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BOOK OF ABSTRACTS

XXVth JUBILEE RISK FACTORS OF FOOD CHAIN

10th - 12th of September 2025

Siedliska, Rzeszów, Poland



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Plenary lecture

History of “Risk Factors of Food Chain” conference

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The history of the conference “Risk Factors of Food Chain” started in 2000. Generally, the topic related to environmental toxicants and health was started in 1988 as a project submitted by Professor Ladislav Massányi. The first experiments were related to cadmium toxicity mainly in relation to reproduction. This project was very successfully approved, and some very new results were published.

Later there was an idea to present and discuss interesting results related to animals and human health. Professor Jozef Golian, Professor Norbert Lukáč, Professor Robert Toman and Professor Peter Massányi from Slovak University of Agriculture in Nitra, Slovak Republic undertook an idea to organize a meeting related to food toxicology and health.

The aim of the conference was (and still is) to unify the forum for the presentation of new advances and research results in the fields of risk factors on the environment, solid management, crop production, animal breeding and human food chain. The conference is targeted at leading researchers, engineers and scientists in the domain of interest from around the world. Topics of interest for the submission include ecological development, ecosystems and ecology, environmental health, environmental impact assessment, solid waste management and recycling, bioremediation of polluted sites, biosensors and molecular diagnostics, biological effects monitoring, ecological science and technology, environmental science and engineering, laboratory techniques and field validation, human health risk, natural toxins, environmental health risk assessment, sustainable agriculture, control and system engineering for food industry, food safety and hygiene, functional food and bioactive factors, nutrition and health of the public, cytotoxicology, toxicology, ecotoxicity of emerging chemicals, new trends in environmental toxicology, research opportunities and priorities etc.

In the year **2000**, this story started as a local conference, but the target of the founders was to upgrade this event to an international conference. The first conference held in 2000 in Nitra, was organized by the Slovak University of Agriculture and Society for Agricultural, Forestry, Food and Veterinary Sciences at the Slovak Academy of Sciences in Bratislava. The conference showed all results obtained in previous period and all-important novelties were published in a monograph edited by Professor Jaroslav Kováčik. Later the conference was mainly organized in Nitra (2000 – 2007). In **2001** there were 32 papers submitted mainly from Slovak Republic but also from Hungary and Austria. In **2002** there were 52 articles submitted from Slovak Republic, but also from Hungary and Czech Republic. In **2003** the scientific committee was formed with experts from Slovak Republic, Hungary, Czech Republic and USA. In **2004** the scientific committee was formed with experts from Slovak Republic, Austria, Hungary, Czech Republic and USA and 75 papers were accepted. In the year **2005** a new chapter of this conference started. Thanks to great cooperation with Professor Marian Zakrzewski, Professor Robert Stawarz and Professor Grzegorz Formicki,

the Pedagogical University of Kraków became the co-organizer of the conference, and the scientific committee was formed with experts from Slovak Republic, Poland, Austria, Hungary, Czech Republic and USA. In 2005, 75 studies from Slovak Republic, Poland, Czech Republic, Germany and USA were presented.

In **2006** the conference was co-organized also by the State Veterinary and Food Administration and the scientific committee was formed with experts from Slovak Republic, Austria, Hungary, Czech Republic, Poland and USA. In **2007** the conference was again organized in Nitra and the results were published in proceedings. In the year of **2008** the conference was organized in Kraków, Poland and the abstracts were published in scientific journal – Slovak Journal of Animal Sciences. In **2009** the conference moved to Račkova dolina, wonderful place in High Tatras, Slovak Republic and papers were published in scientific journal “Potravinarstvo” (Slovak Journal of Food Sciences). In **2010** the conference was organized by Slovak University of Agriculture in Nitra, Slovak Republic, Pedagogical University of Kraków, Poland, Szent István University in Gödöllő, Hungary and Tomas Bata University in Zlín, Czech Republic. The scientific committee was formed by the experts from Slovak Republic, Poland, Hungary, India and Italy. The most significant results were published in monograph edited by Robert Stawarz and Grzegorz Formicki.

From **2011** the organization of this international conference was confirmed by Slovak University of Agriculture in Nitra, Slovak Republic, Pedagogical University of Kraków, Poland, Szent István University in Gödöllő, Hungary and University of Rzeszów, Poland and the conference was placed in Iwonicz, Poland. All abstracts were published in the conference proceedings and selected full papers were published in a monograph edited by Norbert Lukáč and Peter Massányi. In **2012** the conference was placed in Topolčianky, the outcomes were published in proceedings and chosen papers were published in scientific journal – Journal of Microbiology, Biotechnology and Food Sciences. Interesting new period continued in **2013** as the conference was for the first time organized in Hungary. Professor Bárdos as the main organizer demonstrated great experiences and the results were finally published in scientific journal – Animal Welfare, Ethology and Housing Systems. In **2014** the conference was again organized in Poland – in Jaworze and the proceedings were edited by Grzegorz Formicki and Robert Stawarz. In a new place – Dudince, Slovak Republic the conference was organized in **2015**. The scientific committee was formed by experts from Slovak Republic, Poland, Hungary, Czech Republic, Italy and Serbia and 38 various papers were presented. For the first time our proceedings received digital object identifier (DOI) as a unique alphanumeric string assigned by a registration agency (the International DOI Foundation) to identify content and provide a persistent link to its location on the Internet. In **2016** the conference was perfectly organized in Rzeszów, and the president of the organizing committee was Professor Malgorzata Dżugan from University of Rzeszów. Scientific committee was formed by the experts from Poland, Slovak Republic, Hungary, Czech Republic, India, Italy and Romania. There were 2 plenary lectures, 16 presentations and many posters. The book of abstract was edited by Monika Wesolowska and selected full paper was published in monograph edited by Małgorzata Dżugan et al. In **2017** year, the conference was organized in picturesque beauty Żmija, Poland by Pedagogical University of Kraków. The Residence Assanya, a recreation and sports complex, provided the venue for presenting high quality presentations and electronic posters. The scientific committee was international – there are great experts from Poland, Slovak Republic, USA, Brasilia, Peru, Hungary and Italy. In **2018**, the conference took place for the second time in Hungary, but the first time organized by Szent István University, Gödöllő, Faculty of Mechanical Engineering, under perfect management with the team headed by Professor Gábor Géczy in Mátrafüred Academic Resort. The topics of the lectures were not limited to plant, animal and human health, but there were different aspects, for example environmental; economic and social, mechanical and technological risks. Later in **2019** the conference was organized in Slovakia, Osrbli. The interesting scientific program was also enriched by an interesting

bowling competition. In the scientific committee there were expert from Spain, Brazil, Poland, Peru and Italy.

Unfortunately, according to COVID pandemia, the conference in **2020** was cancelled.

So, we re-started again...

According to changing situation the **2021** "Risk Factors of Food Chain" was organized by University of Rzeszów in Iwonicz. Many interesting contributions were presented. In **2022** the conference was organized by Pedagogical University of Kraków in Węgierska Górka. At the conference 49 contributions were presented and finally a Book of abstracts was published. In **2023** the conference moved to Hungary, where MATE University perfectly prepare the conference in Gyöngyös. The conference was interestingly enriched by various practical food and environmental excursions with very high impact. In **2024** the organizer of the conference was again Nitra and selected a nice place in Low Tatras – Bystrá. In the scientific committee there were expert from all over the world – from Spain, Mauritius, Serbia, Brazil, Greece, Poland, Italy, Egypt, Slovak Republic, Argentina, India, Australia, Peru and USA. Now in the **2025** the 25-th "Risk Factors of Food Chain" is organized by University of Rzeszów in Siedliska.

A 25-year celebration is commonly known as a Silver Jubilee. It signifies a significant milestone, often marking 25 years since a wedding, the start of an organization, or a monarch's reign. It's a time to reflect on past achievements and look forward to the future.

Scientific and Organizing Committee

2000 (I.): Nitra (SK)	09/2000
2001 (II.): Nitra (SK)	27/09/2001
2002 (III.): Nitra (SK)	26/09/2002
2003 (IV.): Nitra (SK)	03/12/2003
2004 (V.): Nitra (SK)	07/10/2004
2005 (VI.): Nitra (SK)	06/10/2005
2006 (VII.): Nitra (SK)	12/10/2006
2007 (VIII.): Nitra (SK)	11/10/2007
2008 (IX.): Kraków (PL)	17/09/2008
2009 (X.): Račková dolina (SK)	18–19/09/2009
2010 (XI.): Nitra (SK)	13–14/09/2010
2011 (XII.): Iwonicz (PL)	05–06/09/2011
2012 (XIII.): Topoľčianky (SK)	19–20/09/2012
2013 (XIV.): Gödöllő (H)	24–26/10/2013
2014 (XV.): Jaworze (PL)	09–10/10/2014
2015 (XVI.): Dudince (SK)	19–21/10/2015
2016 (XVII.): Rzeszów (PL)	19–21/09/2016
2017 (XVIII.): Żmiąca (PL)	20–22/09/2017
2018 (XIX.): Mátrafüred (H)	26–28/09/2018
2019 (XX.): Osrblie (SK)	09–11/09/2019
2020: cancelled due to COVID	
2021 (XXI.): Iwonicz (PL)	06–08/09/2021
2022 (XXII): Węgierska Górka (PL)	10–12/10/2022
2023 (XXIII.): Gyöngyös (HU)	20–22/09/2023
2024 (XXIV.): Bystrá (SK)	04–06/09/2024
2025 (XXV.): Siedliska (PL)	10–12/09/2025

Plenary lecture

Dental caries - promoting and dental caries - protective nutritional factors

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Dental caries is a disease with a multifactorial etiology and causes the destruction of tooth tissue by bacteria, that results from the interaction of plaque microbiota, host system cells, and also diet. The microbiological aspect of enamel caries indicates that changes in the quantitative proportions of the solid, physiological microbiota towards an increase in *Streptococcus mutans* and *Lactobacillus* spp. and a decrease in the number of *mitis* group Streptococci including *S. sanguinis* play a key role in caries. In addition to the microbiological aspect, host defense systems also play an important role in caries prevention based on physiological caries defense mechanisms. The action of non-specific immune factors contained in saliva is aimed at preventing excessive proliferation of microorganisms. Moreover, diet plays a key role in the incidence of dental caries, with dietary patterns and sugar intake being important factors influencing the incidence of tooth decay. In addition, promoting healthy eating habits is key to reducing the risk of dental caries and improving overall oral health. Dietary patterns are associated with the prevalence of dental caries, where higher sugar-sweetened beverage consumption correlated with increased caries experience. In addition, high sugar consumption was classified as a major risk factor for dental caries, with studies indicating that limiting free sugars to less than 10% of energy intake can reduce caries risk. Furthermore, unhealthy eating practices affect the risk of dental caries. On the one hand, diet can influence the occurrence of caries, while on the other hand, certain food components can prevent it by influencing the oral microbiota by inhibiting the growth and metabolism of cariogenic bacteria. A special role in caries prevention is played by polyols as replacements for sucrose in the diet, as well as foods containing polyphenols, which may have potential beneficial effects in preventing caries and plaque accumulation. Polyphenols are a large group of chemical compounds found in foods. They are present in fruits, tea, coffee, cocoa, herbs and spices. Currently, caries prevention includes the use of preparations with fluoride and the fluoridation of water. Unfortunately, the uncontrolled use of fluoride, can lead to negative effects such as fluorosis of the teeth or bones. Non-fluoride-based prevention methods including the use of chlorhexidine, probiotics, xylitol, but also the introduction of polyphenols into the diet can provide effective support for caries prevention. In summary, four elements are required for the onset of caries: dietary habits - the consumption of carious sugars, the presence of bacteria in the mouth, which break down carbohydrates from the diet into acids, the susceptibility of the host and the duration of action of the sugars from foods while ingested and remaining in the mouth. Therefore, diet plays a crucial role in the incidence of dental caries, with dietary patterns and sugar consumption being significant factors influencing caries prevalence. Additionally, promoting healthful eating practices is vital for reducing the risk of dental caries and improving overall oral health.

Keywords: dental caries, diet, sugar, microbiota, oral health, polyphenols

Plenary lecture

Evaluation of biological and toxic properties of phytochemicals using model organisms

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The ever-increasing amount of foreign substances in the environment is causing growing concern about the ecological and global impact on the environment, as well as on human and animal health. The current trend is to seek preventive and therapeutic measures to protect against the toxic and carcinogenic effects of these substances. The plant kingdom is considered a primary source of food and medicine. The use of herbal medicines and food supplements containing plant extracts or their components is an integral part of human and animal nutrition, as well as the treatment and prevention of various diseases. In recent decades, interest in the potential health benefits of plant extracts has been steadily increasing. Many of the effects are related to the presence of secondary metabolites (phytochemicals), which are biologically active components of plants and, thanks to their complex effects, can reduce the risk of several diseases in humans and animals. For the plant itself, they are part of its defence mechanisms against environmental stress, and it is precisely this defensive ability of plants that offers great potential for protecting humans and animals from the harmful effects of pollutants found in the environment. The analysis of the biological properties of plant extracts and their components also includes the evaluation of their *in vitro* effects using model organisms. Their use makes it possible to evaluate the ability of extracts to protect organisms from oxidative stress and eliminate harmful effects during the simultaneous exposure of living organisms to harmful substances found in the environment. Currently, a number of different methodologies have been proposed to evaluate the effects in real time or at specific time intervals. Using selected *in vitro* tests, we monitored the effect of substances on cell response, proliferation, metabolic activity and cell cytotoxicity.

Keywords: cytotoxicity, plant extracts, cell lines, proliferation, metabolic activity

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Plenary lecture

Gastrodiplomacy: why origin of food matters

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Hospitality as a diplomatic tool has been present ever since the first diplomatic encounters. Food has religious, as well as traditional symbolism: an invitation to a dining table and sharing valuable food resources with foreigners is a symbolic gesture of peace and understanding. Gastronomy reflects national traditions and food is a carrier of national identity, therefore, more and more embassies around the world engage in the strengthening of the national brand through gastronomy events, cooking workshops, and wine tastings. The emerging concept of gastrodiplomacy as part of public and cultural diplomacy thereby supports national economic interests. Food and drink thus transforms into a value added commodity supporting the communication of the core values of a country. In my presentation I will explore the connection between national identity and food, and how gastronomy can be applied in diplomacy.

Keywords: gastronomy, diplomacy, gastrodiplomacy

The Role of Hormonal Contraception in the Context of STD Infections

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This article focuses on highlighting the role of hormonal contraception in the spread of sexually transmitted diseases (STDs). Hormonal contraception, particularly single- and combined-component oral pills, is a popular method of preventing unplanned pregnancies. Its mechanism primarily involves the suppression of ovulation, thickening of cervical mucus, and changes to the uterine lining, which hinder fertilization and implantation of the egg. Studies indicate that the use of hormonal contraception may increase the risk of contracting certain sexually transmitted infections (STIs), including chlamydia (*Chlamydia trachomatis*) and genital herpes (HSV-2). However, further research is needed, considering various populations and risk factors. There is still a common misconception that hormonal contraception protects against STDs, which may lead to serious health consequences. Condoms remain the most effective means of protection against sexually transmitted infections, as they create a physical barrier against bodily fluids. Sexual education plays a key role in STDs prevention, it raises awareness of the need for regular testing, promotes responsible attitudes, and encourages knowledge of available diagnostic and treatment options. Early detection of infections allows for prompt treatment and helps reduce the spread of disease.

Keywords: hormonal contraception, sexually transmitted diseases (STDs), infections, sexual education

Study of dendritic cells survival during co-cultivation with bacteria in a nanofiber scaffold 3D cell culture system

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The survival of dendritic cells during co-cultivation with bacteria is critical for understanding immune responses and developing effective treatments. This study investigates the survival rates and apoptosis levels of dendritic cells co-cultured with *Staphylococcus aureus* and *Streptococcus uberis* on nanofiber scaffolds made from different materials. Dendritic cells were differentiated from isolated CD14+ peripheral blood monocyte cells using GM-CSF + IL 4. These cells were cultured on nanofiber scaffolds made from synthetic polymer polycaprolactone (PCL), PCL combined with natural polymer silk fibroin (PCL/SF) and compared to traditional 2D culture using flow cytometry. Our findings demonstrate that dendritic cells cultured on PCL/SF scaffolds exhibited significantly higher survival rates and lower necrosis percentage compared to those on PCL and control 2D culture. While PCL scaffolds showed improved dendritic cell survival rate over 2D cultivation controls, the PCL/SF scaffolds were markedly more favorable for dendritic cell survival both in the bacteria-unaffected cell culture and also under bacterial stress. The bacteria induced stress was measured at 1-hour, 3-hour, and 24-hour co-cultivation intervals. The differences were most pronounced at the 24-hour mark, highlighting the potential of PCL/SF scaffolds in enhancing dendritic cell resilience in 3D cell culture systems. These results suggest that PCL/SF scaffolds provide a much better environment for dendritic cell growth and survival during bacterial co-cultivation. These outcomes offer promising implications for future research and cell culture applications.

Keywords: 3D cultivation, nanofiber scaffold, dendritic cells, cell survival, co-culture

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Effect of intraperitoneal administration of resorcinol on spermatozoa motility parameters and morphology in rabbits *in vivo*

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The aim of this study was to evaluate the effect of resorcinol on rabbit spermatozoa after intraperitoneal administration *in vivo*. The experiment was conducted on six male rabbits of the Hyla breed, aged 5 months (an age at which sexual maturity is reached), with an average body weight of approximately 6 kg. The animals were divided into two groups (n = 3 per group): control and experimental. Semen was collected using an artificial vagina and evaluated immediately after collection. Sperm motility parameters were assessed using Computer-Assisted Sperm Analysis (CASA), and morphology was examined under an optical microscope (magnification: 2000×; 500 spermatozoa assessed per rabbit). The resorcinol solution was prepared by dissolving 1250 mg of resorcinol in 5 ml of physiological saline. The solution was administered intraperitoneally at a dose of 25 mg per kilogram of body weight. Semen samples were collected prior to the first application and then two more times, always five days after each administration of resorcinol. In the experimental group, both total motility and progressive motility increased over the course of the study. Total motility increased from 53.61% before treatment to 76.07% after the first application, and further to 86.40% after the second application. Progressive motility increased from 32.10% to 57.45% and then to 76.64%, respectively. Initially, 6.50% of spermatozoa showed morphological abnormalities. This rate increased to 11.60% after the first administration, but then decreased to 7.67% after the second. These results suggest that intraperitoneal administration of resorcinol at this dosage may have a stimulatory effect on sperm motility, particularly progressive motility, without significantly increasing the share of morphologically abnormal spermatozoa.

Keywords: spermatozoa, resorcinol, CASA, motility, morphology

Antibacterial peptides as modern food preservatives

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A primary concern in the food industry is contamination by pathogens like *Salmonella* spp., *Shigella* spp., *Escherichia coli*, *Listeria monocytogenes*, and *Pseudomonas aeruginosa*. In this context, bioactive peptides are emerging as promising natural biopreservatives capable of extending food shelf-life. These peptides exert their antibacterial properties by inhibiting microbial growth and reproduction, often through disrupting cell membranes or targeting intracellular components. Moreover, their biocompatibility and biodegradability *in vivo* make them an attractive and promising alternative to synthetic chemical preservatives. In this work the antimicrobial peptide AB10 (AMPAB10) with chemical formula C₁₅₃H₂₅₉N₃₃O₂₉ (Mw = 3024.89 Da) was designed based on snake venom proteins. The microdilution method was used to define minimum inhibitory concentrations (MICs) of AMPAB10 against *Escherichia coli* ATCC 10536, *Klebsiella pneumoniae* ATCC 13883, *Shigella flexnerii* ATCC 12022, *Pseudomonas aeruginosa* ATCC 15442, *Salmonella enterica* ATCC 12325 and *Listeria monocytogenes* SID 2249. The results indicate a high antibacterial activity (> 6 µg/ml) against *E. coli*, *K. pneumoniae*, *S. flexnerii* and *L. monocytogenes*, average activity (93.75 µg/ml) against *S. enterica*, and rather low properties (187.50 µg/ml) against *P. aeruginosa*. AMPAB10 demonstrates activity against common foodborne pathogens, making it a promising food additive capable of preventing microbial growth in various products. A key advantage of this peptide is its susceptibility to digestion within the human gastrointestinal tract after consumption, ensuring high safety for the consumer. This innovative approach to food preservation offers a unique and safe solution for enhancing food quality and safety.

Keywords: antimicrobial peptides, MIC, food preservation

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Platinum nanoparticles affect the motility and viability of rabbit spermatozoa *in vitro*

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The use of nanoparticles (NPs) in various industries and technologies is becoming more common. A question about the potential negative or positive effects of NPs on living organisms remains unanswered. Although NPs can enhance many existing processes, several studies have highlighted the potential harmful effects of NPs on cells and organisms. Our study, therefore, aims to examine the effect of platinum nanoparticles (Pt NPs) on rabbit spermatozoa *in vitro*. In the experiments, selected Pt NP concentrations (1, 30, 250, and 500 µg/mL) were used. Ejaculates were diluted 1:9 with Pt NPs dispersions and exposed for 4 hours at 37°C. Spermatozoa motility was analyzed using the CASA system at time intervals of 0, 2, and 4 hours. At the 4-hour final time point, mitochondrial activity was measured using a mitochondrial toxicity test (MTT), and ProAKAP4 protein levels were assessed with the ELISA method. After 4 hours, spermatozoa motility was negatively affected by the rising concentration of Pt NPs (30, 250, 500 µg/mL ($p < 0,0001$)). Mitochondrial activity was significantly reduced at Pt NPs concentrations of 250 and 500 µg/mL ($p < 0,0001$). ProAKAP4 protein levels, a marker of spermatozoa motility and viability, gradually decreased with increasing Pt NPs concentration (250 µg/mL ($p < 0,05$); 500 µg/mL ($p < 0,01$)), indicating a negative effect on spermatozoa motility and fertilization ability at the molecular level. The impact of nanoparticles on living organisms and the environment remains poorly understood, despite their numerous advantages. Due to their small size and ability to cross biological barriers, nanoparticles pose a significant risk of ecosystem contamination, making it important to understand their mechanisms of action and potential effects on living organisms at the cellular level.

Keywords: nanoparticles, platinum, sperm, motility, mitochondrial activity, toxicity, viability, ProAKAP4

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Comparative evaluation of calcium L-threonate enrichment of probiotic cow and goat milk acid-rennet cheese

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Functional dairy products enriched with minerals and probiotic cultures are of growing interest in food technology and nutrition. This study evaluates the effects of calcium L-threonate supplementation (10 and 20 mg Ca 100 g⁻¹) on the physicochemical, microbiological, and sensory properties of probiotic acid-rennet cheese from cow and goat milk fermented with *Lactobacillus acidophilus* LA-5[®].

Cow and goat milk was supplemented with calcium L-threonate (0, 10, or 20 mg Ca 100 g⁻¹), heat-treated (72°C, 15 sec), inoculated with *L. acidophilus* LA-5[®] starter culture (2% w/w) and rennet (0.2 % w/w), and coagulated at 33 °C to pH 4.60. The resulting curd was cut, drained, homogenized, and refrigerated for 24 h before analysis. Analyses comprised pH, titratable acidity (°SH), color (CIELab), syneresis, and viable probiotic counts. A trained panel assessed appearance, texture, taste, and odor of cheese.

Calcium L-threonate did not alter cheese color. Supplementation induced a dose-dependent decrease in post-fermentation pH (from 4.62 to 4.51–4.50) and titratable acidity, while significantly reducing syneresis ($p \leq 0.05$). Viable *L. acidophilus* counts remained $\geq 10^9$ CFU g⁻¹ in the control and 10 mg Ca treatments; the 20 mg Ca batch registered 8.92 log CFU g⁻¹. Organoleptic evaluation indicated no adverse impact on overall acceptability, texture, or odor of all cheese samples.

The addition of calcium L-threonate at 10 mg Ca per 100 g of milk prior to coagulation resulted in a significant reduction of syneresis (particularly in goat-milk cheese), while maintaining *L. acidophilus* viability above 9.03 log CFU g⁻¹ and exerting no adverse effects on organoleptic parameters.

Keywords: calcium L-threonate, probiotic cheese, *Lactobacillus acidophilus* LA-5[®], physicochemical properties, organoleptic evaluation

The contamination of rapeseed honey by pesticide residues and polycyclic aromatic hydrocarbons

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Rapeseed honey, while a popular monofloral honey, can be susceptible to pesticide contamination due to the extensive use of pesticides in oilseed rape cultivation. On the other hand, due to the presence of fatty acids it can absorb hydrophobic polycyclic aromatic hydrocarbons (PAHs) occurred as environmental pollutants. The aim of the study was to assess the safety of rapeseed honey in terms of pesticide and PAH content. The study included 15 samples of rapeseed honey originated directly from apiaries of Podkarpackie (5) and Lublin (5) provinces as well as available on the local market (5). Honey samples were prepared by extraction using the QUECHERS method and then analysed by GC-MS technique. The analysis was conducted in the selected ion monitoring mode (SIM) based on the quantitative ions. The 58 pesticides belonging to various groups (carbamates, organophosphorus, organochlorines, pyrethroids and neonicotinoids) were analysed. None of these compounds were detected in the honey samples tested, which proves their purity. In turn, among 20 PAHs analysed, only 7 (naphthalene, 2-methylnaphthalene, 1-methylnaphthalene, acenaphthene, fluorene, phenanthrene and fluoranthene) were detected. However, any of four major harmful PAHs (PAH4) legally limited in food (benz[a]anthracene, chrysene, benzo[b]fluoranthene and benzo[a]pyrene) were identified. The most common was phenanthrene, present in each sample (from 12.6 to 97.7 µg/kg). Interestingly, the lowest average PAHs content was found in commercially available samples (63.4 µg/kg), which indicates their good quality. The study confirmed the high quality and safety of rapeseed honey produced in South-Eastern Poland which can confirm both proper use of pesticides in rapeseed cultivation and cleanliness of the bees' habitat in terms of PAHs pollution.

Keywords: honey, rapeseed, pesticides, PAHs, GC-MS

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Effect of storage temperature on the shelf-life of Golden Delicious apples from a consumer perspective

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Preserving the quality of fresh fruit is of primary importance not only for producers and distributors, but also for the final consumer. Consumers expect fruit stored at home to remain fresh, aesthetic and enjoyable for a long time. The aim of this research was to investigate how storage temperature and humidity affect the weight loss of one of the most popular apple varieties, Golden Delicious, and thus indirectly its quality and shelf life. The tests were carried out in a laboratory environment, in a darkroom, to measure the effect of storage conditions only. The apples were stored at different temperatures (3, 5, 10, 15 and 24 °C) and at typical relative humidity for nine weeks. Weight loss, which is a good indicator of water content loss, was measured weekly. The smallest weight loss was observed in samples stored at 3-5 °C, while a rapid and spectacular deterioration was observed in fruit stored at 15 and especially 24 °C. The results show that a difference of just a few degrees can have a significant impact on the shelf life of apples and directly affect the consumer's perception of the freshness of the fruit days or weeks after purchase. The research shows that refrigerated storage is not only important at the industrial level: refrigeration habits and conditions at home also have a decisive influence on the suitability of the fruit for consumption. This knowledge can help consumers to be more aware of home storage, reduce food waste and enjoy the natural quality of fruit for longer.

Keywords: Golden Delicious, post-harvest, consumer storage, quality preservation

House cricket flour for the food application as a source of histamine and risk elements

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House cricket flour is a high-protein, gluten-free product made from ground crickets. It has become increasingly popular as a sustainable gluten-free alternative to traditional flours. From the point of view of food safety, there can be several risk components present in the crickets. Biogenic amines are compounds that can be found in a variety of foods, including some insect species. We focused on occurrence of histamine content and selected risk elements such as lead, cadmium, arsenic and aluminum in the flour (powder) made from the house crickets, which were grown under the controlled conditions. House crickets were fed by soya and wheat flour until they gained 1.5 cm of the body length. After their slaughter and processing into the cricket powder, they were analyzed for selected risk element and histamine content. Optimized HPLC-DAD method for determination of histamine was applied. For composition of risk elements, sample preparation was treated by mineral decomposition and sample analysis was performed by ICP-OES instrument (Agilent Technologies). Histamine can be a concern in insect-based foods like house crickets, as it can cause allergic reactions and other health adverse effects in people who are sensitive to it. Mean content of histamine in the cricket flour was 3.11 ± 0.06 mg.kg⁻¹. Content of lead was determined to be in the amount 0.39 ± 0.21 mg.kg⁻¹ DW, arsenic 0.53 ± 0.29 mg.kg⁻¹ DW, aluminum 40.59 ± 1.06 mg.kg⁻¹ DW. Cadmium was not detected. Proper storage and handling of house crickets is important to prevent the growth of bacteria and the accumulation of biogenic amines to minimize the risk of high biogenic amine levels in such food source. It is important to monitor the quality of the feed used for cricket house in the sense of risk element content as well, following our case, where higher aluminum content was detected.

Keywords: house crickets, biogenic amines, food safety, lead, aluminum, cadmium

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Dual role of air quality in the food chain – PM10 and PM2.5 monitoring in small towns of pest county, Hungary

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Air quality is influenced by numerous factors, several of which are directly linked to processes within the food chain. These include dust and ammonia emissions from agricultural practices, energy demand associated with thermal processing, odour and air pollutant emissions during food production, and gases released through the fermentation of food waste. Conversely, air quality also affects production: suspended and deposited particulate matter not only poses a risk to human health but can also impair the respiratory functions of plants and animals. In our research, we conducted continuous monitoring of PM10 and PM2.5 concentrations in three small towns in Pest County – Gödöllő, Isaszeg and Pécel – alongside basic meteorological parameters. These towns are not considered major industrial emission sources and do not have official air quality monitoring stations under the Hungarian National Air Quality Network. The primary contributors to local air quality were found to be road traffic, residential heating, and transboundary pollution from Budapest, transported by the prevailing north-westerly winds. The aim of our study was to determine the extent and variability of air quality fluctuations in a suburban environment and to assess how much these can be attributed to local versus regional sources. Special attention was given to how changes in heating technologies – such as shifts from gas boilers to biomass or heat pump systems – may have a measurable long-term impact on particulate concentrations. The use of low-cost sensor technology proved effective in detecting short- and medium-term trends and may support the assessment of air quality as a risk factor within the food chain.

Keywords: air quality, PM10, PM2.5, suburban environment, low-cost sensors, environmental monitoring

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Phytochemical profiling of microgreen *Brassica oleracea* L. and potential perspectives in the elimination of chronic diseases

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Microgreens are rich in beneficial compounds such as glucosinolates, vitamins, and antioxidants that have potential health benefits by reducing the risk of chronic diseases such as cancer, cardiovascular disease, and diabetes. Therefore, the aim of our work was to perform phytochemical profiling of microgreens of the vegetable cabbage *Brassica oleracea* L. The total polyphenols, flavonoids, and phenolic acids in the experimental extract of microgreen were estimated, as follows. According to the Folin-Ciocalteu method, the total polyphenols content was 25.13 ± 2.84 mg GAE/g dry weight (d.w.). Further investigations of total flavonoid content confirmed 29.55 ± 0.89 mg QE/g d.w. In relation to total phenolic acids content evaluation, 24.45 ± 1.51 mg CAE/g d.w. was recorded. Moreover, HPLC-DAD analysis was used as a proper method for the identification and quantification of polyphenols in *Brassica oleracea* L. extract. Identification of monitored elements was carried out by comparing retention times and UV spectra. From the analysis of phenolic compounds, cryptochlorogenic acid (3257.13 ± 6.19 mg/kg) and chlorogenic acid (3122.95 ± 3.94 mg/kg) were the most available in large quantities molecules in the *Brassica oleracea* L. microgreen extract. Additionally, neochlorogenic acid (26.15 ± 0.28 mg/kg), was also detected. The obtained results regarding the content of polyphenols, flavonoids and phenolic acids in microgreen *Brassica oleracea* L. confirm the high content of bioactive compounds, which suggests their health potential, especially in the context of anti-inflammatory, antioxidant and anticancer effects.

Keywords: microgreen, polyphenols, flavonoids, phenolic acids

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Comparative analysis of antiviral and antibacterial properties of Polish Fir Honeydew and Manuka honeys

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The objective of this study was to evaluate and compare the antiviral and antibacterial properties of honeydew honey derived from coniferous trees in the Podkarpackie region of Poland (12 samples) and commercially available Manuka honey with varying methylglyoxal (MGO) concentrations (100, 250, 400, and >550 mg/kg). The botanical origin of the Manuka honey was confirmed through melissopalynological analysis. Antiviral activity was assessed using the double-layer phage assay with RNA (phi6, MS2) and DNA (T7, phiX174) bacteriophages as viral surrogates. Antibacterial properties were evaluated by determining the Minimum Inhibitory Concentration (MIC) and Minimum Bactericidal Concentration (MBC) against Gram-positive (*Staphylococcus aureus*, *Bacillus cereus*) and Gram-negative (*Escherichia coli*, *Salmonella enterica*) bacteria. The strongest antiviral effects were observed against phi6 virus, used as a model for enveloped RNA viruses, such as SARS-CoV-2. Manuka honey samples with higher MGO content (400 and >550 mg/kg) showed significantly greater viral reduction than honey with lower MGO, although several honeydew honey samples demonstrated comparable or even superior antiviral activity. MS2 viral inhibition was notably stronger in honeydew honey than in Manuka honey. Bacteriophage phiX174 (non-enveloped DNA virus) was the most resistant, both honey types achieved up to 2-log reductions in viral titers. Honeydew honey exhibited strong antibacterial activity, particularly against Gram-positive strains, with mean MIC values of 20.5% for *S. aureus* and 21.0% for *B. cereus*. *E. coli* was the most resistant strain (mean MIC = 22.5%). Manuka honey showed the highest antibacterial potential against *S. aureus* (MIC range: 8–15%, mean = 10.25%), with efficacy strongly correlated to MGO content. However, its activity against *E. coli* was lower (mean MIC = 16.25%). MBC values were generally higher than MIC values, with the highest MBC observed for *B. cereus*. These findings demonstrate that honeydew honey from the Podkarpackie region possesses significant antiviral and antibacterial properties, often comparable to those of high-grade Manuka honey, highlighting its potential as a natural antimicrobial agent.

Keywords: honeydew honey, Manuka honey, antiviral, antibacterial

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Plastic threat to male fertility: Investigating the impact of nanoplastics on Leydig cells

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In recent years, growing attention has been paid to the toxicological effects of micro- and nanoplastics (MNPs) on living organisms. Particularly concerning is their potential to interfere with reproductive function via endocrine disruption. Leydig cells, as key regulators of testosterone synthesis in the testes, are especially sensitive to environmental pollutants. In this study, we investigated the cytotoxic and oxidative effects of carboxylated polystyrene nanoplastics (PS-NPs, 0.03 μm) on TM3 mouse Leydig cells. The cells were exposed to increasing concentrations of PS-NPs (1, 10, 50, 100, and 200 $\mu\text{g}/\text{mL}$) for 24 hours, followed by evaluation of cytotoxicity (MTT assay and Alamar Blue test), oxidative stress (NBT test) and steroidogenesis (ELISA). MTT as test of cell viability and cytotoxicity demonstrated reduced mitochondrial activity at 100 $\mu\text{g}/\text{mL}$ ($p < 0.05$), and a highly significant decrease at 200 $\mu\text{g}/\text{mL}$ ($p < 0.001$), indicating compromised mitochondrial function and overall cytotoxicity of tested nanoplastics. Similarly, Alamar Blue results showed a significant decline in cell metabolic activity beginning at 50 $\mu\text{g}/\text{mL}$ ($p < 0.05$), with more pronounced effects at 100 and 200 $\mu\text{g}/\text{mL}$ ($p < 0.01$) after 24 h of exposure to plastic nanoparticles. The NBT assay, which detects intracellular superoxide radical production, revealed a statistically significant increase in ROS levels at lower concentrations (1 and 10 $\mu\text{g}/\text{mL}$; $p < 0.01$, and 50 $\mu\text{g}/\text{mL}$; $p < 0.05$), suggesting that PS-NPs induce oxidative stress even at relatively low doses despite slightly reduced cell viability in these experimental groups compared to the control. Importantly, testosterone production was significantly decreased even at the lowest tested concentration - 1 $\mu\text{g}/\text{mL}$ ($p < 0.05$), with further declines observed at 10, 50, and 100 $\mu\text{g}/\text{mL}$ ($p < 0.01$) and reaching a highly significant decrease at 200 $\mu\text{g}/\text{mL}$ ($p < 0.001$). These findings indicate that PS-NPs not only impair cell viability and induce oxidative stress but also disrupt steroidogenic function at concentrations relevant to environmental exposure. The observed cellular response raises concerns about the environmental presence of PS-NPs and their potential impact on male reproductive health. Further studies are needed to elucidate the molecular mechanisms underlying these effects.

Keywords: polystyrene nanoplastics, Leydig cells, cell viability, steroidogenesis, oxidative stress

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Integrated photovoltaic thermal systems for safer and more efficient food processing

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In this study, we explore a practical approach to enhancing both the thermal and electrical performance of photovoltaic (PV) systems, with a specific focus on their potential application in food production facilities. Reliable energy is a cornerstone of the food chain. Hot water and electricity are not only essential for daily operations but also for maintaining safety standards. For instance, water temperature is a recognised Critical Control Point (CCP) in many food safety procedures. Our work combines hands-on experiments with advanced modelling to fine-tune the performance of PV systems under real-world conditions. We focus on key factors, such as managing low inlet temperatures and optimising flow rates, to improve heat transfer efficiency. We also investigate the use of nanofluids as promising coolants, carefully analysing how their properties affect performance, from the type of nanoparticles used to the concentration of surfactants and fluid composition. Additionally, we examine how panel orientation and continuous thermal monitoring can facilitate stable and energy-efficient processes, particularly in food industry settings where maintaining consistent temperatures is crucial. To support these efforts, we've developed a hybrid model that predicts how PV panels will behave under different weather and operating conditions, helping guide smarter system design.

Keywords: photovoltaic cooling, nanofluids, hybrid modelling, heat transfer enhancement, thermal management

**Temperature-copper interaction and its impact on oxidative biomarkers in grass carp
(*Ctenopharyngodon idella*): *in situ* study**

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This study investigated the combined effect of water temperature and copper concentration on oxidative stress in grass carp (*Ctenopharyngodon idella*). Oxidative stress was gauged by the levels of protein carbonyls (PC; nmol/mg TP), a pivotal indicator of oxidative damage. The study was conducted *in situ* over a six-month period (April–November) on blood samples collected from 37 individuals of different sexes. The water temperature ranged from 13.7 to 26.4°C, while the copper concentration in the blood ranged from 0.46 to 2.52 ppm. Blood copper concentrations were analysed by inductively coupled plasma optical emission spectrometry (ICP-OES), and water temperature was measured directly at the sampling site using digital thermometers with an accuracy of ± 0.1 °C. Protein carbonyl levels were determined spectrophotometrically after derivatization with 2,4-dinitrophenylhydrazine (DNPH), and the resulting absorbance was measured at 370 nm. GraphPad Prism 8.1 software was used for statistical evaluation of the data. Despite the substantial range of temperatures and copper concentrations examined, no statistically significant differences in PC levels were observed among the various groups. Additionally, no discernible trend was identified that would suggest an influence by the interplay of these factors on the oxidative stress. The levels of PC varied from 0.52 to 11.31 nmol/mg TP, with no substantial changes attributable to temperature or copper concentration variations. The absence of statistically significant results may be attributable to several factors, including low sample variability, limited number of individuals, or the matrix used, which may be less sensitive to oxidative changes. Conversely, it is plausible that the environmental factors examined do not, in fact, impose a substantial burden on *C. idella* within the prevailing conditions.

Keywords: *in situ*, grass carp, oxidative stress, trace elements, copper

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Expression and localization of vitamin D3 receptors and metabolic enzymes in tissues of the reproductive system of hens

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Besides the main role in calcium and phosphorus homeostasis, vitamin D3 has been revealed as an important regulator of the female reproductive processes in humans and animals; however, its role in the reproductive system of birds is poorly known. This study aimed to examine vitamin D3 receptor (VDR and PDIA3) and metabolic enzyme (1 α -hydroxylase and 24-hydroxylase) mRNA transcript and protein abundances, and protein localization within the ovary, oviductal shell gland, pituitary, liver, and kidney of laying hens. We showed the patterns of the relative mRNA and protein abundances of examined molecules in the ovary, in relation to follicle development, as well as in other examined structures. Immunohistochemically, PDIA3, 1 α -hydroxylase, and 24-hydroxylase were localized in the pituitary, follicular theca and granulosa layers, and luminal epithelium and tubular glands of the shell gland. In addition, these proteins were localized in the liver and kidney. Our results indicate that tissues of the reproductive system have both receptors, VDR, mainly involved in genomic action, and PDIA3, probably involved in the rapid, non-genomic effect of vitamin D3. The finding of 1 α -hydroxylase and 24-hydroxylase expression at mRNA and protein levels indicates that the reproductive system of hens has the potential for vitamin D3 synthesis and inactivation, and may suggest that locally produced vitamin D3 can be considered as an important factor in the regulation of ovarian and shell gland function in female chickens. These results provide a new insight into the possible mechanisms of vitamin D3 action and metabolism in the avian reproductive system.

Keywords: vitamin D3 metabolism, VDR, PDIA3, reproductive system, birds

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Non-invasive methods for enhancing microbiological and chemical safety of food

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The increasing consumer demand for safe, chemical-free food necessitates the development of non-invasive technologies that enhance both microbiological and chemical safety. This work reviews and synthesizes recent pioneering strategies—including continuous ozonation with UV-C, cyclic ozone treatments, and combinatorial ozone-toxin removal systems—that aim to reduce microbial burden, limit pesticide residues, and preserve bioactive quality in perishable plant-based products. A novel continuous post-harvest treatment of cranberries with simultaneous ozonation and UV-C irradiation resulted in a 3.4 log CFU/g reduction of fermentation bacteria, shelf-life extension under cold storage, reduced water loss, and decreased mass losses by approximately 5% compared to controls. In raspberry production, real-time ozone exposure led to a microbial load reduction of around 2 log CFU/g, stimulated low molecular mass antioxidant synthesis with an increase in total polyphenols of over 20%, and enabled a 25% reduction in fungicide applications without compromising plant health. Daily post-harvest ozone exposures of saskatoon berries improved antioxidant potential, increased vitamin C and polyphenol content in early storage, mitigated water and bioactive compound losses during later stages, inhibited microbial growth on the fruit surface, and significantly reduced storage losses. These non-invasive strategies effectively suppress microbial contamination and support chemical safety by reducing reliance on synthetic fungicides or chemical preservatives. Moreover, they preserve or enhance nutritional and sensory attributes, thereby aligning with sustainability goals and consumer expectations for 'clean-label' produce. Non-invasive technologies such as continuous ozonation coupled with UV-C, cyclic ozone treatments, and ozone-based preservation regimes offer robust, sustainable means to elevate food safety — both microbiological and chemical — while promoting quality retention. Future implementations should focus on optimizing treatment parameters tailored to specific commodities, integrating cost-benefit analyses, and ensuring scalability from pilot to commercial operations.

Keywords: fruit, preservation, ozone, UV-C irradiation, microbial reduction, fungicide reduction, antioxidant retention

Application of redox potential in water quality assessment: Investigation of temperature dependence and related parameters

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Rapid determination of water quality facilitates regulatory tasks and inspections in a number of technologies (food industry, swimming pool technology, wastewater treatment). Parameters that can be used for rapid determination include dissolved oxygen, pH value, and redox potential (ORP)-based classification. The use of the latter—which is essentially knowledge of the degree of oxidation-reduction capacity—is a widely used method despite the many uncertainties associated with the multitude of parameters influencing the redox potential value and their synergistic effects. In our research, we attempted to replace the monitoring of free chlorine content used for disinfection purposes with redox potential measurement, while simultaneously measuring the temperature and pH of the water. In addition to these automatically measured values, conductivity, dissolved oxygen (DO) and Ca concentration were also examined. We determined the correlation between the parameters and sought to establish a more accurate mathematical model between the two parameters than had been previously available. We set up our measuring system at the Szent István Campus of the Hungarian University of Agricultural and Life Sciences with an automatic, temperature-controlled recirculation system suitable for continuous data collection. Previous studies have confirmed that increasing the temperature increased the conductivity of the water, while the amount of dissolved oxygen decreased. For example, at 15 °C, the DO value was 8.9 mg/l, while at 35 °C it was only 8.07 mg/l. Conductivity increased from 2.46 mS/cm to 2.61 mS/cm. In contrast, the redox potential (ORP) remained relatively stable. The pH value also increased in parallel with the rise in temperature. We examined the applicability of redox potential by means of correlation analysis with other parameters determining water quality. Based on our results, redox potential alone is not a sufficient indicator, but when used in combination with other physical and chemical parameters, it can be a valuable tool for the rapid and effective assessment of water quality.

Keywords: water quality, redox potential, temperature, dissolved oxygen, conductivity

Current issues of communal sewage sludge utilization in Hungary

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The utilization of communal sewage sludge is a particularly important task nowadays. Among the possible utilization technologies, we find the fermentation (anaerobic digestion) or co-fermentation with other organic waste, thereby we can produce renewable energy, biogas. A particularly important utilization option is composting or vermicomposting, as a result of which we can produce compost or vermicompost, a soil replenishing force with a high organic matter and nutrients content. In the case of agricultural utilization, proper chemical testing of the sludge compost is essential. It is particularly important to test for potential toxic elements and organic micropollutants, which are decisive for the subsequent agricultural utilization of the sludge. The removal of organic micropollutants from wastewater is a very important task according to EU Directive 2024/3019, but testing micropollutants from wastewater is not enough. The analytical investigations should also extend to sewage sludge, as it is assumed that many pharmaceutical residues and their degradation products are concentrated in communal sewage sludge, so these degradation products may cause potential hazards in the event of subsequent agricultural utilization. In our material, we summarize the possibilities of municipal sewage sludge utilization in Hungary, highlighting vermicomposting. We briefly summarize our laboratory, pilot-scale and industrial-scale vermicomposting results.

Keywords: communal sewage sludge utilization, potential toxic elements, micropollutants, EU Directive 2024/3019

Impact of propolis and the combination of propolis with polycyclic aromatic hydrocarbons on apoptosis and necrosis in hen ovarian follicle granulosa cells

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Polycyclic aromatic hydrocarbons (PAHs) are mutagenic, carcinogenic, teratogenic, and immunotoxic to living organisms. Propolis, a natural bee product with antioxidant properties, may offer protective effects against the action of PAHs. This study investigated the cytoprotective potential of two distinct propolis extracts: P2, exhibiting lower, and P3, exhibiting higher antioxidant capacity in granulosa cells (GCs) derived from preovulatory ovarian follicles of laying hens. Primary GCs were isolated from the chicken preovulatory follicles (F2) and cultured for 24 h, then exposed for next 24 h to mixture of PAHs (MIX 4) alone or in combination with P2 or P3 at concentrations of 0.04, 0.08, and 0.2 mg/ml. MIX 4 contained the mixture of PAHs in concentration found in egg yolks of hens receiving a mixture of 16 PAHs for 28 days. Cytotoxicity and apoptosis were assessed using the RealTime-Glo™ Annexin V Apoptosis and Necrosis Assay (Promega), measuring both luminescence (apoptosis) and fluorescence (necrosis). Both P2 and P3 promoted apoptosis in a dose-dependent manner. Interestingly, the highest dose of P3 (0.2 mg/ml) did not increase apoptosis compared to the control. Exposure to MIX 4 induced moderate apoptosis. Treatment with propolis extracts in combination with MIX 4 enhanced apoptosis, particularly extract P3, which possess higher antioxidant capacity than P2 sample. Importantly, none of the treatments caused a substantial increase in fluorescence, indicating no induction of necrosis. These results suggest that propolis extracts, particularly P3 may exert a dual modulatory role in response to PAHs-induced stress: (i) enhancing controlled apoptosis of damaged cells, (ii) possibly protecting healthy cells through antioxidant mechanisms at higher concentrations.

Keywords: apoptosis, propolis, PAHs, granulosa cells, chicken

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Phytogenic feed additives in poultry nutrition: A sustainable alternative to antibiotic growth promoters

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The use of phytogenic feed additives, especially medicinal herbs and their derivatives, is becoming increasingly important in poultry nutrition as a natural and sustainable alternative to antibiotic growth promoters. This trend reflects the growing global concern about antimicrobial resistance and the demand for safer, residue-free animal products. Herbs such as *Origanum vulgare*, *Thymus vulgaris*, *Salvia officinalis*, *Mentha piperita*, *Allium sativum* and *Curcuma longa* are rich in bioactive compounds — including essential oils, polyphenols, flavonoids and tannins — that exhibit a broad spectrum of biological activities. These phytochemicals have been shown to have antimicrobial, antioxidant, anti-inflammatory, hepatoprotective and immunomodulatory effects. When included in poultry diets, they contribute to improved gut health by modulating intestinal microflora, stimulating digestive secretions and improving nutrient digestibility. In addition, numerous studies have reported positive effects on growth performance, feed conversion ratio and carcass quality, as well as on the oxidative stability and nutritional profile of poultry products - by lowering cholesterol levels and enriching omega-3 fatty acids. Herbal additives can be administered in various forms — dried plant material, aqueous or alcoholic extracts or essential oils - usually at a level of 0.5% to 2% of dietary dry matter. Essential oils are used in much lower concentrations due to their high potency. However, the efficacy and safety of herbal supplementation depends on numerous factors, such as standardization of phytochemical content, interactions with other dietary components, bird species and age, and potential toxicity from excessive dosing. Despite these challenges, phytogenic feed additives represent a promising tool to promote poultry health, improve production efficiency and support antibiotic-free farming systems. Future research should aim to optimize formulations, elucidate mechanisms of action and ensure consistent quality and efficacy under commercial conditions.

Keywords: phytogenic feed additives, poultry, nutrition

Effect of medicinal mushroom extracts on the quality of rice flour-based pasta

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The number of individuals dependent on a gluten-free diet is steadily increasing, leading to a growing demand for nutritionally valuable and sensorially appealing gluten-free food products. The aim of this study was to develop gluten-free pasta based on rice flour enriched with 15% shiitake (*Lentinula edodes*) extract and 5% maitake (*Grifola frondosa*) extract, and to evaluate their technological and sensory properties. The following analytical methods were employed: determination of crude protein content using the Kjeldahl method; analysis of ash and moisture content; and spectrophotometric determination of antioxidant activity (AA) using the DPPH radical, expressed as Trolox Equivalent Antioxidant Capacity (TEAC, mg/g dry matter), as well as total polyphenol content (TPC) using the Folin–Ciocalteu reagent, expressed as gallic acid equivalents (mg/g dry matter). Sensory evaluation was conducted by a panel of 12 trained assessors using a 9-point hedonic scale. The lowest crude protein content was observed in egg-free pasta with maitake extract (4.66%), while the highest was found in egg-based pasta with 15% shiitake extract (8.89%). The addition of mushroom extracts increased the ash content from 6.51% (control sample) to 8.89% (egg pasta with shiitake). The highest antioxidant activity ($p < 0.0001$) was recorded in the sample with 5% maitake extract (3.703 ± 0.230 mg/g), while the lowest was observed in the control egg-free sample (2.200 ± 0.051 mg/g). The total polyphenol content ranged from 1.796 ± 0.432 mg/g (control egg-free) to 2.865 ± 0.607 mg/g (control egg-based pasta). In terms of sensory acceptance, the highest overall rating was achieved by egg pasta enriched with 15% shiitake and 5% maitake extracts. The findings of this study highlight the potential of mushrooms as functional ingredients in gluten-free products, contributing to the diversification of the product range and the promotion of consumer health.

Keywords: rice flour, mushroom extracts, shiitake, maitake, pasta, antioxidant activity, sensory evaluation

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Cardiometabolic benefits of a phytonutrient-rich sea buckthorn juice in hypercholesterolemic women

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Lifestyle and dietary changes are key strategies for preventing cardiovascular diseases, which are currently the primary cause of death in Europe and worldwide. Increased attention in nutritional science is focused on phytonutrients - natural bioactive compounds from plants that perform specific biological activities and modify physiological functions to improve human health. The purpose of this study was to investigate whether 8-week intervention with 100% sea buckthorn juice could modulate the lipid profile, antioxidant status, and body composition in hypercholesterolemic women. A group of 18 hypercholesterolemic non-medicated adult women with a mean age of 54.10 ± 2.88 years, consumed 50 mL of sea buckthorn juice daily for 8 weeks. Anthropometric and biochemical parameters were monitored before and after 8 weeks of consumption of sea buckthorn juice. The intervention significantly increased the level of high-density lipoprotein (HDL; $p < 0.001$) and improved LDL/HDL ratio ($p < 0.001$). Serum malondialdehyde (MDA) production decreased ($p < 0.001$), activity of glutathione peroxidase (GPx) significantly increased ($p < 0.001$), and total antioxidant capacity (TAC) of the serum was not significantly increased ($p > 0.05$). After sea buckthorn juice consumption, significant reduction of C-reactive protein (CRP; $p < 0.01$) and orosomucoid (ORM; $p < 0.001$) were observed. Regarding anthropometric parameters, the intervention resulted in a significant decrease of visceral fat (VFA; $p < 0.01$), body fat (BFM; $p < 0.001$) and increase of fat free mass (FFM; $p < 0.01$). The results suggest a potential beneficial effect of sea buckthorn juice on body composition, blood lipids, inflammation and antioxidant status in hypercholesterolemic women.

Keywords: sea buckthorn juice, phytonutrients, antioxidants, nutritional and health parameters, cardiovascular diseases

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Organoleptic properties of ice cream with fiber

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Dietary fiber plays a pivotal role in health maintenance by modulating carbohydrate and lipid metabolism and fostering the growth of beneficial gut microbiota. Its incorporation into food products not only enhances nutritional value but also positively influences technological functionality and sensory characteristics of ice cream. Inulin, a soluble dietary fiber, increases viscosity, refines microstructure, limits ice crystal growth, and prolongs melting time. It may also partially replace fat without detriment to texture or mouthfeel. The objective of this work was to compare the organoleptic properties of sheepmilk ice creams fortified with 4 % inulin versus 4 % apple fiber preparation. A twenty member trained panel performed sensory profiling using a 9 point linear scale with anchored endpoints. The left anchor denoted: poorly defined appearance, graininess (low smoothness), softness (low firmness), rapid melting, dark color, and low-intensity taste and odor; the right anchor corresponded to: highly distinctive appearance, high firmness, great smoothness, delayed melting, light color, and intense taste and odor. Samples were coded with random three digit numbers. Statistical processing (mean values and standard deviations) was conducted in Statistica v. 13.1 (StatSoft, Tulsa, OK, USA). One way analysis of variance was applied, and differences between means were evaluated by Tukey's test ($p \leq 0.05$). Ice creams containing inulin demonstrated enhanced smoothness and firmness, as well as the longest melting times. Despite equivalent sucrose levels, the inulin enriched samples were judged sweetest and demonstrated a more homogeneous, creamy consistency compared to those with apple fiber. Conversely, sheep milk ice cream with apple fiber exhibited a darker, redder hue, reduced smoothness, and increased graininess relative to the inulin formulation. These results indicate that inulin exerts a more favorable effect on the organoleptic quality of sheep milk ice cream than the apple fiber preparation.

Keywords: ice cream, dietary fiber, inulin, organoleptic characteristics

Effect of polycyclic aromatic hydrocarbon administration on the concentration of steroid hormones in blood plasma of the domestic hen

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Polycyclic aromatic hydrocarbons (PAHs) are endocrine-disrupting chemicals classified as Persistent Organic Pollutants. They are mainly formed during the incomplete combustion of organic matter, occurring both naturally (e.g., forest fires) and through human activities such as industrial processes or vehicle emissions. In the environment, PAHs typically appear as complex mixtures. This study was designed to examine how a mixture of 16 different PAHs - including 16 representative PAHs such as naphthalene, phenanthrene, pyrene, benzo[a]pyrene, and others - affects the concentrations of sex steroid hormones, specifically progesterone (P4), testosterone (T), and estradiol (E2), in the blood plasma of laying hens. For the experiment, 24 Bovans hens aged 70 weeks were divided into three groups of eight birds each. The control group received dichloromethane at a concentration of 0.1% (used as the PAH solvent), while the two experimental groups were given PAH mixtures at either a higher (MIX I) or lower (MIX II) concentration. The PAH doses were chosen based on the levels found in egg yolks from free-range hens (for MIX I) and caged hens (for MIX II). The compounds were administered per os to the hens over a period of 28 days. Blood samples were collected at the start of the experiment and then on days 7, 14, 21, and 28. The concentrations of P4, T, and E2 in the blood plasma were determined by the RIA method using commercial kits. The results were statistically analyzed using Two-Way Repeated Measures ANOVA, and the significance of differences between the means was checked by Tukey's test at $p < 0.05$. Results are presented as percentages relative to the values observed in the control group. Compared to the control group, MIX I reduced P4 concentration on the 28th day of the experiment by 45% ($p < 0.05$) as well as increased T levels on the 21st day of the experiment by 64% ($p < 0.05$). On the other hand, MIX II significantly increased E2 concentrations by 42% and 63% on the 14th and 21st days of the experiment, respectively ($p < 0.05$). The results indicate that the effect of PAHs on plasma sex steroids is strictly dose-dependent: higher doses (MIX I) increase T but decrease P4, whereas lower doses (MIX II) reduce T but elevate E2 concentrations. The observed hormonal disorders may directly lead to issues with fertility, egg quality and the overall reproductive condition of birds in environments contaminated with PAHs. An explanation of the mechanism of PAH influence on reproduction requires further research.

Keywords: Polycyclic aromatic hydrocarbons, steroid hormones, chicken

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Impact of polycyclic aromatic hydrocarbon mixtures on caspase activity in chicken ovarian epithelial cells

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Polycyclic aromatic hydrocarbons (PAHs) are common air pollutants which have mutagenic and cancerogenic properties. There are studies showing that exposure to these compounds may increase the risk of ovarian cancer. Most ovarian cancers have epithelial origin. Caspases, especially initiator caspases (e.g., caspase-8, -9) and executioner caspases (e.g., caspase-3, 6, 7), are crucial in eliminating damaged or abnormal cells, including potentially cancerous ones. Consequently, a change in caspase activity can indicate the likelihood of a tumour occurring. The first aim of these studies was to investigate the effect of PAH mixtures on the apoptotic process in ovarian epithelial cells. A second objective was to determine the roles of the aryl hydrocarbon receptor (AhR) in mediating caspase-dependent cell death induced by PAH mixtures. Experiments were conducted on 90-week-old Bovans laying hens (n = 12). Ovarian surface epithelial (OSE) cells were enzymatically isolated from small yellow follicles (8–12 mm) and seeded (50,000 cells/well) onto collagen I-coated 96-well plates. After 24 hours of attachment, cells were treated with 1 μ M α -naphthoflavone (AhR antagonist) for 2 hours, followed by exposure to four PAH mixtures for 24 or 72 hours. Caspase activity was assessed using luminescent assays. All PAH mixtures decreased caspase-8, caspase-9 and caspase-3/7 activity after 24 and 72 hours. AhR antagonist abolished the inhibitory effect of all PAH mixtures on caspase-8 after 24 hours and caspase-3 activity at both time points. This antagonist also eliminated inhibitory action of MIX I, MIX II and MIX IV after 24 hours on caspase-9 activity. While, adding MIX III for 24 hours to pre-treated with α -naphthoflavone OSE cells resulted in increased caspase-9 activity. Despite pre-incubation of OSE cells with α -naphthoflavone, all PAH mixtures decreased caspase-8 activity, while only MIX IV diminished caspase-9 activity after 72 hours. In conclusion, PAH mixtures decrease caspase activity, in chicken ovarian surface epithelial (OSE) cells, via AhR-dependent signalling pathways with the effect varying according to the specific PAH mixture and caspase type. The increase in caspase-9 activity following α -naphthoflavone pre-treatment and subsequent exposure to MIX III reinforces the role of AhR signaling in modulating this apoptotic pathway. However, the continued suppression of caspase-8 activity at 72 hours, despite AhR blockade, suggests the involvement of additional or more sustained regulatory mechanisms.

Keywords: PAH mixtures, caspase activity, AhR, OSE cells, hen

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Mercury concentrations in grey seal pups (*Halichoerus grypus*) undergoing rehabilitation in seal rescue center in Poland

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Mercury (Hg), a hazardous contaminant renowned for its environmental persistence, poses a considerable risk to marine ecosystems. It is a powerful neurotoxin that can affect marine mammals on both individual and population scales. Mercury in the marine environment can accumulate in individual species over time. Biomagnification elevates mercury levels higher up the food chain. As small prey organisms acquire mercury, their predators—including fish and marine mammals—consume it, resulting in much larger levels in their own bodies. Grey seals (*Halichoerus grypus*), as apex or near-apex predators, are particularly susceptible to this occurrence. Grey seals, impacted by mercury poisoning, can function as sentinel species and essential components of their coastal ecosystems. Especially vulnerable to this neurotoxin are young individuals. Hg can traverse the blood-brain barrier, resulting in neurological impairment and developmental dysfunction. Symptoms in seals may encompass confusion, diminished hunting efficacy, and modified social behaviors. Mercury can inhibit immunological function, rendering seals more vulnerable to infections and disease epidemics. Chronic exposure can result in harm to the kidneys and liver, which are tasked with filtering and storing mercury. Therefore, in this study we investigated the total Hg blood concentrations in grey seal pups which were found stranded along the Polish coast and brought to the Seal Rescue and Rehabilitation Center. Material from 32 grey seal pups and two ringed seal pups staying at the center in 2024 and from 6 grey seal pups undergoing rehabilitation at the center in 2023 were analyzed. A total of 97 whole blood samples were analyzed, as in most individuals the material came from two or three blood collections, at different stages of rehabilitation (the first collection – immediately after arrival at the center; the second collection – after approximately two weeks of stay at the center; the third collection – after another two or three weeks of stay after the second collection). The results were compared with the blood morphology and blood biochemistry to check the influence of Hg. The highest Hg concentrations found in seal pup blood was 2,746 µg/g while the lowest was 0,0125 µg/g. In most cases seal pups exhibited higher Hg concentrations at the admission to the seal rehabilitation center, which gradually decreased during rehabilitation. The Hg concentrations were found to be within similar range as previously noted in the seals from other studies in the Baltic Sea and the North Sea. Most of the concentrations found in this study were below the toxic threshold for Hg determined in pinniped blood, set at 0,2 µg/kg. Three grey seal pups (two males and one female) exhibited Hg concentrations above the threshold (>2 µg/kg), however they do not exhibit signs of toxicosis.

Nanometric dimensions, macroscopic effects: insights into the modulatory effects of different shapes of ZnO nanoparticles on the motility characteristics of bull spermatozoa under cold stress

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Zinc oxide nanoparticles (ZnO NPs) are considered a promising tool in reproductive biotechnology due to their antioxidant, anti-inflammatory and protective properties. In recent years, increasing attention has been focused on their potential to protect spermatozoa from various stressors, including cold stress. Short-term exposure of spermatozoa to low temperatures around 5 °C, common during ejaculate transport or handling prior to insemination, can adversely affect spermatozoa viability and motility. The aim of this study was to evaluate the protective effects of different morphologies of ZnO nanoparticles against cold stress (5 °C) in bovine spermatozoa. Three types of ZnO NPs were tested: spherical nanoparticles (< 60 nm - ≤40nm), heterogeneous mixture (< 100 nm - ≤40 nm) and ZnO nanowires (1 nm in length). Fresh ejaculates from Holstein bulls (n=9) were collected via an artificial vagina and diluted (1:25) with pre-prepared ZnO NP solutions at concentrations of 10, 50, 100 and 250 µg/ml. Saline served as a control. After 4 hours of storage at 5 °C, spermatozoa motility parameters were evaluated using computer-assisted sperm analysis (CASA). The parameters analyzed included total motility (MOT), velocity curved line (VCL), distance curved line (DCL) and amplitude of lateral head displacement (ALH). A significant increase in MOT was observed at 10 µg/ml heterogeneous mixture and 250 µg/ml nanowires (P<0.01), while a significant decrease in MOT occurred at higher concentrations of heterogeneous mixture and most of the tested concentrations of spherical ZnO NPs (P<0.01–0.001). DCL and VCL showed similar trends, with increased values in the same two groups and decreased in the groups exposed to spherical ZnO NPs or high doses of heterogeneous mixture (P<0.05–0.01). ALH increased at 10 µg/ml heterogeneous mixture and 250 µg/ml nanowires (P<0.05–0.01), but spherical ZnO NPs significantly decreased it at most concentrations. Overall, spherical ZnO NPs showed predominantly negative effects on spermatozoa motility parameters regardless of concentration. In contrast, the heterogeneous mixture at 10 µg/ml and nanowires at 250 µg/ml improved spermatozoa motility, velocity and trajectory length under cold stress conditions. These findings show that both the concentration and morphology of ZnO NPs significantly influence their biological activity.

Keywords: bull, spermatozoa, CASA, ZnO nanoparticles, cold stress

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Plastic age: Endocrine disruptors and their impacts on different cellular models

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The increasing presence of synthetic chemicals, particularly endocrine-disrupting chemicals (EDCs), in the environment poses significant threats to human and animal health. This study aimed to investigate the impact of selected EDCs, specifically bisphenol S (BPS), 4-nonylphenol (4-n-NP), and 4-octylphenol (4-OP), on male reproductive and endocrine functions using in vitro models. In the first experimental model, bovine spermatozoa were exposed to varying concentrations of nonylphenol to assess its interaction with progesterone receptors (PRs) and mitochondrial activity via MTT assay. Results revealed that nonylphenol binds to PRs with lower affinity than progesterone, yet increasing concentrations led to a slight rise in PR binding. This suggests a potential receptor-mediated mechanism contributing to endocrine disruption at the gamete level. In the second model, mouse Leydig TM3 cells were treated with 4-n-NP and 4-OP to evaluate their effects on steroid hormone production, cell viability, oxidative stress (ROS production), and gap junction intercellular communication. Both compounds altered hormone secretion profiles depending on stimulation with basal medium, cAMP, or hCG. While mitochondrial function was not severely impaired, significant ROS overproduction and compromised membrane integrity were detected. Additionally, both EDCs induced a marked inhibition of GJIC, particularly after short exposure, highlighting possible disruptions in intercellular signalling function. A third experimental design explored the pro-inflammatory potential of BPS in human umbilical vein endothelial cells (HUVECs). Although cell viability remained unaffected, BPS significantly altered the secretion of inflammatory mediators, including prostaglandin E2 and interleukin-6, suggesting a role in inflammatory modulation independent of cytotoxicity. Our findings confirm that common plastic-derived EDCs interfere with hormonal, reproductive, and inflammatory pathways even at sub-cytotoxic concentrations. The implications of such disruptions underline the urgency for further risk assessments.

Keywords: endocrine disruptors, spermatozoa, Leydig cells, endothelial cells, cytotoxicity, oxidative stress, inflammation

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The impact of salt content reduction on the safety and quality of meat products

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Reducing salt content in meat products is an important topic in the field of food science and public health. Excessive salt intake is associated with several health risks, especially increased blood pressure and the occurrence of cardiovascular diseases. Due to the fact that meat products are a significant source of sodium in the daily diet, reducing salt content becomes a key step to improve the nutritional value of these foods. This work was focused on comparison of the quality and safety of a heat-treated meat products. Four batches of meat products – frankfurters with salt concentrations of 2.1 (control), 1.8, 1.7 and 1.5% were prepared. Heat-treated products were packed in modified atmosphere and stored for 21 days at 4°C. Chemical and microbiological parameters, color changes were observed in the products and sensory evaluation was also carried out. The results confirmed that the reduction of the salt content to concentrations of 1.5-1.8% of the salt in the final meat products did not affect the microbiological quality of the frankfurters produced. Due to the lower sodium chloride concentration (1.5%), a slight, but not critical, change was observed in the texture and flavour intensity of the products, which still remained attractive to the consumers. The obtained results demonstrated that it is possible to reduce the salt content to a level of 1,5-1,8 % in the production of soft meat products such as frankfurters, while these products retain acceptable sensory, chemical and microbiological characteristics when using a modified gas atmosphere and a storage temperature of 4 °C. The results also point to the possibility of further development of other meat products with reduced salt content without significant loss of important quality characteristics, which may contribute to improving the nutritional value.

Key words: salt reduction, meat products, microbiology, sensory quality

**Concentration of selected risk elements in bull and rams' semen
and relation to the occurrence of morphologically altered spermatozoa**

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In this study the concentration of selected risk elements in bull and ram semen and relation of these metals to spermatozoa morphology was investigated. Analysis by atomic absorption spectrophotometry showed that copper concentration was significantly higher ($p < 0.0001$) in ram semen in comparison with bull semen. The zinc concentration was higher in bull semen in comparison with ram semen. The iron and cadmium concentrations in the semen were similar. Higher concentration of lead was found in ram semen. Higher levels of nickel were found in ram semen in comparison with bulls. In bull semen $11.79 \pm 4.88\%$ of morphological altered spermatozoa were found. Higher occurrence of morphologically altered spermatozoa was in ram semen (17.17 ± 3.76) in comparison with the semen of bulls. Separated tail, tail torso, and knob twisted tail were the most frequent forms of morphologically altered spermatozoa in both species. Correlation analysis in bulls showed high positive relation between iron and zinc ($r = 0.72$), nickel and separated tail ($r = 0.76$), separated tail and tail torso ($r = 0.71$), tail torso and total number of morphologically altered spermatozoa ($r = 0.72$), and between tail ball and total number of pathological spermatozoa ($r = 0.78$). In rams' high positive correlation between cadmium and lead ($r = 0.98$), nickel and separated tail ($r = 0.77$), separated tail and total number of morphologically altered spermatozoa ($r = 0.69$), knob twisted tail and retention of cytoplasmic drop ($r = 0.78$), and between knob twisted tail and other morphologically altered spermatozoa ($r = 0.71$). High negative correlation in ram semen was observed between copper and nickel ($r = 0.71$), copper and separated tail ($r = 0.70$), and between iron and tail torso ($r = 0.67$). The results suggest that the studied metals have a direct effect on spermatozoa quality.

Key words: biogenic elements, xenobiotics, semen, bull, ram

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The concentration of biogenic and risk elements in canine reproductive organs in relation to sex

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Aim of this study is focused on the concentrations of sodium, potassium, iron, calcium, copper, zinc, cadmium, lead and mercury in reproductive organs of dogs related to sex. Average, minimal and maximal concentrations were determined and consequently the correlations between individual elements were analyzed. The average concentration of sodium in samples of dogs was 7957.77 ± 4732.95 mg/kg and the concentration of potassium was 9543.49 ± 5929.42 mg/kg. Detection of concentration of iron showed in monitored samples average concentration of 156.86 ± 115.90 mg/kg. Average concentration of calcium in monitored samples of dogs was 19.29 ± 28.57 mg/kg. Detection of concentration of copper proved the average concentration of 4.11 ± 0.78 mg/kg. Analysis of zinc concentrations in selected samples showed average concentration of 120.17 ± 69.02 mg/kg. The average concentrations of risk elements were relatively low, Cadmium in monitored samples was 0.35 ± 0.12 mg/kg and concentration of lead was 0.37 ± 0.23 mg/kg. The average concentration of mercury in analyzed samples was 0.03 ± 0.07 mg/kg. Strong positive correlation was detected between sodium and copper, sodium and cadmium, sodium and mercury, potassium and cadmium, copper and mercury and between cadmium and mercury. In females, the correlation analysis showed various strong negative correlations: between sodium and potassium, sodium and copper, potassium and zinc, potassium and cadmium, potassium and lead, iron and mercury, calcium and copper, calcium and mercury, copper and zinc, copper and cadmium, copper and lead. Strong positive correlation in females was established between sodium and zinc, sodium and cadmium, sodium and lead, iron and calcium, zinc and cadmium, zinc and lead, as well as between cadmium and mercury. Strong negative correlation in males was established between sodium and lead, potassium and iron. Strong positive correlation in male was established between sodium and copper, sodium and cadmium, sodium and mercury, potassium and cadmium, potassium and mercury, copper and cadmium, copper and mercury as well as between cadmium and mercury.

Key words: biogenic elements, xenobiotics, reproductive organs, dog

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The use of physicochemical methods for linden (*Tilia* sp.) honey authentication study

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Natural linden honey is a valuable source of biologically active compounds, famous of wide antibacterial properties. A significant part of this honey type is sold directly by beekeepers, however it is also available in commercial market, mainly as product imported from UE or outside UE. Due to, a comparative analysis of the physicochemical parameters of local and commercial lime honey was conducted. A total of 25 lime honey samples collected from local beekeepers and 10 samples bought in local stores were evaluated regarding the physicochemical indicators: hydroxymethylfurfural content, diastase activity, pH, color, water content and electrical conductivity, as well as pollen characteristics. All local honeys fulfilled the established criteria for monofloral honey (in the case of linden honey 20% of *Tilia* pollen content) whereas among commercial samples 40% did not fulfil this criterion. Moreover, the differences between local and commercial samples in favor of local honeys were found, for conductivity (670.3 and 506.9 μ S), acidity (20.2 and 17.4 mval/kg), HMF content (4,6 and 20 mg/kg), color (38,1 and 42,5 mm Pfund) and diastase activity (14.7 and 19.2 DN). In the group of commercial samples any significant differences in tested parameters were found between lime and adulterated honeys were found, excluding *Tilia* sp. pollen content (by 31% lower) and HMF (by 62% higher). Moreover the best commercial samples were characterized by worse values of tested parameters than the local samples with lowest quality (22-34% *Tilia* sp. pollen content). It has been shown that physicochemical analyses can complement pollen analysis of honey during authentication, but cannot replace it. Moreover, the study indicated the safest place to buy linden honey is direct sale at the apiary, cheap honey in supermarkets may be adulterated and of lower quality.

Keywords: honey, linden, quality, pollen analysis, physicochemical indicators

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Harmony of water, minerals and plants – The future of functional beverages

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Proper hydration and the supply of carbohydrates and electrolytes play a fundamental role in maintaining physiological functions, supporting thermoregulation, and ensuring energy balance during physical activity. Conventional isotonic beverages are often based on synthetic additives; however, increasing consumer interest is directed towards natural alternatives that offer both nutritional and health-promoting benefits. The aim of this study was to investigate the potential of NFC fruit juices combined with herbal and tea infusions as natural carriers of minerals and sugars for the formulation of functional beverages with controlled tonicity. In this research, the ionic composition (Na^+ , K^+ , Ca^{2+} , Mg^{2+}) and sugar profile (glucose, fructose, sucrose) of selected NFC juices (apple, cherry) were analyzed in combination with herbal infusions (mint, nettle) and tea extracts (black, green). The assessment focused on their contribution to the osmolality of the beverages, as well as the balance between carbohydrate and mineral fractions, which together determine the functional and physiological properties of the drinks. Preliminary results indicate that plant-based matrices significantly enrich the mineral composition, while at the same time modifying the carbohydrate profile, resulting in beverages with improved nutritional value and hydration potential. The findings suggest that the integration of NFC juices with herbal and tea infusions represents a promising strategy for the development of new-generation functional beverages. Such formulations may enhance electrolyte availability and optimize sugar composition, thus supporting both effective hydration and metabolic stability. This natural approach may serve as a sustainable alternative to conventional isotonic drinks, tailored to the needs of athletes as well as the general population.

Keywords: electrolytes; bioavailability; sugars; NFC juices; herbal infusions; osmolality

**Agricultural use of treated wastewater from the perspective of the Directive (EU)
2024/3019 concerning urban wastewater treatment**

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The basic requirements for the collection, treatment and discharge of urban wastewater are contained in Directive 91/271/EEC. The basic objective of the directive is to protect the environment from the harmful effects of wastewater discharges. The directive also contains requirements for the treatment and discharge of wastewater from certain industrial sectors. The directive has undergone extensive amendments in the last few years, the latest amendment being issued in November 2024 (Directive 2024/3019/EU). The directive has been expanded to include several new areas: e.g. the obligation to introduce tertiary treatment and the tightening of the limit values for certain parameters (N- and P-forms) for treated wastewater, the obligation to introduce quaternary treatment to remove micropollutants, achieving energy neutrality, and the monitoring and reduction of microplastics. The introduction of tertiary treatment aims to protect sensitive waterbodies and prevent eutrophication. According to the Directive, in order to reduce the nutrient load on the receiving waterbody, a proportion of treated wastewater can be used for irrigation in agricultural areas. If the wastewater is reused in this way, it must meet specified requirements. The reuse of treated wastewater can be affected by the presence of micropollutants and microplastics in it.

Keywords: Directive 2024/3019/EU, tertiary treatment, quaternary treatment, wastewater reuse, agricultural irrigation, micropollutants, microplastics

Proposing new control strategy to a solar pot

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Nowadays, one of the biggest problems is the ever-increasing demand for energy and to satisfy this need, which causes a serious environmental burden. This puts alternative, environmentally friendly solutions at the forefront. The solar pot investigated in this work is a new invention, having received utility model protection from the Hungarian Intellectual Property Office in 2021. The device can be used to cook food and heat liquids in a 100% renewable, environmentally friendly way using solar energy. Cooking or heating food can be done hygienically, in accordance with the relevant food regulations. The solar pot can be used not only for preparing food, but also for reheating already prepared food or heating liquids for other purposes. The aim of the research is to develop and apply a completely new control for the solar pot. The control can be given in an explicit, analytical mathematical form, which directly expresses the cooking tank temperature, thus making the control simple and easy to apply. By rearranging this formula to the volumetric flow rate, one can express explicitly the required flow rate to maintain a desired constant cooking tank temperature. The significance of this is that it may often be necessary to keep the tank temperature at a constant value. During the research, computer simulations are performed. Furthermore, the proposed control method is applied to an experimental system consisting of the solar pot and a solar collector. The comparison of the modelled and measured results helps to evaluate the control regarding its efficiency and applicability. According to the expected results, the utilization of solar energy using the new control will be efficient, and a constant cooking tank temperature can be successfully maintained by changing the volumetric flow rate as needed. The results will facilitate the spread of devices using solar energy by demonstrating their applicability and efficiency and the examined control can also be applied to other solar heating systems.

Keywords: solar cooking, solar pot, mathematical modelling, control, simulation results

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Effects of sea buckthorn berry supplementation on magnesium, calcium, and phosphorus levels in a type 2 diabetes rat model

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Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance and impaired glucose homeostasis, with an increasing prevalence worldwide. In addition to well-established risk factors such as obesity, sedentary lifestyle, and genetic predisposition, recent research highlights the important role of certain macro- and microelements in modulating glucose metabolism, insulin signaling pathways, and the prevention of diabetes-related complications. Among these, magnesium, calcium, and phosphorus have been extensively studied due to their critical involvement in metabolic processes. This study investigated the effects of sea buckthorn (*Hippophae rhamnoides* L.) berry supplementation applied by gastric probe on blood mineral concentrations in Zucker diabetic fatty (ZDF) rats, a widely used animal model for T2DM. The animals were divided into three groups: KS (diabetic control group, n = 10) receiving water, R1 (daily oral administration of 250 mg·kg⁻¹ body weight of dried sea buckthorn berries, n = 8), and R2 (daily oral administration of 500 mg·kg⁻¹ body weight of dried sea buckthorn berries, n = 8). Magnesium is known to enhance insulin sensitivity and exert anti-inflammatory effects; however, our results showed no statistically significant differences in serum magnesium levels among the groups (P > 0.05). In contrast, calcium concentrations were significantly elevated in the high-dose R2 group compared to control group (P < 0.05), suggesting a dose-dependent effect of sea buckthorn supplementation. Furthermore, phosphorus levels were significantly increased in both treated groups R1 and R2 relative to the control group (P < 0.05). These findings indicate that supplementation with sea buckthorn berries may modulate calcium and phosphorus metabolism in the context of diabetes, potentially contributing to improved metabolic regulation. Further research is necessary to clarify the underlying biochemical mechanisms and to evaluate the therapeutic potential of these mineral alterations in diabetic patients.

Keywords: *diabetes mellitus*, magnesium, calcium, phosphorus, ZDF rats

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Affecting the dextrose of turkey spermatozoa motility?

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Turkey semen is sensitive to cooling and short-term liquid storage, which quickly reduces its fertility. To preserve fertilising ability, it is essential to use a semen extender with components suitable for turkey spermatozoa. Dextrose (glucose) is a monosaccharide and a primary energy substrate for cellular metabolism, including ATP production in spermatozoa. In reproductive biology, glucose is commonly added to *in vitro* culture media and semen extenders to support the motility and viability of mammalian spermatozoa during storage. However, in the case of birds, this knowledge is poor, or they are not adequately examined. Therefore, the focus of this work was to determine the effect of dextrose on the selected motility parameters of turkey spermatozoa in *in vitro* conditions. Experimental samples were prepared with several concentrations of dextrose: from 0.009 to 0.144 g.10mL⁻¹ (in the saline solution). Spermatozoa motility parameters were measured after 0, 1, 2, 3, 4 and 5 hours by the CASA system (Computer Assisted Semen Analyzer) – program Andro Vision®. The results showed that higher doses of dextrose significantly reduced both total and progressive spermatozoa motility at the beginning of cultivation. With increasing cultivation time, any significant effect of dextrose on turkey motility parameters was observed. Although some authors report the suitability of dextrose for use in the case of poultry spermatozoa, our results indicate that dextrose, glucose in the D-form, does not show any positive effects on turkey spermatozoa motility under liquid storage in *in vitro* conditions.

Keywords: semen extender, carnitine, *Meleagris gallopavo*, motility

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Effect of catechin on viability of mononuclear cells

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Catechins are natural polyphenolic compounds known for their antioxidant and anti-inflammatory properties. Their potential immunomodulatory effects have attracted increasing attention, particularly in relation to immune cell function. This study aimed to investigate the effect of catechin on the viability of peripheral blood mononuclear cells (PBMCs) *in vitro*. PBMCs cells were isolated from peripheral blood using density gradient centrifugation. Cells were treated with various concentrations of catechin hydrate for 1 and 3 hours. Cell viability was assessed using flow cytometry (BriCyte E6) with YO-PRO-1 and propidium iodide staining. Catechin treatment showed a concentration-dependent effect on PBMCs viability. Lower concentrations preserved or slightly enhanced cell viability, while higher concentrations led to a reduction in viable cells. Catechin modulates the viability of PBMCs in a dose-dependent manner. These findings suggest potential immunomodulatory effects of catechin and warrant further investigation into its mechanisms of action.

Keywords: lymphocyte, monocyte, viability, catechin

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Sensory characteristics of milk fermented by *Lactobacillus acidophilus* with inulin and sodium butyrate

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Sodium butyrate is endogenously produced in the human body by the gut microbiota during the fermentation of nondigested carbohydrates—principally cellulose, inulin and resistant starch—in the large intestine. To naturally enhance endogenous sodium butyrate synthesis, one should include in the diet foods rich in dietary fiber and resistant starch, or alternatively incorporate sodium butyrate as a food additive. Accordingly, the aim of this study was to evaluate the impact of supplementing milk with 4 % inulin and 0.07 % sodium butyrate on the sensory characteristics of milk fermented by *Lactobacillus acidophilus* LA5. A trained sensory panel (n = 20; age range 20–40 years) carried out descriptive profiling. Fermented milk samples were scored on a 9-point structured scale (1 = undetectable/undesirable to 9 = very intense/highly desirable) for the following attributes: consistency, color, milky-creamy taste, sour taste, sweet taste, off-taste, sour odor, fermentation odor and off-odor. Data were analyzed using Statistica v. 13.1 (StatSoft, Tulsa, OK, USA). Means and standard deviations were computed, and one way analysis of variance was performed. Significant differences between means were determined by Tukey's post hoc test at $p \leq 0.05$. The addition of inulin and sodium butyrate prior to fermentation significantly increased the intensity of sour taste and odor in the fermented milk, concomitantly diminishing the perception of milky-creamy and sweet taste. No significant effects on the consistency or color of *L. acidophilus* LA5 fermented milk were observed. Moreover, panelists showed a preference for the inulin and sodium butyrate enriched samples over the control, suggesting that these additives may be successfully employed in fermented milk formulations.

Keywords: fermented milk, sodium butyrate, organoleptic attributes

Evaluation of arsenic uptake by rice (*Oryza sativa*) in different soils and farming methods

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This study investigates the relationship between total arsenic (As) concentrations and key soil parameters across organic and conventional rice cultivation systems in Hungary. The widely cultivated Hungarian rice variety *M 488* was grown under varying agronomic conditions across nine field sites, including Szarvas (SZ1: conventional; SZ2: aerobic), Gyomaendrőd (GY1: conventional; GY2: organic), Csárdaszállás (CS1: conventional; CS2: organic), and Kisújszállás (K1, K2: conventional; K3: organic). All fields employed flooded irrigation, except SZ2, which utilized drip irrigation under aerobic conditions. Soil and plant samples were collected in eight replicates per site. The highest total soil As concentration was observed in GY1 ($8.65 \pm 0.70 \text{ mg kg}^{-1}$), significantly exceeding levels in all other sites. The lowest concentrations were recorded in CS2, CS1, GY2, and SZ2 (ranging from 4.48 ± 0.98 to $5.24 \pm 0.24 \text{ mg kg}^{-1}$). On average, conventional systems exhibited significantly elevated soil As levels ($6.95 \pm 1.31 \text{ mg kg}^{-1}$) compared to organic and aerobic systems. Pearson correlation analysis revealed that soil As content ($r = 0.407$), humus ($r = 0.561$), and sulphate concentrations ($r = 0.315$) were positively associated with As accumulation in polished rice grains ($p < 0.01$). Conversely, higher soil pH ($r = -0.561$) and phosphate levels ($r = -0.382$) were significantly correlated with reduced As uptake in rice grains. Arsenic distribution within rice organs followed the order: root > shoot > brown rice > polished rice. The highest As concentrations in all plant tissues were consistently found in GY1. Aerobic cultivation (SZ2) resulted in markedly lower As accumulation across all rice organs. While no significant differences in As content were observed between conventional and organic systems in roots, brown rice, or polished rice, shoot As concentrations were significantly higher in conventionally grown rice. These findings underscore the influence of both soil physicochemical properties and cultivation practices on arsenic dynamics in rice agroecosystems. Adoption of alternative irrigation strategies and targeted soil management may serve as effective mitigation approaches to reduce arsenic accumulation in rice grains.

Keywords: Arsenic content, soil-plant interactions, organic farming, conventional farming, aerobic irrigation

Mercury concentrations in maternal and fetal tissues - preliminary correlation studies

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Mercury (Hg) is a toxic heavy metal that can cross the placental barrier, potentially affecting fetal development. This metal is found not only as environmental pollutants but also in consumed food. During prenatal development, the developing fetus is particularly sensitive to adverse factors due to the intensive processes of cell division and differentiation, and even a small dose of mercury can negatively impact its development. The aim of the study was to assess mercury concentrations in selected maternal and fetal tissues and their associations with demographic factors (mother's age, number of pregnancies, place of residence) and behavioral factors (smoking, diet). Biological samples such as the placenta, umbilical cord, amniotic fluid, cord blood, amniotic membranes, and breast milk were analyzed for total mercury concentrations. The data were combined with survey responses, and descriptive statistics and correlation analyses were then performed. Tissue mercury concentrations were very low, ranging from 0.0001 to 0.0036 µg/g. The greatest variability was observed in human milk. Hg concentrations in all tested samples, except milk samples, exceeded the limit of quantification. A strong positive correlation was found between mercury concentrations in the placenta and umbilical cord ($r = 0.75$, $p < 0.001$), indicating the possibility of transplacental transport of mercury. The remaining correlations were not statistically significant. However, the overall exposure level in the study group was low. Larger studies are needed to confirm these observations and better define the role of demographic and environmental factors in mercury accumulation.

Keywords: mercury, placenta, umbilical cord, maternal exposure

Analysis of sulfonamide residues in varietal honey samples using a rapid immunochromatographic test

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Honey contamination with veterinary drug residues, particularly sulfonamides, remains a concern for food safety and public health. The presence of such residues may cause allergic reactions, disturb gut microbiota and contribute to antimicrobial resistance. Sulfonamides are synthetic antimicrobial agents formerly applied in the treatment of bee diseases such as American foulbrood and noseosis. Although their use is currently prohibited in the European Union, the detection of these substances in honey has been reported. The objective of this study was to determine the presence of sulfonamide residues in honey using a rapid screening method based on lateral flow immunoassay (LFIA) technology. A total of 70 honey samples (linden, multifloral, rapeseed, and buckwheat variety) of various origin (local and imported) were analyzed using the Bioeasy Rapid Test for sulfonamides in foods. Results indicated that no sulfonamide residues were detected in any of the analyzed samples. The test's functionality and sensitivity were verified using a positive control adulterated with sulfonamides. These findings indicate that the tested honey samples meet current safety standards. The applied LFIA method demonstrated high potential as a rapid, cost-effective, and reliable tool for routine screening of sulfonamide residues in honey usable for strengthening food safety monitoring systems.

Keywords: sulfonamides, honey contamination, veterinary drug residues, lateral flow immunoassay (LFIA), rapid screening test

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Global perspectives on the environmental fate and impact of spent gunshot

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Lead pollution from spent gunshot causes a threat to wildlife and ecosystems worldwide. The research examines the environmental impacts of lead shot, which has been widely used at shooting ranges and wetlands for the past decades, and continues to exist in soil and water. Waterfowl and other animals often make mistakes the lead pellets for food or grit, eat them, which results in fatal poisoning. The ecological risks increase due to the solubility of lead, together with associated metals such as arsenic and antimony in acidic conditions. Although the European Chemicals Agency prohibited the use of lead ammunition in wetlands starting in 2021, the lead pellets are still present in wetland areas, and the environmental impacts of alternative materials like steel, copper, and tungsten are still under study. We analyzed the articles for decades to assess the toxicological impacts of lead shots on waterfowl and their environmental behavior and evaluate the effectiveness of mitigation strategies. The review also presents an overview of worldwide regulations regarding lead shot restrictions as well as assessments of non-toxic ammunition alternatives. The study shows that worldwide coordination between stronger laws and technological advancement, and complete environmental monitoring systems is essential. Additionally, this review provides a foundation for future research on how spent shot pellets influence microbiological processes in bottom sediments - particularly the denitrification in aquatic ecosystems.

Keywords: lead pollution, lead shot, non-toxic ammunition, wetlands, ammunition regulations

Effects of silica nanoparticles on stallion spermatozoa motility and viability *in vitro*

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Silica nanoparticles (SiO₂ NPs) are increasingly used in technologies such as biomedicine, diagnostics, food science, and cosmetics, raising concerns about their potential cellular effects. This study aimed to evaluate their impact on progressive motility and mitochondrial activity of stallion spermatozoa *in vitro*, as current data in this area remain limited. Fresh semen was collected from breeding stallions in the Nitra region and diluted in experimental groups. The samples were exposed to seven concentrations of SiO₂ NPs: S1 (1000 µg/ml), S2 (500 µg/ml), S3 (250 µg/ml), S4 (125 µg/ml), S5 (62.5 µg/ml), S6 (31.25 µg/ml), and S7 (15.62 µg/ml). Progressive motility (PRO) was analyzed at 0, 1, 2, 3, and 4 hours of incubation. The MTT assay was used to assess mitochondrial activity after 4 hours of exposure. At 0 hours, none of the experimental groups showed statistically significant changes in PRO compared to the control. After 1 hour, a significant decrease in motility was observed only in group S7, while group S6 showed a borderline trend. After 2 hours, all groups (S1–S7) demonstrated a statistically significant reduction in PRO compared to the control, with the strongest effects in groups S6 and S7. The control group itself showed a substantial decline in motility over time. After 4 hours, only group S2 showed a statistically significant difference in PRO compared to control, while all other groups did not differ significantly. MTT assay results revealed no statistically significant changes in mitochondrial activity in any of the exposed groups after 4 hours of incubation. These data indicate that silica nanoparticles may transiently impair progressive sperm motility in a concentration- and time-dependent manner, while not significantly affecting mitochondrial activity within the studied range.

Keywords: silica nanoparticles, stallion spermatozoa, CASA, progressive motility, MTT

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Valorization of phytonutrients in rose petal agro-waste feedstuff

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Rosa damascena Mill., known as Damask rose, is a famous ornamental plant originating from *Rosaceae* family, and it ranks among the primary crops grown for essential oil production in Bulgaria. The processing of rose flowers yields rose oil, rose concrete, rose absolute, and rose water. However, the residual rose flowers left after essential oil distillation remain underutilized. These by-products contain a conspicuous nutritional value and can be supplemented to animals directly without any modification or can be used after fermentation of the agro-residues. Most of them offer an inexpensive source of nutrients as compared to traditional feeds and support animal productive performance, boosting the profitability of farms. In addition, incorporation of *Rosa damascena* Mill. into food formulations has been associated with reduced nitrite content and enhanced antioxidant and nutritional profiles, supporting its application in the production of functional foods. The objective of this study was to assess the chemical and phenolic content of *Rosa damascena* Mill., with a focus on identifying its phytochemical constituents to evaluate its nutritional and functional potential. In our study, the chemical analyses were conducted in accordance with the Official Methods of Analysis of AOAC. Additionally, Folin–Ciocalteu method was performed to determine total phenolic content and results were expressed as gallic acid equivalents (mg GAE/100 g fresh mass). The proximate composition of dried rose petals waste showed a dry matter content of 912.57 g/kg, with a considerable proportion of fibre fractions (NDF: 595.40 g/kg, ADF: 488.41 g/kg). The content of nitrogenous substances reached 144.76 g/kg, fat 30.24 g/kg, and nitrogen-free extract 498.06 g/kg. Results of total phenolic content in dried rose petal waste sample was approximately 393.83 mg GAE/100 g dry weight. The presence of substantial levels of phenolic compounds underscores the value of rose petal agro-waste as a promising natural source of antioxidants for animal nutrition. These findings confirm that dried rose petals waste is rich in plant bioactive compounds, particularly phenolic compounds, supporting their application as a functional feed ingredient.

Keywords: spent rose petals; chemical composition; circular economy; phenolic compounds, antioxidant activity.

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Relationship between stable isotopes and mercury concentrations in the blood of Caspian gull from southern Poland

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In the environment, mercury (Hg) occurs naturally; however, anthropogenic activities have significantly altered its turnover by making it more bioavailable to biota. In aquatic ecosystems, Hg is converted to methylmercury (MeHg), which can bioaccumulate in living organisms and also biomagnify along the food chain. As a result, animals from high trophic levels, including top predators, are significantly influenced by their toxic effects. Since the chicks are fed local food products by their parents, they are important bioindicators of local environmental pollution. In this context, the study aimed to determine whether Hg is present in the chick's blood and whether its presence is influenced by the trophic position of individuals ($\delta^{15}\text{N}$ as a proxy) and related to the feeding habitat ($\delta^{13}\text{C}$ as a proxy). The material was collected from Caspian gull chicks in June 2024 from two colonies located in Dwory and Jankowice (southern Poland, Central Europe). We found that Hg was present at quantifiable concentrations in the blood of all specimens (ranging from 0.014 $\mu\text{g/g}$ to 0.200 $\mu\text{g/g}$). Since neither localization nor sex was significant for all measured parameters, we pooled the data for further analysis. We found a strong, significant positive correlation between Hg and $\delta^{15}\text{N}$ and a non-significant weak negative correlation with $\delta^{13}\text{C}$. We conclude that exposure to Hg is closely linked to the trophic position, whereas its relationship with feeding habitat requires further research.

Keywords: Hg, bioaccumulation, biomagnification, predators, isotopes

The microbiota of dishes stored in restaurant buffet counters

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The aim of the study was to perform a microbiological analysis of dishes stored in buffet counters at a restaurant in southern Slovakia. Over a two-month period, 22 dish samples were collected at two time points: immediately after placement in the serving equipment (sample A) and after three hours of storage (sample B), following relevant legislative guidelines. The microbiological evaluation focused on total viable counts (TVC), coliform bacteria, yeasts, and microscopic filamentous fungi. In freshly prepared dishes (A), TVC ranged from 2.6 to 3.6 log CFU·g⁻¹. After three hours (B), the range shifted slightly to 3.1 – 3.6 log CFU·g⁻¹. A statistically significant increase in TVC ($p < 0.001$) was found in several dishes, including Szegedin goulash, chicken broth, roasted pork knuckle, roasted trout, fried zucchini, rice, croquettes, pork steak, rosemary potatoes, pea soup, chicken sauté, stuffed cabbage, and mashed potatoes. Only tarhonya showed no significant difference ($p > 0.05$) after storage. Coliform bacteria were absent ($< 1.0 \times 10^1$ CFU·g⁻¹) or present in minimal amounts ($< 4.0 \times 10^1$ CFU·g⁻¹) in most fresh samples. However, after storage, increased levels were found in tarhonya (5.4×10^1 CFU·g⁻¹), vegetable soup (6.2×10^1 CFU·g⁻¹), and mashed potatoes (7.2×10^1 CFU·g⁻¹). In contrast, other dishes such as chicken broth, pork knuckle, fried zucchini, rice, dumplings, and rosemary potatoes maintained low coliform levels, and 16 dishes had no detectable coliforms. Filamentous fungi were detected both in fresh and stored samples of roasted trout, Hungarian potato soup, and mashed potatoes. Additional increases were found after three hours in tarhonya, fried zucchini, rice, and croquettes, though still below 4.0×10^1 CFU·g⁻¹. Yeast counts were generally low, but elevated levels were identified post-storage in tarhonya (6.0×10^1 CFU·g⁻¹), Spanish-style meat rolls (6.3×10^1 CFU·g⁻¹), and mashed potatoes (9.8×10^1 CFU·g⁻¹). These findings suggest that good manufacturing practices were not consistently adhered to, particularly in sanitation procedures and in maintaining appropriate holding temperatures in the buffet equipment.

Keywords: microbiota, dishes, storing, hygiene, restaurant

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Monitoring the properties of *Brassica oleracea* and its effect on H295R cell line viability and steroid secretion *in vitro*

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The aim of this study was to determine the effect of *Brassica oleracea* on human adrenocortical carcinoma cell line (H295R) *in vitro*. H295R cells were exposed to six various concentrations of *Brassica oleracea*: 25, 50, 100, 150, 200 and 250 µg/mL for 24 hours. The free radical-scavenging potential of the experimental extract was evaluated using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) method. The DPPH method revealed that the free-radical scavenging activity of the *Brassica oleracea* microgreen was 8.26 (±0.01) mg TEAC/g d.w. The analysis of mitochondrial activity of H295R cells was evaluated by MTT assay which measures the reduction of a yellow tetrazolium salt to insoluble blue formazan in the mitochondria of viable cells. The MTT results showed significant increase (P>0.01) in mitochondrial activity at experimental doses 100 and 200 µg/mL of extract. Assessment of the progesterone secretion was performed using an enzyme-linked immunosorbent (ELISA) assay and showed significant (P>0.01) elevation at concentrations 200 and 250 µg/mL of *Brassica oleracea* extract after 24 hours. Based on the findings it can be concluded that addition of *Brassica oleracea* extract can slightly improve cellular viability, hormone production and antioxidant capacity.

Keywords: H295R, *Brassica oleracea*, MTT, progesterone, *in vitro*

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