antioxidant properties were expressed in samples obtained by US extraction and precipitated with ethanol extract from black mulberry pulp. These findings are meaningful in understanding the potential applications of soy hulls as a commercial source of pectin-like polysaccharides and in the developing of natural pharmaceuticals, food, and drug design.

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PP_VI-2 Soy hull as a potential source of functional pectin-like polysaccharides

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Pectin is a globally recognized polysaccharide with significant relevance in the biopolymer market due to its inherent functional properties and extensive applications in the food, pharmaceutical, and biomedical industries. Pectin is widely used in the food industry as an excellent thickening agent for producing jellies and jams, a pH stabilizer in dairy products and low-calorie products, and an emulsifier in pharmaceutics for the design of drugs to treat gastrointestinal disorders, blood cholesterol reduction, and cancer treatment, as well as a good former of edible films and coatings, foams, and paper substitutes. This class of natural polysaccharides is found primarily in citrus fruits and apple pomace. Today, there is a growing demand for this type of hydrocolloid, with both the scientific and industrial fields focusing on utilizing new sources of pectin and developing novel extraction methods. Soy hull, a significant by-product of the soy processing industry, is often regarded as waste and is either used for animal feed or discarded directly, resulting in resource wastage and environmental pressure. Over the last twenty years, research has shown that soy hulls can be a significant source of pectin-type polysaccharides with different functional and techno-functional properties. Additionally, it has been shown that these properties are primarily dependent on the processing method used. This work provides an overview of the current knowledge of the processing methods and functionality of pectin-like polysaccharides derived from soy hulls.

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PP_VI-3 Fingerprinting of olive oil by-products: Suitable matrices to formulate new food formulations with high added value

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Olive oil by-products represent a valuable resource for the development of novel foods and functional ingredients. Their reuse supports a cost-effective and environmentally sustainable approach and provides natural alternatives to synthetic additives, significantly contributing to the reduction of food waste along the production chain. The use of these natural matrices into food formulations can improve technological properties and enhance the nutritional, health-promoting, and safety characteristics of the final products.

In this work, microbiological and chemical characterisation of two olive oil processing by-products, olive mill wastewater (OMW) and pâté olive cake (PO), was conducted to assess their microbiological safety and potential nutraceutical value.

Microbial profiling revealed the dominance of *Acetobacteraceae*, accounting for 73% of the bacterial community in OMW and 54% in PO. Notably, PO also showed a significant presence of *Lactobacillaceae* (28%), exclusively composed of *Lactobacillus* spp., while other microbial families were found in lower amounts. Chemically, the phenolic composition of the two matrices highlighted essential differences. Total phenolic content was higher in OMW (3573 mg/L) compared to PO (1858 mg/L). In detail, HPLC analyses revealed that OMW was particularly rich in hydroxytyrosol (3362 mg/L) and tyrosol (492 mg/L), while the PO, although presenting lower overall phenolic level, showed a broader qualitative profile that included hydroxytyrosol (298 mg/L), tyrosol (136 mg/L), oleuropein (260 mg/L), vanillic acid (70 mg/L), p-coumaric acid (90 mg/L) and apigenin (90 mg/L). In conclusion, both by-products represent phenol-rich matrices, which through proper processing can be used for the formulation of food and/or functional ingredients.

PP_VI-4 Valorization of apple pomace as a green source of prebiotics

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Apple pomace (AP), a bio-residue from the cider-producing industry, is gaining attention for its potential to support sustainable circular economy models and promote human health through functional food applications. Despite its abundance and richness in bioactive compounds, AP remains an underutilized resource [1]. This study aimed to evaluate the prebiotic activity of AP by comparing its effects with well-known prebiotic substances—glucose, inulin, and fructooligosaccharides (FOS)—used as positive controls. The prebiotic potential was assessed in vitro using four probiotic strains: *Lactobacillus casei* (NCTC 6375), *Lactobacillus plantarum* (DSM 12028), *Lactobacillus acidophilus* LA-5 (Probio-Tec, Denmark), and *Bifidobacterium animalis subsp. lactis* Bb12 (Probio-Tec, Denmark). Samples were prepared in MRS broth with a 2% (w/v) concentration and pasteurized (72–75 °C for 1 minute). The bacterial inoculum was adjusted to 5 × 10^5 CFU/mL, and growth was monitored by measuring absorbance at 620 nm over a 48-hour incubation period at 37 °C. Across all tested strains, AP led to higher optical density (OD) values compared to inulin and FOS, with readings exceeding 2.5 during the stationary phase and an earlier onset of exponential growth at 8 hours. The performance with LA-5 was particularly notable, where AP outperformed glucose within the first 3 hours of growth. These results confirm that AP is a highly effective carbon source, capable of stimulating the growth of beneficial microbes more efficiently than traditional prebiotics. Consequently, AP holds promise as a functional ingredient in gut health-promoting products while simultaneously advancing the goals of circular economy practices.

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PP_VI-5 Nutritional composition and antioxidant potential of chia (*Salvia hispanica* L.) leaves and flowers: A valorization approach

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The valorization of agro-industrial by-products offers a sustainable strategy for developing functional innovative ingredients with health-promoting properties [1]. *Salvia hispanica* L. (chia) is highly valued for its nutritious seeds, however the leaves and flowers are commonly discarded [2]. In this way, this study aimed to evaluate the nutritional composition and antioxidant potential of these plant parts. Moisture, fat, protein, ash, carbohydrates, and energy value were determined using official food analysis methodologies (AOAC); while the antioxidant activity was assessed using two *in vitro* assays: the TBARS and DPPH assay. The boths plant parts showed a relevant nutritional composition. Carbohydrates standing out in the leaves as the major macronutrient (91.78±0.31 g/100 g dry weight), followed by protein (7.20±0.30 g/100 g dw) and fat (1.02±0.01 g/100 g dw); the same occurred in the chia flowers with 82.43±0.48 g/100 g dw of carbohydrates and, in this case, a higher protein value (15.9±0.50 g/100 g). Regarding the antioxidant potential, both extracts exhibited promising action, with low EC_{50} values: 0.14±0.01 mg/mL and 0.030±0.001 mg/mL for leaves and flowers in TBARS assay, respectively. These results highlight the great potential of chia leaves and flowers as sources of natural antioxidants, which could be used to fortify other food products or as functional ingredients with bioactive properties. This approach contributes to the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action), by promoting health, reducing food waste, and supporting circular economy practices.

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PP_VI-6 The potential of aquafaba as a foaming agent in the production of plant-based aerated candies

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Dietary requirements based on nutritional and ethical (veganism), as well as health (allergies) and religious (fasting) reasons may preclude the use of foam candies made from conventional ingredients, despite their appeal to the consumers. In this study, the possibility of using aquafaba, the residual liquor from cooking of legumes [1], as a substitute for egg white and available mean for creating foamy confectionery, was examined. For aquafaba preparation chickpeas were subjected to soaking in cold water, boiling, cooling and draining. During whipping, the smell and color of remaining viscous liquor weakened and faded significantly, and the resulting foam was whitish with a neutral smell and taste, and was used as such for the production of foamy candies without the addition of colors and aromas. The quality parameters of foam obtained from egg white and aquafaba were examined. Samples of aerated candies with gelatine (G), agar and egg white (AgE), as well as with agar and aquafaba (AgAq), as a foaming agents were produced. The colour characteristics (CIE Lab), firmness (texture analyser TA.XT Plus), and sensory evaluation (scoring method) of obtained candies, were determined. It was shown that aquafaba had a higher foaming ability (7.48%) compared to egg white (6.82%), while its foam stability was lower (53.3% versus 58.67%). The samples with aquafaba were darker in colour compared to those with egg white and gelatin. Aquafaba contributed to a decrease in the firmness compared to egg white (37.04±4.28 to 36.8±8.12 g), and especially gelatin (322.14±5.23 g). Based on the sensory analysis, all the obtained candies belonged to the very good quality category, and those with aquafaba received very similar ratings to the egg white samples (4.20 and 4.35, respectively). Aquafaba has proven to be a good foaming agent in candy preparation, and a promising, plant-based and eco-friendly alternative to animal proteins.

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PP_VI-7 Antioxidant activity and phenolic compounds in potato peels

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Potato (*Solanum tuberosum* L.) is one of the most widely consumed agricultural products worldwide. In addition to their nutritional value, potatoes are a source of phytonutrients, especially phenolic compounds, whose content depends on the variety, agronomic, and environmental factors [1]. Potatoes are extensively used in the production of various processed potato products (e.g., chips, French fries, and purees), which is accompanied by the generation of a large amount of potato peel as a by-product. Therefore, in recent years, there has been a rising interest in the valorization of potato peels as a valuable source of bioactive compounds in the food and pharmaceutical industries [2]. The primary objective of this study was to evaluate the phenolic compounds content and antioxidant activities in the peels of twelve potato varieties grown in Serbia. Extraction of phenolic compounds was performed using 70% ethanol and 0.9% NaCl (7:3) with ultrasound assistance. Extracts were analyzed for total phenolics, 2,2-diphenyl-2-picrylhydrazyl hydrate assay (DPPH) radical scavenging activity, and ferric reducing antioxidant potential (FRAP). The quantification of chlorogenic acid and caffeic acid was performed using high-performance liquid chromatography (HPLC) equipped with a diode array detector. The total phenolic content ranged from 2.17±0.23 mg GAE/ g d.w. to 4.04±0.18 mg GAE/g d.w. The chlorogenic acid content varied in the range of 189.03 - 1081. µg/g d.w., while caffeic acid content was in the range of 29.25 - 76.64 µg/g d.w. The average DPPH and FRAP activities of potato peel extracts were 25.63±1.89 µM TE/g d.w. and 10.09±0.74 µM TE/g d.w., respectively. Despite observed variations among varieties, our data support findings that potato peel extracts could be used as a sustainable source of natural antioxidants.

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PP_VII-1 Harnessing phytochemicals in functional foods: Innovations in health optimization and sustainable food systems

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Functional meal production that maximizes health as well as supporting sustainable food systems relies on phytochemicals [1]. These bioactive, naturally occurring molecules in plants exhibited numerous beneficial activities, classified and discussed herein, in terms of modes of action such as antioxidant properties, regulation of signaling pathways, and epigenetic influence, to application in designing functional foods [2]. The discussion of innovative extraction and processing techniques, including supercritical fluid extraction and nanoencapsulation, highlights the integration of traditional knowledge and indigenous foods to improve bioavailability and efficacy [2]. The creation of phytochemical-enhanced functional meals addresses important health problems, including the prevention of metabolic diseases, improvement in cognitive function, regulation of gut flora, and conservation of cardiovascular health [1]. Simultaneously, sustainability is strongly emphasized, with value- addition of food waste and farming methods based on phytochemicals and how they contribute to the growth of a circular food economy. Notwithstanding these advances, concerns for stability, bioavailability, consumer suitability, and controlling compliance remain [2]. Personalized functional foods, artificial intelligence applied to phytochemical's research, and interdisciplinary approach in closing the gap between phytochemistry, nutrition science, and food technology are among the forthcoming directions that have been identified [1, 2]. This study points to the significance of phytochemicals in developing new, sustainable, and healthy functional foods, which then calls for increased funding to be provided to researches and policy assistance [2]. With regard to achieving global health and developing sustainable food systems that answer the vision of Food Transitions 2050, several initiatives are needed.

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PP_VII-2 Screening of the phenolics content and antioxidant properties of 27 extracts from traditional pear fruits

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Pyrus communis L. (Rosaceae) is a globally cultivated fruit consumed fresh or processed into foods and traditional products. In ethnomedicine, pear is used to treat various disorders – hypertension, diabetes, hypercholesterolemia, for weight control, etc. [1] Pears are rich in sugars, amino acids, minerals, fiber, and phenolics with antioxidant and anti-inflammatory effects [2]. Due to growing interest in traditional varieties as sources of health-promoting phytochemicals, this study examined the chemical composition and antioxidant activity of 27 extracts from three Serbian traditional varieties: *Lončara*, *Kaluđerka*, and *Takiša*. Fruits were collected at full ripeness, frozen, and extracted with water, 50% ethanol, and 96% ethanol. The extracts were obtained from peel, flesh, and their mixtures. Total phenolic (TPC) and flavonoid content (TFC), and antioxidant capacity (DPPH) were measured spectrophotometrically at a concentration of 1 mg/mL. TPC ranged from 6.06-146.61mg GAE/g dw. The highest TPCs were recorded in 96% ethanol peel extracts, notably from *Kaluđerka* and *Takiša* (146.61 and 144.56 mg GAE/g, respectively). Moderate TPC appeared in 50% ethanol extracts of *Lončara* flesh and mixtures, while water extracts showed the lowest TPC. TFC ranged from 1.81to 7.67 mg QE/g and was the highest in 96% ethanol peel of *Kaluđerka*, followed by 50% and 96% ethanol peel extracts of *Takiša*. In general, peels had higher TFC than flesh and mixed samples. DPPH• results confirmed the strongest scavenging activity in 96% ethanol peel extracts of *Kaluđerka* (41.8%) and *Takiša* (40.5%). Peel extracts showed greater scavenging capacity than flesh and mixtures, in line with their TPCs and TFCs. Overall, *Kaluđerka* had the highest bioactive content and antioxidant potential, followed by *Takiša* and *Lončara,* especially in the ethanolic peel extract, while the water extracts of all varieties had the lowest. The preliminary results of this study show that the analyzed varieties could be further investigated regarding functional foods.

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PP_VII-3 Small berry, strong potential: Phytochemical and antioxidant assessment of black goji (*Lycium ruthenicum* Murray)

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Goji berries are recognized for their diverse health-promoting properties, and the fruit of *Lycium ruthenicum* Murray, known as black goji berry, has emerged as a valuable functional food due to its antioxidant and potential anticancer effects [1]. The present study investigates the chemical composition and antioxidant potential of an ethanolic extract of dried black goji berries (*L. ruthenicum*), originating from China and purchased on the Serbian market, prepared by maceration process with 95% ethanol. Spectrophotometric analyses revealed a high total carbohydrate content (770.48 mg Glc/g dry extract), predominantly in the form of reducing sugars (491.68 mg Glc/g). The extract was rich in total phenolic compounds (47.32 mg GAE/g), with significant levels of flavonoids (23.00 mg RU/g) and phenolic acids (12.30 mg CA/g). In addition, total and monomeric anthocyanins were detected at 3.67 mg Cy 3-glc/g and 1.31 mg Cy 3-glc/g, respectively. HPLC-PDA analysis, the quantities of 11 phenolic compounds, including cinnamic and benzoic acid derivatives as well as flavonoids, were determined in the extract. Gallic acid (6.53 mg/g), rutin (4.59 mg/g), *p*-coumaric acid (3.31 mg/g), and sinapic acid (2.57 mg/g) were the most abundant, followed by notable amounts of chlorogenic, caffeic, and syringic acids, and flavonoids such as epicatechin and myricetin. The antioxidant potential of the ethanolic extract of *L. ruthenicum* was evaluated using DPPH, ABTS, and total antioxidant capacity assays. The extract demonstrated a total antioxidant capacity equivalent to 72.57 mg ascorbic acid/g. It showed moderate free radical scavenging activity, with IC_{50} values of 245.99 μg/mL (DPPH) and 387.73 μg/mL (ABTS), which, although lower than ascorbic acid, indicate a relevant biological activity. These results highlight *L. ruthenicum* as a potent natural source of phenolic compounds with promising antioxidant properties, supporting its traditional use and potential for nutraceutical applications.

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PP_VII-4 Anti-inflammatory potential of FeJuice® nutritional formula

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Anemia of inflammation (AI) is the second most common type of anemia. It is responsible for about 40% of all anemia cases, either on its own or as part of a combined anemia, such as with iron deficiency anemia (IDA). This means that around 1 billion people worldwide are affected by AI [1]. Standard treatment for anemia is oral iron supplementation, which is followed by side effects. FeJuice® bar is made from fruits and vegetables, based on the innovative FeJuice® nutritional formula. It is rich in highly bioavailable iron and has shown great potential in prevention and treatment of mild IDA, without side effects. The aim of this study was to evaluate FeJuice® anti-inflammatory potential, which may be beneficial in cases of AI and combined anemias.

FeJuice® bar extract was prepared with MeOH. The content of cinnamic and five hydroxycinnamic acids was determined by HPLC-DAD. The inhibition of COX-1 and COX-2 was determined by ELISA assay.

The most abundant compounds identified were chlorogenic acid (12.9±0.37µg/g de) and cinnamic acid (11.7±0.07µg/g de). Among the tested compounds, *p*-coumaric acid demonstrated the highest COX-1 inhibitory activity, with 36% inhibition at a concentration of 20µM. Other acids showed inhibition ranging from 13% to 21%, while the FeJuice® bar extract (BE) achieved 24.3% inhibition at 50µg/mL. However, this activity was significantly lower compared to the standard anti-inflammatory drug indomethacin, which showed 55.1% inhibition at 62.5nM. In contrast, BE exhibited a notably higher inhibitory effect on COX-2, reaching 51.8%, while cinnamic acids inhibited COX-2 in the range of 10–14%. Celecoxib, used as a standard COX-2 inhibitor, showed 66% inhibition at a concentration of 440nM.

In conclusion FeJuice® bar demonstrated high selectivity towards COX-2, which may be beneficial for managing anemia associated with inflammation. However, further evaluation is necessary to confirm these findings.

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PP_VII-5 Effects of a novel nutraceutical on iron bioavailability in a rat model of iron deficiency anemia

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To evaluate the effect of a novel nutraceutical derived from fruits and vegetables, rich in bioavailable iron, on the iron status of Wistar rats with experimentally induced iron deficiency anemia (IDA).
Three-week-old male Wistar rats were fed a specialized diet for 84 days to induce IDA, defined as hemoglobin (Hb) levels below 13.7 g/dL. Blood samples were collected on days 55, 69 and 84, to monitor progression of IDA. After confirmation of IDA, rats were randomly assigned to either a control group (n = 6) or an experimental group (n = 6; 4 survivors). The control group received 1.2 mL/day of saline via oral gavage, while the experimental group was administered 1.2 mL/day of a novel fruit- and vegetable-based nutraceutical smoothie, also via oral gavage, for 31 consecutive days. Hematological and biochemical parameters were measured both before and after the treatment. Paired t-tests were used to evaluate within-group changes, and independent t-tests were used to compare differences between groups. Statistical significance was set at $p < 0.05$.
After 31 days of treatment, Hb levels declined further in both groups compared to baseline levels at the start of the treatment period (control: $p = 0.0009$; experimental: $p = 0.0081$). Red blood cell counts showed a slight but non-significant increase in both groups. Serum iron levels decreased in the control group and increased in the experimental group; however, these within-group changes did not reach statistical significance. No significant between-group differences were observed for Hb, transferrin saturation, or ferritin levels.
The nutraceutical showed modest effects on iron-related parameters in IDA rats. Although the results were not statistically significant, observed trends suggest a potential benefit for iron metabolism. Further studies are needed to confirm its efficacy and optimize treatment.

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PP_VII-6 Quantification of total phenolics, phenolic compounds and anthocyanins as contributors to the antioxidant activity of wine

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Wine is a product of the alcoholic fermentation of grapes or some other fruits, characterized by a highly complex chemical composition. The chemical profile of wine largely depends on the ripeness and quality of the grapes, as well as the agroecological conditions in which the grapes were cultivated. In addition, technological procedures during the primary processing of grapes, the use of oenological agents, temperature regimes during alcoholic fermentation and maceration, oxygen exposure, and the conditions of wine care, storage, and final processing can significantly influence both the sensory characteristics and the chemical composition of the final product [1]. The aim of this study was to determine the content of total phenolics, phenolic compounds profile, and anthocyanins as potential sources of antioxidant activity in wine. Seven wine samples were analyzed, originating from different geographical regions and produced from various grapevine cultivars. The content of total phenolics and anthocyanins was determined using UV-VIS spectrophotometry. The detected concentrations of total phenolics ranged from 866.7 mg/L to 1833.3 mg/L, while the anthocyanin content varied between 31.26 mg/L and 117.90 mg/L. Individual phenolic compounds were identified using liquid chromatography, with gallic acid and catechin found to be the dominant components. The obtained results, along with basic physicochemical parameters of the wines, were processed using chemometric multivariate analysis methods to identify patterns and correlations among the analyzed samples.

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PP_VII-7 Phytochemicals from Serbian berry flours: Assessing the antioxidant features, total phenolic and monomeric anthocyanins content

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Berries, advocated as “superfoods” based on present phytochemicals, nutrients and dietary fibres, have been used in the diet for centuries [1]. Nowadays, with growing diet and health-related awareness, the consumption of berries becomes attractive beyond the fresh state [2]. Inevitably, the applied processing method on berries imposes changes in the phytochemicals content and their antioxidant activity. Therefore, corresponding research aims to tackle the antioxidant capacity through DPPH and ABTS assays, as well as the total phenolic (TPC) and total anthocyanins content (TAC) by pH-differential method of the commercially available flours from raspberry (RBF), blackberry (BBF) and strawberry (SBF) originating from Serbia obtained by air drying by condensation. Additionally, raspberry and blackberry seed flour from cultivars ‘Willamette’ (RS) and ‘Čačanska Bestrna’ (BS), respectively, were examined.

The estimated TPC of berry flours in descending order was RS>BS>RBF>SBF>BBF, where the maximal value was 77.16 mg GAE/ g DW for RS. Concerning TAC, the highest content was detected in SBF (0.65 mg C3G/g DW) and BBF, followed by RBF, while in seed flour, anthocyanins were not detected. The highest percentage of inhibition in the DPPH assay was recorded for RS (92.53%), similar to other flours except SBF, where the corresponding value was slightly lower (85.58%). Maximal values for the ABTS assay were obtained for seed flour, particularly BS (21.26 mmol TE/g DW), while the minimal result was delivered by SBF (13.97 mmol TE/g DW).

The general conclusion is that the berry flour is a potent natural ingredient of newly developed food products for boosting and tailoring the phytochemicals content and antioxidant capacity, depending on the level of inclusion in the products’ formulation.

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PP_VII-8 Alfalfa seed flour as a wheat sourdough bread ingredient: Assessing phenolic profile and antioxidant activity

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Considering bread's role in everyday diet, its enrichment with phytochemicals expressing biological activity is important in contributing to overall well-being. Legumes are emerging as a sustainable, nutrient-rich and affordable ingredient for bread-making [1]. Alfalfa stands out as an extensively cultivated forage legume which is also approved and safe for human consumption in the form of edible seeds, sprouts, and protein concentrates. Diverse bioactive constituents of alfalfa seeds, such as phenols, flavonoids and saponins, demonstrate antioxidant, anticancer, antiatherosclerotic, antidiabetic and antiobesity activities [2]. Additionally, sourdough fermentation re-emerges as a biotechnological process that aligns with the demand for healthy food production and can improve the concentration of phenolic compounds present in alfalfa.Therefore, the present study aims to investigate the effect of convective dried alfalfa seed flour (ASF) inclusion in quantities of 5 and 10% in the production of standard and sourdough wheat bread on bread's phenolic profile and antioxidant activity. The ASF inclusion into standard bread formulation significantly increased the antioxidant activity determined by ABTS (19.63±3.38 to 258.31±5.92 μmol T/100 g) and FRAP (163.90±1.26 to 483.66±37.02 μmol T/100 g), particularly at 10% of ASF inclusion. Further enhancement of the antioxidant activity of bread samples was achieved through sourdough fermentation, where sourdough bread containing 10% of ASF expressed the highest antioxidant activity (299.01±14.74 μmol T/100 g for ABTS and 572.70±30.25 μmol T/100 g for FRAP). Bread samples containing ASF were enriched with particular phenolic compounds such as gallic, caffeic, *p*-coumaric, sinapic and ferulic acids, catechin, epicatechin, quercetin and apigenin, not available in control standard wheat bread, and their content further increased when sourdough fermentation was introduced. This suggests that ASF possesses strong antioxidant properties and its usage as a bread-making ingredient alone or combined with sourdough fermentation leads to the enrichment of bread with phenolic compounds expressing high antioxidant activity.

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PP_VIII-1 Oxorhenium(V)-picolinate complexes as catalysts for olefin epoxidation in cells

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Olefins are commercially valuable materials commonly used to manufacture products like plastic, detergent, adhesive, rubber, and food packaging. Once present in cells, they are usually transferred to epoxides by P450 cytochrome, followed by chemical transformations through epoxide hydrolase enzymes (EHs) activity, or by forming conjugates with glutathione via glutathione S-transferase (GST) activities [1]. Over the last ten years, the chemistry of oxorhenium(V) complexes and their application in homogeneous catalytic olefin epoxidation have been developed. Metabolite of tryptophan, picolinic acid, as an N,O ligand, significantly contributed to the Re(V) complexes' olefin catalytic efficacy [2]. Five new picolinate-based Re(V) complexes have been synthesized and evaluated for their catalytic activity for the cyclooctane epoxidation as the model reaction. Complexes 1-4 were synthesized in the reaction of an equimolar amount of $[ReOCl_3(PPh_3)_2]$ and the corresponding ligand (HL1–HL5), using acetonitrile or DCM/methanol as solvent at 85 °C for 24h. Chemical structure was confirmed using standard analytical methods (IR, NMR, MS), and two of them were crystallized in the monocrystal form suitable for X-ray analysis. Complexes were tested in cyclooctene epoxidation using *tert*-butylhydroperoxide (TBHP, 5.5 M in decane) as the oxidant ($CHCl_3$, 50 °C, 1 mol% catalyst loading, 3 equiv. TBHP). The cyclooctene conversion to epoxide was analyzed by GC/MS. All five complexes showed immediate activity without an induction period. Most of the cyclooctene gets converted within the first three hours, after which the productivity drops sharply and levels out. Also, in all five cases, the selectivity toward epoxide dropped over time, as various side-products, such as the ring-opened cyclooctane diol, were observed by GC/MS. After 24 hours, the 5-bromopicolinate complex reached the overall highest conversion of all five tested complexes of 85%, followed by 6-chloro, 6-bromo, 6-fluoro, and finally 5-hydroxo substituted complexes. In addition, especially 6-fluoro substituted complex showed a loss of selectivity over the 24 h reaction time, as the formed epoxide is converted again, mainly to the ring-opened diol.

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PP_VIII-2 ATR–FTIR analysis of pruning residues from *Aronia melanocarpa* (black chokeberry)

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Aronia (*Aronia melanocarpa* (Michx.) Britton is a valuable plant known for its numerous health benefits. Its berries possess exceptionally high phenolic content and antioxidant capacity compared to other fruits. While the berries have been extensively studied, limited data exist on pruning residues, which may also serve as a source of valuable compounds. Attenuated Total Reflection – Fourier transform infrared spectroscopy (ATR–FTIR) is a simple and rapid technique that provides information on the functional groups of compounds present in various samples, including wood [1]. Aronia wood has not been extensively studied using this technique. One study focused on the characterization of proanthocyanidins isolated from Aronia wood [2]. Therefore, further research on the characterization of aronia wood and bark is needed.

The aim of this study was to characterize and find the chemical differences between Aronia wood and bark using ATR–FTIR spectroscopy combined with principal component analysis (PCA). The bark and the wood were separated and pulverised. ATR–FTIR spectra were recorded and then analyzed using PCA. Several differences, mainly in peak intensities, were observed between the wood and bark spectra. Peaks contributing to the separation of bark from wood spectra were identified at 2850, 2920, 2360, 1290 and 1090 cm^{-1}. The ATR–FTIR combined with PCA is a useful tool for the rapid characterization of different parts of aronia shoots.

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PP_VIII-3 ATR–FTIR characterization of fig (*Ficus carica* L.) pruning residues

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The fig (*Ficus carica* L.) is a tree or shrub native to the Middle East and Western Asia. In Serbia, it is a widespread plant grown as a single specimen in orchards, vineyards and/or gardens. There are a limited number of studies on the fig woody part. Wood materials have characterized quickly and efficiently using green techniques as Attenuated Total Reflection–Fourier Transform Infrared (ATR–FTIR) spectroscopy. Although previous studies have examined fibers extracted from fig bark and natural rubber derived from the fig tree [1, 2], fig tree pruning residues have not been extensively studied. Exploring these residues as a potential natural alternative material could offer valuable insights and applications.

The aim of this study was to characterize and find chemical differences between bark and wood fig trees using ATR–FTIR spectroscopy combined with principal component analysis (PCA). The ATR–FTIR spectra were recorded, followed by multivariate statistical analysis using PCA. The PCA showed a clear separation depending on the part of the shoots (bark or wood). Distinct spectral differences between bark and wood were observed, with strong bands at 2920 cm^{-1} and 2850 cm^{-1} characteristic of the bark, while peaks at 2310 cm^{-1} and 1030 cm^{-1} were more pronounced in the wood spectra. It can be concluded that ATR–FTIR combined with PCA is a powerful method for the rapid characterization of different parts of fig shoots.

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PP_VIII-4 From nature to skincare: Unlocking the cosmeceutical potential of serbian medicinal plants through bioactivity-linked HPTLC and ATR-FTIR profiling

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The increasing consumer preference for natural and sustainable cosmetic products has heightened the interest in plant-derived ingredients with anti-aging and skin-whitening properties. This study investigates the potential of medicinal plants native to Serbia, particularly those from the Rosaceae, Lamiaceae, Plantaginaceae, Hypericaceae, and Asteraceae families, as sources of bioactive compounds suitable for cosmeceutical applications. An integrated analytical approach combining High-performance thin-layer chromatography (HPTLC) with bioassays was employed, including HPTLC-DPPH and HPTLC-Tyrosinase, to evaluate the radical scavenging and tyrosinase inhibitory activities of various herbal extracts [1]. In addition, the HPTLC plates were derivatized by immersion in $FeCl_3$ solution for phenol profiling, phosphoric acid solution for steroid profiling, and Fast Blue B salt solution for detecting flavonols, phenolics, amines, and tannins. Active compounds were further characterized using Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy (ATR-FTIR) [2]. Results indicated that Rosaceae species, such as hawthorn and dog rose, exhibited significant tyrosinase inhibition, potentially due to active unsaturated fatty acids. Conversely, Lamiaceae species, including mountain and wall germander, displayed potent antioxidative properties. Agrimony demonstrated both strong radical scavenging and tyrosinase inhibition. Chemical profiling revealed the presence of steroid-like phenolic compounds, aromatic structures, and polar glycosides as key bioactives. Overall, these findings highlight the promising potential of Serbian medicinal plants as sustainable, bioactive-rich resources for developing novel anti-aging and skin-whitening cosmetic formulations.

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PP_VIII-5 Enhancement of the antibacterial and phytochemical profile of *Cotinus coggygria* extracts by lacto-fermentation: An HPTLC bioassay and UHPLC-DAD-MS/MS study

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Cotinus coggygria Scop. (Anacardiaceae), known for its broad spectrum of biological activities, holds promise as a source of novel antimicrobial agents. This study investigates the impact of spontaneous lactic acid fermentation on the phytochemical composition and bioactivity of ethanolic and ethyl acetate extracts from *C. coggygria* leaves. High-performance thin-layer chromatography (HPTLC) coupled with effect-directed assays (EDA) was employed to evaluate antibacterial properties [1]. Antibacterial activity was assessed against gram-negative bacteria *Escherichia coli* and *Klebsiella pneumoniae*, and gram-positive bacteria *Staphylococcus aureus* and *Bacillus subtilis* using the MTT colorimetric assay. The fermented extracts, particularly the ethyl acetate fraction, exhibited enhanced activity, displaying more intense and numerous inhibition zones across all tested strains. Metabolic fingerprinting was carried out through chromatographic separation using ultra-high-performance liquid chromatography coupled with a diode array detector and tandem mass spectrometry (UHPLC-DAD-MS/MS). This analysis confirmed the fermentation-induced enrichment of polyphenolic compounds, including gallic acid derivatives, flavonoid glycosides, and ellagitannins [2]. Shikimic acid, a key intermediate metabolite in plants and bacteria known for its antibacterial properties against *S. aureus* and *E. coli*, is present only in the fermented ethyl acetate extract. These metabolites are known to disrupt bacterial membranes, inhibit biofilm formation as well as enzymes that are key to bacterial growth, which may explain the enhanced antibacterial activity observed. Our findings underscore the potential of fermentation as a tool to boost the therapeutic value of medicinal plants and support further exploration of *C. coggygria* as a source of bioactive secondary metabolites against drug-resistant pathogens.

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PP_VIII-6 Evaluating the influence of temperature on metal concentrations in bottled water contained in PET Packaging

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The safety of bottled water depends not only on the chemical composition of the content but also on the influence of packaging and storage conditions. This study aimed to investigate the effect of temperature on the concentration of metals in bottled water packaged in PET containers. Samples from six commercial brands on the domestic market were analyzed under three temperature conditions: -20°C, 25°C, and 40°C. Quantitative analysis of 18 elements was performed using ICP-MS, with a particular focus on toxic metals: antimony (Sb), cadmium (Cd), and lead (Pb). The highest concentration of antimony was recorded in “Knjaz Miloš” water at 40°C (15.59µg/L), significantly exceeding the maximum allowed concentration for drinking water (5µg/L, EU and EPA standards). Cadmium was detected in most samples, with the highest value observed in Voda “Voda” at -20°C (0.50µg/L). In most brands, a decrease in cadmium concentration was observed with increasing temperature, suggesting a possible inverse temperature trend, although inconsistent across all samples. Trace levels of lead were found in multiple samples, with a maximum of 1.76µg/L. A weak positive correlation between temperature and the concentrations of Sb, Pb, and Cu was observed, indicating a potential temperature-induced migration of certain elements from the packaging. In addition to health-relevant elements, strontium (Sr), lithium (Li), and barium (Ba) stood out due to high variability in concentration across brands. Their stable presence and significant inter-brand differences suggest their potential application as markers of geological origin and water source type. The results emphasize the importance of monitoring the storage conditions of bottled water and the need for further investigation into the chemical stability of PET packaging under varying temperature conditions.

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PP_VIII-7 Interactive effects of microplastics and toxic metals pollution in Serbian urban environments

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Microplastics (MPs) represent a global threat to soil biota, food chain, and human health [1]. Although MPs and toxic metals are ubiquitous contaminants, little is known about the hazardous nature of their coupled co-contamination effects [2]. This study examined the prevalence of MPs in Serbian (sub)urban soils and investigated the intricate relationship between MPs and accompanied toxic metals Cd, As, and Pb. MPs abundance was assessed by an optimized density separation method. Cd, As, and Pb contents in soil and model plant were determined using inductively coupled plasma optical emission spectroscopy (ICP-OES). On average, urban soils contained 489 ± 281 MPs per kg, whereby polystyrene (PS) was the main contributor (28.57%). The highest contents of MPs (600 MPs kg^{-1}), Cd (2.23 µg g^{-1}), As (36.92 µg g^{-1}) and Pb (64.83 µg g^{-1}) were found in soils from Bor. Spearman correlation analysis revealed the connection between MPs abundance, soil physicochemical parameters, and toxic metals mobility. MPs in soils negatively correlated with soil pH (-0.63). Significant positive correlations identified between soil MPs and bioavailable contents of Cd (0.82), As (0.95), and Pb (0.63) indicated that MPs presence may promote toxic metals mobility. In addition, Cd content in roots and shoots positively correlated with MPs in soils (0.61 and 0.65), suggesting that MPs in soils might improve toxic metal uptake by plants. These findings demonstrated that soil MPs could intensify the migration of toxic metals in the soil-plant system, increasing the risks to the environment and human health.

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PP_VIII-8 Development and optimisation of an evaluation platform for the determination of *in vitro* antioxidant activity of various Himalayan balsam (*Impatiens glandulifera* Royle) extracts

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Himalayan balsam (HB) spreads rapidly—up to 645 km² annually—and is among Europe's most virulent invasive alien plant species. Predominantly found in riparian zones, it displaces native vegetation and hinders forest regeneration via resource depletion and allelopathy. Alternative uses for HB are therefore being actively sought [1].

It has been suggested several times that extracts of the HB could be used as natural sources of antioxidants [2]. One of the drawbacks of current *in vitro* antioxidant activity assays is their limitation regarding the nature of the extraction solvent, which prevents a direct comparison of the activities of polar and non-polar extracts within the same assay. For example, a water-based antioxidant activity assay is not suitable for testing *n*-heptane extracts, in which the presence of non-polar antioxidants, such as carotenoids, is expected to be predominant. In fact, *n*-heptane and aqueous mixtures are not miscible, which can lead to precipitation of antioxidants and false negative results.

The aim of this study is to develop and optimise a robust evaluation platform for the direct comparison of the antioxidant activity of polar and non-polar HB extracts. Analysis was conducted using two complementary spectrophotometric *in vitro* assays based on free radical neutralisation: 2,2-diphenyl-1-picrylhydrazyl (DPPH) and 2,2'-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) (ABTS). Preliminary extractions were performed with whole plants and leaves and with extraction solvents of different polarity (water (H_2O), methanol (MeOH), ethanol (EtOH), acetone, dichloromethane and *n*-heptane). The extracts were obtained by maceration at room temperature. The results of the optimization platform, including the changes in the composition of the reagent medium and the concentration of the extract relative to the solvent, and their effects on the antioxidant activity in both assays are presented, from the initial to the final phase. In one of the optimization steps of the DPPH assay with a 1:1 MeOH–EtOH reagent medium, the relative antioxidant activity (mg ascorbic acid equivalents/g dry weight) of selected polar extracts was as follows: crude extracts (H_2O: 0.47±0.12, MeOH: 1.25±0.18, EtOH: not measurable) and 5 times concentrated extracts (H_2O: 0.93±0.04, MeOH: 1.61±0.05, EtOH: 0.37± 0.05).

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PP_IX-1 Sensory analysis and aroma profiling of biscuits enriched with monofloral bee pollen

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The effects of bee pollen addition on the nutritional and sensory properties of biscuits have been investigated by several researches. However, no scientific information is available on the aroma formation in biscuits enriched with different types of bee pollens. In current research, the sensory and volatile profile of rapeseed, sunflower, and phacelia bee pollens, as well as biscuits enriched with these products were compared. For the investigations, sensory evaluation and gas chromatography-mass spectrometry-olfactometry (GC-MS-O) analysis were applied.

According to the organoleptic analysis, the phacelia pollen-containing biscuits had mild hay-like aroma, while those with rapeseed pollen possessed cabbage-like flavor. The odour intensities of the products intensified with the increasing pollen concentration, which was accompanied by a decrease in overall liking and liking values for taste and smell attributes. In terms of consumer preference, sunflower pollen was found to be the most suitable for product development as the overall liking scores of sunflower pollen-enriched biscuits did not differ significantly from the control. However, the addition of 10% rapeseed of phacelia pollen reduced the sensory acceptance of biscuits significantly. [1].

The results of volatile profiling showed that the addition of pollen increased the number of aroma components as well as odor-active compounds. All biscuits had some unique odorants that were not present in the other samples. It has been established that the number of terpenoid compounds in biscuits is significantly lower than in pollen. No benzene compounds, esters and hydrocarbons were identified in the biscuits. Regarding the unique volatiles in pollen-enriched biscuits, dimethyl trisulfide was a characteristic rapeseed odorant in the biscuit possessing stewed cabbage flavor. Although the pollens did not contain this flavor compound, its presence was formerly detected in rapeseed flower [2]. Terpenes like *α*-pinene and limonene may indicate fortification with sunflower and phacelia pollen, as the control biscuit did not contain these odour components. Some aldehydes (3-methylbutanal, nonanal) and fatty acids (acetic, hexanoic, octanoic and decanoic acids) may also be the markers of pollen addition in products.

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PP_IX-2 Sensory evaluation and consumer acceptance of innovative poppy seed-based spread

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Spread or butter traditionally refers to dairy butter or margarine, the use of which is associated with a number of health issues, as well as jam, which contains large amounts of sugar. For this reason, nut- and seed-based butters/spreads, rich in nutritionally valuable ingredients, are becoming increasingly important in the diet [1]. Poppy seeds are a good functional raw material due to their high content of essential nutrients – proteins, dietary fiber, polyunsaturated fatty acids and other bioactive compounds, vitamins and minerals. In addition, poppy seeds provide unique sensory attributes, such as nutty flavour and crunchy texture [2]. In the present study, an effort was made to produce a novel spread based on poppy seeds, in which 30% of fat was replaced with high oleic sunflower oil (HOSO), while sugar was substituted with sweeteners (stevia and xylitol) in amount of 50% and 75%. The production of the spreads included grinding the raw materials, refining the poppy seeds and the fat phase in a ball mill, homogenising with other ingredients and filling into storage containers. Based on the assessment of a panel of 8 experts using the scoring method, it was determined that the spread samples with fat and sugar partially replaced with HOSO and sweeteners had a better overall sensory quality (i.e. excellent, X_m=4.78 and X_m=4.65, respectively), compared to the control sample, which was rated as very good (X_m=4.41). Consumer acceptability of obtained spreads was tested on 75 respondents using a 5-point hedonic scale. The results showed that all formulated spreads were highly appreciated. In terms of overall acceptability, more than 70 % of tested consumers replied that they “like it extremely” or “like it”. The findings of this study indicated that poppy seeds have good potential for the production of highly acceptable functional spread.

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PP_IX-3 Aroma compounds of 'Tamjanika Bela' wines

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Wine is a highly popular alcoholic drink. The aroma profile of wine, mainly derived from grapes through fermentation and aging process, is one of the key factors influencing its quality. The aroma of the wine is a complex feature that results from the interaction between the chemical compounds in the wine and the senses of smell and taste. Substantial research efforts have been done in exploring innovative methods to improve desirable aromas and flavors in wine, thus gaining a competitive edge in the global market. The 'Tamjanika Bela' grape variety is an indigenous Serbian grape that belongs to the Muscat varieties. Wines obtained from 'Tamjanika Bela' are characterized by light, floral, and refreshing aroma [1].

This work aimed to analyze the aromatic profile of wine of the 'Tamjanika Bela' obtained from the grape that was grown in two different conditions: 1) shaded by a black anti-hail net, and 2) exposed to full solar radiation. The experiment was carried out in a vineyard located near Obrenovac (RS Serbia), during the 2020 and 2021, two seasons that differed considerably in climatic conditions. The wine was obtained by the standard technological process of microvinification, whereas the analyses of volatile aromatic compounds (VC) were performed using GC-MS analysis. Aromatic profile of studied wines was characterized by alcohols, acids, esters and terpenes in addition to other minor classes. Concentrations of quantified VC differed in wines obtained from grapes grown under contrasting climatic conditions; in 2020, concentrations of alcohols, acids, esters and terpenes were higher in wines obtained from grapes shaded by a black anti-hail net. In 2021, the opposite trend was observed; wines obtained from grapes fully exposed to solar radiation had higher concentrations of VC with exception of alcohols. The most notable changes in relative abundance of VC were observed in wines from 2020 for alcohols, esters and terpenes. To assess the impact of quantified compounds on the overall aroma profile of the analyzed wines odor activity values (OAVs) were calculated as the ratio of the volatile compound concentration to its odor threshold value (ODT). Among many compounds found in substantial amounts, only 12 VC (isoamyl alcohol, phenylethyl alcohol, hexanoic acid, octanoic acid, isoamyl acetate, ethyl hexanoate, ethyl octanoate, ethyl decanoat, ethyl 9-decenoate, β-phenylethyl acetate, linalool and 2,3-butanediol) were identified as crucial odorants with OAVs >1. These compounds usually contribute to floral, rose, honey, rancid, sweet, fruity, honey, citrus, and lavender aroma. The experimental conditions influenced the aromatic profile, while the overall aroma of studied wines was mainly attributed to 12 volatile compounds.

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PP_X-1 Improving the prebiotic activity of orange jam through enzymatic treatment

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Citrus pectin is primarily used in the food industry for producing jellies and jams. Increasing interest is now being directed toward pectic oligosaccharides (POS), which are obtained through the partial hydrolysis of pectin and are valued for their potential functional properties [1] [2]. This study aimed to develop a novel functional prebiotic jam from orange fruits through enzymatic treatment. Different commercial enzymes were tested to determine the optimal processing conditions and assess their effect on POS prebiotic activity. The impact of enzymatic treatment on the growth of probiotic strains was also evaluated. Throughout storage, analyses of physicochemical properties, antioxidant activity, microbiological stability, and sensory profile were conducted. The physicochemical results highlighted that the antioxidant compounds, as phenols and vitamin C, were stabilised by the hydrolysed pectin. Moreover, enzymatic treatment enhanced the growth of two tested probiotic bacteria by 2 Log units compared to the untreated control. Total mesophilic bacteria, yeasts, moulds and *Clostridium* spp. were not detected at any sampling time. From a sensory standpoint, only odour and bitterness showed a statistically significant decrease compared to the initial product. Overall, the findings confirm that enzymatic modification of fruit pectin can promote bioactive molecules stability and increase the prebiotic potential of jam, thus serving as a low-cost technological innovation for the food industry.

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PP_X-2 Antibacterial activity of essential oils extracted from Lamiaceae family plants on *Listeria monocytogenes*

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The purpose of this study was to examine the effectiveness of essential oils extracted from *Majorana hortensis* Moench and *Thymus vulgaris* L. for the control of the growth and survival of pathogenic bacteria *Listeria monocytogenes* ATCC 19115. *Listeria monocytogenes*, the cause of listeriosis, is acid-tolerant, psychrotolerant (cold-tolerant) and salt-tolerant bacterium, which can make difficult the preservation of food. It can contaminates the food at any stage during food growth or processing and method such as refrigeration, which ordinarily slow microbial growth, are ineffective in limiting growth of the organism [1].

Essential oils were extracted from dry herbs by distillation. Antibacterial activity was investigtaed by the disk diffusion method in the presence of pure essential oils and four suspensions in 96% ethanol (2:1, 1:1, 1:2, 1:3). The best results, with microbicide effect, appeared in the presence of suspensions and pure oil from Marjoram. The 2:1 suspension showed the strongest inhibitory zone of 57 mm, the 1:1 suspension -51.67 mm, and the 1:2 and 1:3 suspensions had inhibitory zones of 36.33 mm. The pure oil exhibited microbicidal activity at an inhibitory zone of 31 mm. The application of Thymi oil also showed a microbicidal effect (inhibitory zone 37 mm in 1:3 suspension, 31 mm in 1:2 suspension, 16 mm with 2:1 suspension, 20.67 mm with pure oil). The 1:1 suspension had no effect on bacterial growth.

This investigation showed possibility of essential oils extracted from Thymi and Marjoram, to act microbicidaly on *Listeria monocytogenes*, even in the small concentration. This could be very important regarding the fact that all microorganisms become resistant on numerous antibiotics. By adding essential oils in food in precisely defined concentration, by taking care of harmonizing with flavor, taste and odor of the particular groceries, it is possible to upgrade the quality of food and also, to protect the groceries from unwanted *Listeria monocytogenes*.

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PP_X-3 When nature turns toxic: Honey contamination with alkaloids

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Plants have evolved defence mechanisms against insects by producing substances known as natural toxins. Although these compounds play an important ecological role, they may also exert a range of harmful effects on human and animal health, including honeybees [1].

Accordingly, this study aims to overview the data available in the Web of Science on honey contamination with natural toxins – specifically pyrrolizidine and tropane alkaloids, during the period 2011–2024.

Literature data highlight the diversity in both the presence and content of these compounds, including the detection of certain *N*-oxides. The number of alkaloids tested varied across studies, ranging from 2 to 35 for tropane alkaloids and up to 35 different pyrrolizidine alkaloids, reflecting vast diversity of their structures. The total alkaloid content also exhibited considerable variation, reaching as high as 283 µg/kg, 288.1 µg/kg, and 323.4 µg/kg for pyrrolizidine alkaloids in honey originating from Ghana, China, and Ethiopia, respectively. However, in some honey samples available on the Italian market levels were below the detectable amounts. Echimidine and lycopsamine were analyzed in almost all samples and found to be the two predominant pyrrolizidine alkaloids in honey. Additionally, retrorsine and senecionine were also analyzed and detected in nearly all samples. The total content of tropane alkaloids reached 46.49 µg/kg and 55.52 µg/kg in thyme flower honey from New Zealand and pepper flower honey from Canada, respectively, significantly higher than in other samples. In multifloral honey from Spain, the highest concentrations of atropine and scopolamine were 3.7 µg/kg and 5.53 µg/kg, respectively [2].

Rising awareness of these contaminants is reflected in the establishment of maximum levels for pyrrolizidine alkaloids under Regulation (EU) 2023/915, as they are possible human carcinogens according to the IARC classification. As a result, increasing emphasis is being placed on their scientific investigation and wide-scope monitoring to safeguard public health.

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PP_X-4 The dual nature of some plants: Medicinal and culinary

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A wide range of plants is valued for its dual medicinal and culinary properties. Certain herbs and spices, distinguished by specific sensory characteristics, such as unique color, taste, and scent, contain specific biomolecule(s) exerting favorable effects on human health, but can also be "spiced" with various contaminants.

The current study aims to provide an overview of the beneficial constituents (Web of Science) and associated hazards (RASFF data, 2011–2024) of selected herbs and spices [1-2].

In paprika, the key bioactive compound is capsaicin, which exhibits thermogenic, pain relieving, anti-lithogenic, anti-inflammatory, and cardioprotective activities, while the main contaminants are aflatoxins (genotoxic carcinogens). Piperine is the principal active compound in pepper, exhibiting antiproliferative, antitumor, antiangiogenesis, antidiabetic, anti-obesity, antimicrobial, anti-allergic, anti-aging, anti-inflammatory, immunomodulatory, and cardio-/hepato-/neuro-protective activities; dark side of pepper is frequent contamination with *Salmonella* (pathogen). Basil, containing methyl chavicol, linalool, eugenol, and terpinolene, exerts antimicrobial, antifungal, insecticidal, antiparasitic, anti-inflammatory, anti-osteoporotic, anticarcinogenic, immunomodulatory, and hepato-/cardio-/neuro-protective effects. On the other hand, basil has been associated with *Salmonella*, *Escherichia coli*, and pesticide chlorpyrifos, acting as an acetylcholinesterase inhibitor. Ginger, known for its anti-inflammatory, analgesic, and cardiotonic effects, primarily attributed to 6-gingerol, has most frequently been contaminated with aflatoxins and *Salmonella*. Turmeric, whose active principle is curcumin, exerting anti-inflammatory, antinociceptive, antiparasitic, antimalarial, and wound-healing activities, was mostly associated with aflatoxins, *Salmonella*, and pesticides ethylene oxide (proven carcinogen) and chlorpyrifos. The antimicrobial, antifungal, antiviral, antitumor, antidiabetic, blood pressure-/cholesterol-/lipid-lowering, and gastroprotective activities of cinnamon are primarily attributed to *trans*-cinnamaldehyde, while the main health concerns were associated with contamination with ethylene oxide, *Bacillus cereus* (pathogen), and chlorpyrifos [1-2].

It is essential to recognize the remarkable diversity of both plant beneficial bioactives and the associated hazards. Continued wide-scope research and monitoring are crucial to maximize the medical and culinary advantages of herbs and spices while minimizing potential health risks.

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PP_X-5 Potential effects of environmental microplastics on essential elements uptake by *Capsella bursa-pastoris* (L.) Medik.

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Recently, microplastics (MPs) in terrestrial ecosystems have attracted serious attention. MPs in soil may adversely affect crop species, food web, and human health [1]. It was reported that soil MPs could decrease Mg content in the roots of tomatoes (*Lycopersicon esculentum* L.) and reduce Ca in the stems and leaves of pumpkin (*Cucurbita pepo* L.) [1, 2]. The present study investigated the potential impacts of environmental MPs on the uptake of essential elements by traditionally used medicinal herb *Capsella bursa-pastoris* (L.) Medik. Soil and plant samples were collected in Belgrade, Sremska Mitrovica, Vršac, and Bor. MPs were isolated from soil by the optimized density separation method. Calcium (Ca), potassium (K), and magnesium (Mg) contents were determined in roots and shoots of *C. bursa-pastoris* by inductively coupled plasma optical emission spectroscopy (ICP-OES). No statistically significant difference was found between sampling sites (Kruskal Wallis, $p<0.05$). Principal Component Analysis (PCA) also showed no distinct clusters among samples from different locations, suggesting that plant uptake was not affected by geographical region. *C. bursa-pastoris* mainly translocated Ca, K, and Mg to the shoots. Shoots contained between 17.26 mg kg^{-1} and 21.22 mg kg^{-1} of Ca, 13.22–20.35 mg kg^{-1} of K, and 1.61–2.05 mg kg^{-1} of Mg. Spearman correlation analysis revealed interconnection among MPs abundance in soil and Ca, K, and Mg contents in plant roots and shoots. Soil MPs exhibited significant negative correlations with Mg in roots (ρ=-0.92) and Ca in shoots (ρ=-0.95), indicating that MPs might inhibit the Mg uptake and transfer of Ca within plant. This study provided insight into the potential implications of environmental MPs on the mineral nutrition of medicinal plants, which are an integral part of the human diet. Further research is required to clarify the MPs influence on crop species and the food chain.

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PP-X-6 Health risk assessment of As, Cd and Pb in infusions prepared from *Capsella bursa-pastoris* L. Medik.

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Owing to their taste and scent, herbal infusions rank among the most widely consumed non-alcoholic beverages globally [1]. The infusion prepared from *Capsella bursa-pastoris* (L.) Medik. benefits human health [2]. However, it can also hold toxic elements, which raises concerns about its safety and potential adverse effects on well-being. This study aimed to determine the levels of arsenic (As), cadmium (Cd), and lead (Pb) in *C. bursa-pastoris* aqueous infusion, along with their potential health risk assessment. Plant samples collected from four cities in Serbia (Belgrade, Sremska Mitrovica, Vršac, and Bor) were used for infusion preparation. As, Cd and Pb determination was performed by inductively coupled plasma optical emission spectroscopy (ICP-OES). The overall trend noticed in recorded concentrations was As>Pb>Cd. Kruskal-Wallis's non-parametric test revealed statistically significant variations ($p<0.05$) in the contents of these elements in the analyzed samples. Infusion prepared from samples from Bor contained the highest concentration of As. Principal Component Analysis (PCA) also indicated the presence of distinct clusters belonging to samples from different locations. Although the highest values for estimated daily intake (EDI), non-carcinogenic-target hazard quotient (THQ), and lifetime carcinogenic risk (LCR) were found for As, all examined parameters were lower than the acceptable limit for children and adults. THQ for As, Cd, and Pb was below 1, and LCR was less than 10^{-4}, indicating negligible risks. Infusions prepared from *C. bursa-pastoris* were safe for children and adults, regarding carcinogenic and non-carcinogenic effects. Nevertheless, calculated levels suggested that children are more vulnerable to health risks. The present study emphasized that drinking herbal extracts could be a significant and direct pathway for PTEs' introduction into human nutrition. The human health risks related to the consumption of herbal infusions should be of concern.

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PP_X-7 Monitoring of pesticide residues in apples: A case study from the Belgrade market

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Apples are among the most popular fruits in the world due to their health benefits. However, because of multiple pesticide applications during the growing season, they may contain residues that can affect food quality and human health. The European Commission (EC) is constantly reviewing the safety of pesticide use, with many active substances being withdrawn from European orchard protection programmes or having their maximum residue levels (MRLs) in fruits reduced due to their pronounced toxicity [1]. This study aimed to investigate the occurrence of frequently used pesticides (fungicides, insecticides and herbicides) in apples collected from different retail outlets in Belgrade, in order to inform consumers about their presence and possible health risks. Pesticide extraction was performed using the QuEChERS method, followed by detection using liquid chromatography–tandem mass spectrometry (LC–MS/MS) [2]. The results showed widespread pesticides contamination in apples on the Belgrade market, with residue concentrations ranging from a few μg kg^{-1} to several hundred μg kg^{-1}, based on fresh weight of samples. Fungicides fludioxonil and pyraclostrobin, and insecticides acetamiprid and chlorantraniliprole, were the most frequently found in apple samples, with pyraclostrobin found at a concentration of 686 μg kg^{-1} exceeding its MRL of 0,5 mg kg^{-1}. The observed levels of pesticide residues indicate a potential health risk for consumers, and the contribution of total dietary intake of pesticides, as well as their possible synergistic effects, cannot be ignored. These results highlight the need for long-term monitoring of pesticide residues in apples and stricter implementation of regulations in the field of food production and safety in the Republic of Serbia.

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PP_X-8 Effectiveness of household processing methods in reducing pesticide residues in apples

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Different pests and diseases can seriously affect the production and quality of apples. To ensure yield and quality, intensive pesticide application is commonly practiced during apple growth, which frequently results in the presence of pesticide residues in the final product [1]. Therefore, monitoring and reducing pesticide residues in apples is important for protecting consumer's health. This study was carried out in order to assess the effectiveness of different household processing methods in reducing pesticide residues presence in apple fruits. The methods examined included immersing the apples in tap water, acetic acid and sodium bicarbonate water solutions, and peeling. Apples analyzed in this study were obtained from local markets in Belgrade. The extraction of pesticide residues was performed by applying the QuEChERS method, followed by analysis with liquid chromatography coupled with tandem mass spectrometry (LC–MS/MS) [2]. Multiple pesticide residues were detected in the apple samples, indicating widespread application of plant protection products. The results revealed a variable effectiveness of the applied treatments, depending on the chemical properties and surface affinity of each pesticide. Peeling proved to be the most effective method for removing most residues, suggesting that a significant portion of residues is localized on or near the apple skin. However, this method showed limited efficiency for certain systemic pesticides, such as acetamiprid. These findings provide valuable insight for consumers aiming to reduce dietary exposure to pesticide residues through simple domestic practices.

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PP_X-9 Microelements concentration in grains of intercropped soybean and common millet

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The deficiency of microelements in plants negatively impacts agricultural production and affects human health, as plants represent a primary source of essential nutrients in the human diet [1]. Promoting sustainable, agriculture-based approaches to enhance micronutrients in grains of crops, with yield increase, can contribute to healthier nutrition through nutrient-rich foods while advancing nutritional security [2]. The main objective of this study is focused on intercropping and bio-fertilizer (Coveron) application as convenient ecological solutions for managing microelements concentration in soybean and common millet grains. Three intercrop combinations (AR - alternating rows, AS1 - alternating strips of 2 rows of soybean and two rows of millet, AS2 - alternating strips of 2 rows of soybean and four rows of millet), together with monocrops as control, were examined. Concentrations of micro- and trace elements were determined using inductively coupled plasma mass spectrometry (ICP-MS). Obtained results revealed AS1 as a perspective combination for boosting Mn and Fe in a grain of soybean, simultaneously increasing the concentration of Fe and decreasing the concentration of potentially toxic elements (Al and Cr) in a grain of millet. The AS2 combination showed similar results, indicating its suitability for enhancing Mn accumulation in millet, too. Accumulation of other microelements was not significantly affected by the planting pattern. The bio-fertilizer was beneficial for increasing the concentration of B, Fe, Co, Zn and Mo in millet grain and Al and Co in soybean grain. According to the results, alternating strips represent promising agricultural practices to boost Mn and Fe concentration in both crops' grains. At the same time, the integration of intercropping and bio-fertilizer has a much greater impact on managing Mn, Fe, Co, Zn, B and Al in millet grain.

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PP_X-10 Mineral profile of selected spices: Nutritional and toxicological assessment

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Spices represent edible parts of plants used in the human diet to enhance food's flavor, aroma, and nutritional value. In addition to organic compounds, they contain significant amounts of macro- and microelements, including potentially toxic elements. The study aim to analyze the mineral composition of nine commonly used spices: cinnamon, nutmeg, coriander, turmeric, sesame, basil, chili, oregano, and ginger [1]. Sample preparation was performed using a wet digestion method with concentrated HNO_3 and H_2O_2, while quantitative elemental analysis (Ag, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn, Ca, K, Na, Mg, Al) was carried out using inductively coupled plasma optical emission spectrometry (ICP-OES). The results showed that potassium (K) and calcium (Ca) were the most abundant macroelements in all analyzed samples, while magnesium (Mg), sodium (Na), and aluminum (Al) were present in lower concentrations. Among the microelements, the highest zinc (Zn) content was found in cinnamon, while ginger showed the highest copper (Cu) content. Iron (Fe) and manganese (Mn) were present significantly, highlighting their nutritional importance. The concentrations of toxic elements (Pb, Ni, Cr, Cd) did not exceed permissible limits, confirming the relative safety of the tested samples for human consumption. The results indicate the potential use of spices as supplementary sources of essential minerals in the daily diet.

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PP_X-11 From food safety concern to responsibility: Insights from Slovenian consumer focus groups

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Food safety (FS) is essential for public health, and foodborne illnesses occurring in the domestic environment are a big challenge. In Europe, between 2018 and 2023, most foodborne outbreaks occurred in consumers' homes (domestic premises), followed by restaurants [1]. Most FS discussions focus on the safety of food itself, often overlooking the role of consumers in maintaining FS. Consumers are usually left to their own devices and need to rely on their knowledge of safe food handling practices. The aim of this study was to investigate consumers' FS knowledge, attitude, and practice in Slovenia through a series of focus group discussions (interviews in small groups) about various food handling activities from shopping to cooking. This also included: 1) how consumers perceive their role and the role of other stakeholders (e.g., inspections) in ensuring FS and 2) what consumers' biggest FS related concerns are. Focus groups with 40 participating consumers were conducted in person and online. Participants had varying demographics (gender, age, education), and each participant attended a single session lasting 1 to 1.5 hours. The understanding of consumers' FS responsibilities was diverse as some participants were more informed about the role of consumers while others relied more on inspections. Consumers also mentioned a variety of FS concerns. They frequently mentioned: pesticides (25%), additives (23%), microbial pathogens (20%), food fraud (10%), insufficient information (10%), inadequate inspections (8%) and antibiotics (3%). There is a need for improved communication (about labeling, food production, FS, etc.) and for consumers to be empowered to maintain FS.

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PP_X-12 Mineral profile of baobab fruit pulp and moringa leaf powders

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Baobab (*Adansonia digitata* L.) and moringa (*Moringa oleifera* Lam.) are plants native to Africa and other tropical regions. Based on their nutritional value and content of bioactive compounds, the fruit pulp of baobab and moringa leaves are recognized as superfoods with a growing global demand. On the global market numerous commercial products are based on baobab fruit pulp and moringa leaves, including their powders, often labeled as nutrient-dense raw whole foods. Additionally, there is a growing interest among food scientists in utilizing baobab fruit pulp and moringa leaves as sources of minerals, vitamins, and bioactive compounds to enhance the nutritional properties of food products. This study aimed to analyze the mineral content of commercial baobab fruit pulp and moringa leaf powders. After microwave digestion, macro- (K, Na, P, Mg, Ca) and microelement (Fe, Zn, Cu, Cr, Mn, Co) contents in analyzed samples were determined by optical emission spectrometry with inductively coupled plasma (ICP-OES). In general, decreasing order of minerals in baobab fruit pulp and moringa leaf powders were: K > Ca > Mg > P > Na > Fe > Mn > Zn > Cu > Co > Cr and K > Ca > P > Mg > Na > Mn > Fe > Zn > Cu > Co > Cr, respectively. The moringa leaf powder had about four times more Ca and Mg, and about three times more Fe and Zn than baobab fruit pulp powder. According to the Recommended Daily Allowance (RDA) values, moringa leaf powder (10 g) is the source of Ca and Mn. At the same time, its contribution to the daily intake of other minerals was less than 15% of the RDA.

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PP_X-13 The potentially toxic elements in human milk samples: Bioaccessibility assessment

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Human milk is the primary source of nutrition for newborns, providing essential nutrients and immunological benefits for infant health. However, it may also accumulate the potentially toxic elements (PTEs) originating from maternal exposure to environmental pollutants. This study assessed both macro and PTE concentrations in 50 human milk samples collected from healthy mothers residing in urban and semi-urban areas of Zadar (Croatia). Participants provided informed consent before the sampling.

Human milk samples were analyzed using inductively coupled plasma–optical emission spectrometry (ICP-OES) and inductively coupled plasma–mass spectrometry (ICP-MS) following the microwave digestion of samples by HNO_3 and H_2O_2. Twenty-four elements' (Al, As, B, Ba, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Na, Ni, P, Pb, S, Se, Sr, and Zn) concentrations were determined. *In vitro* bioaccessibility assays simulating the gastrointestinal tract (GIT) — using gastric (GE) and gastro-intestinal (GIE) fluids — were performed at 37°C to determine the bioaccessible PTE concentrations. The UBM bioaccessibility assay was adopted and adapted to the human milk samples [1, 2].

The highest pseudo-total concentrations were observed for K > Ca > Na > P > S > Zn > Mg > Fe > Cu, while concentrations of Co, Cr, Hg, and Ni were not detected. Many essential elements were present at concentrations consistent with nutritional recommendations. Elevated levels of As, Cd, and Pb were determined in some of the investigated samples regardless of maternal smoking status, indicating multiple exposure sources. Bioaccessibility results showed that Ba, Cd, Cu, Fe, Mn, and Zn were most bioaccessible in the stomach (GE), whereas Cu, Mn, and Zn were higher bioaccessible in the small intestine (GIE) compared to the other investigated PTEs. These findings pointed to the importance of monitoring maternal exposure to environmental pollutants during lactation, as certain PTEs showed significant bioaccessibility, posing potential risks to infant health.

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PP_X-14 Food additive intake in infertile and fertile men: A cross-sectional study

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Growing concerns regarding the impact of environmental and dietary factors on male fertility have prompted investigations into the role of food additives. Several studies have suggested that chronic exposure to synthetic additives—such as preservatives, colorants, and flavor enhancers—may interfere with reproductive function through oxidative damage, hormonal disruption, or microbiota alteration [1, 2]. This study aimed to compare the intake of food additives between infertile and fertile men and explore its potential association with sperm quality. The study included infertile men diagnosed by a specialist and age-matched fertile controls (n=30 in each group). Dietary intake was assessed using 3-day food consumption records and a semi-quantitative food frequency questionnaire. Additive intake was estimated by matching consumed packaged food items with label data and, when unavailable, Turkish Food Codex maximum levels [3, 4]. Infertile men consumed a broader range and greater amounts of food additives compared to controls. The most notable differences were observed in nitrite intake (E249, E250), which exceeded the acceptable daily intake (ADI) in two infertile individuals. Processed meat consumption—a primary source of nitrites—was significantly higher in the infertile group (p=0.04). Additionally, significant negative correlations were found between specific food colorants (e.g., E127, E129) and sperm concentration (p<0.01), as well as between emulsifiers and sperm motility (e.g., E491, E962). Despite most individual additive intakes remaining within ADI limits, the overall pattern of increased exposure and greater diversity in additive consumption among infertile men suggests a potential link with impaired sperm quality. These findings underscore the need for longitudinal and mechanistic studies, as well as public health guidance on minimizing unnecessary additive intake in reproductive-age males.

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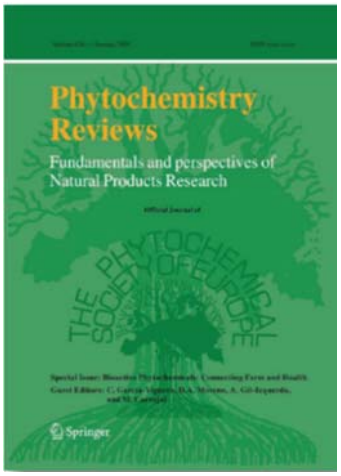

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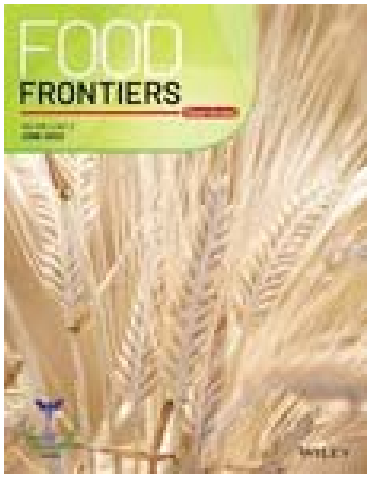

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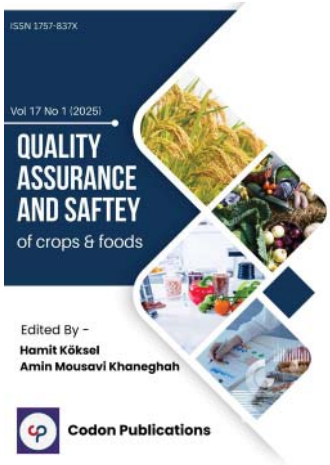

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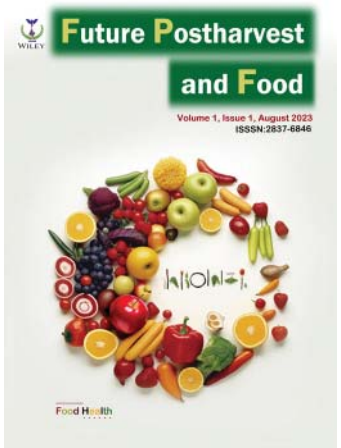

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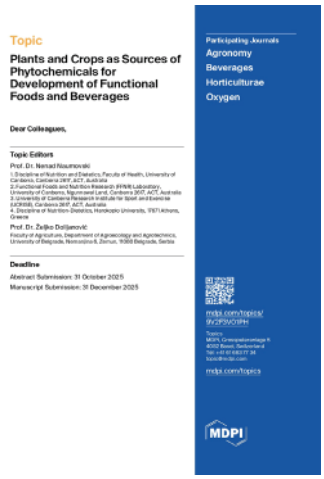

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