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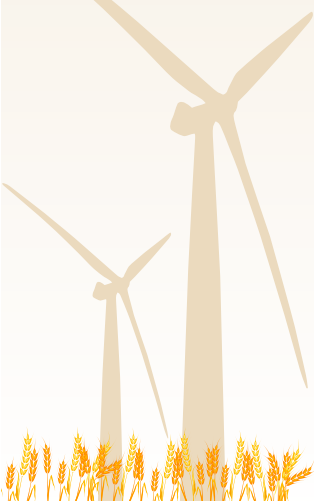
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The influence of nutritional and environmental factors on body weight and selected biochemical parameters in dogs

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Keywords: nutrition, dog, calories, energy, obesity, overweight

Obesity is a major concern of the 21st century, both among humans and animals. It can exacerbate accompanying diseases and lead to new ones, as well as cause a decrease in the quality of life. A study was conducted to evaluate the influence of various factors on occurrence of overweight and obesity. A group of 31 dogs was selected, in which 15 of them had proper body condition (BCS 5/9) and 16 animals had excessive body weight (BCS 6-9/9). A survey was conducted to obtain information on the health, nutrition and environmental conditions of tested animals. Examination of biochemical parameters were additionally used to assess the animals health. Based on the obtained results, a directly proportional relationship was found between the concentration of lipid metabolism indicators in the blood (ALT, TG and TBARS) and the age of the tested dogs. In addition, comparison of the estimated energy of the daily dose with the energy resulting from the needs of the animals proved that dog owners cannot correctly estimate the amount of food they give their dogs and the method of measuring the ration of food has an impact on the occurrence of excessive body weight in dogs.

The effect of plant cover and gypsum parent material on the soil organic matter storage and transformation

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Keywords: gypsum soil, limestone soil, soil organic matter stabilization, humic acid composition, plant lignin

Soils play a crucial role in carbon storage, holding a significant amount of carbon compared to the atmosphere and biomass. The soil organic matter (SOM) constitutes about 70% of the organic carbon in soils and its properties can vary based on environmental factors like soil properties, parent material, plant species, and climate. By storing large amounts of terrestrial carbon (C), soils prevent it from being released into the atmosphere as carbon dioxide, the main greenhouse gas. Gypsum rock-derived soils are unique examples that intrigue soil scientists due to their uncommon formation, which includes a low proportion of quartz-silicate components like calcareous soil. We examined soils derived from gypsum and limestone, assuming the former had a special ability to accumulate and stabilise soil organic matter (SOM) under temperate climatic conditions when compared to limestone-derived soil. We compared the benefit of gypsum or limestone as a parent material and the effect of vegetation cover on the quantity and quality of SOM. Our objectives included assessing and comparing the soil organic matter content, determining lignin levels in plants, and evaluating humic acid composition. We analyzed various soil properties and studied the structure of humic acids as indicators of SOM quality. Our findings revealed that SOM in gypsum soils was more mature and contained more aromatic HAs compared to limestone soils. Gypsum soils had higher enzyme activity and greater vegetation cover, with fine roots containing larger amounts of lignin than in

limestone soils. We identified the factors influencing soil properties and determined the interaction between parent material, vegetation cover, and their impact on SOM storage. Our study highlighted the significance of fine-root composition (lignin, Ca, K) and enzyme activity in carbon accumulation. Gypsum, as a parent material, favoured SOM accumulation through physical stabilization by providing active Ca cations for SOM protection, along with silt and clay particles. It also contributed to biochemical stabilization through elevated enzyme activity and a greater quantity and quality of biomass. Our results underscored the importance of gypsum soils in mitigating global warming by preserving SOM in the long term.

Selected parameters of the health quality of red cabbage at different stages of its growth

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Keywords: red cabbage, nutrients, nitrates, nitrites

The aim of the study was to determine the effect of the growth stage of red cabbage on the content of basic composition and selected chemical contaminants. Mature and 28-day-old young shoots of red cabbage of *Langedijker* cultivar were the research material. There were analyzed the content of dry matter, protein, ash, total fat, total carbohydrates, nitrates and nitrites. The obtained results indicate that the mature and young shoots of red cabbage contain similar amount of basic nutrients. Statistically significant differences were observed only for total carbohydrates and dry matter content. The content of total carbohydrates was higher in mature red cabbage. The value was 5.94 g/100 g of the product for mature counterpart and 3.59 g/100 g of the product for young shoots. The average content of dry matter in mature red cabbage (8.38%) was significantly higher than the content of dry matter in young shoots (5.94%). The growth stage of red cabbage had a significant impact on the accumulation of selected chemical contaminants in it. Compared to mature red cabbage, young shoots contained approximately ten times more nitrates and almost three times more nitrites. The research clearly shows that the growing stage of red cabbage has a significant impact on the content of selected chemical contaminants.

The effect of biofortification of lettuce with iodoquinolines in hydroponics on the content of iodine and selected bioactive compounds

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Keywords: biofortification, lettuce, iodine, iodoquinolines, iodine deficiency, bioactive compounds

Iodine deficiency in the diet, which affects about 2 billion of the world's population, creates the need to search for new methods of enriching food with this microelement. Iodoquinolines used for innovative iodine biofortification are derivatives of quinoline, which is a heterocyclic aromatic compound containing a nitrogen atom in its structure. The aim of this study was to examine the effectiveness of the use of iodoquinoline for the biofortification of lettuce with iodine in hydroponic cultivation by assessing the content of iodine and selected bioactive ingredients.

The following application of iodine compounds (all in 5 µM molar mass equivalents) were tested in the studies: control (without of iodine application); KIO₃ (positive iodine control), 8-hydroxy-7-iodo-5-quinolinesulfonic acid, 5-chloro-7-iodo-8-quinolinol, 5,7-diiodo-8-quinolinol and 8-iodo-4-hydroxy-3-quinolinecarboxylic acid. Lettuce (*Lactuca sativa* L. var. *capitata* cv. 'Melodion') was planted in a nutrient film

technique (NFT) hydroponic study in a greenhouse. After its harvest, leaf samples were collected, and then the content of iodine, L-ascorbic acid, dehydroascorbic acid, polyphenolic compounds and antioxidant activity was analyzed. In addition, based on the results of iodine determinations, the percentage of its recommended daily intake (% RDA-I) was calculated by consuming a 50 g serving of fresh lettuce leaves.

Compared to the control, the concentration of iodine in lettuce plants increased by an average of 70.26 times, and its level ranged from 8.99 mg I · kg⁻¹ dry weight (after 5-chloro-7-iodo-8-quinolinol application) to 117.50 mg I · kg⁻¹ of dry weight (after 8-hydroxy-7-iodo-5-quinolinesulfonic acid application). Plants fortified with 8-hydroxy-7-iodo-5-quinolinesulfonic acid were characterized by the highest concentration of this element, which was 221.7 times higher than in control plants. Consumption of a 50 g serving of fresh lettuce leaves enriched with this iodoquinoline would provide 195.46% of the RDA-I. The highest content of L-ascorbic acid and dehydroascorbic acid was found in plants enriched with 8-hydroxy-7-iodo-5-quinolinesulfonic acid and 5,7-diiodo-8-quinolinol, respectively, and their concentration was 1.32 and 2.55 times, respectively higher than in non-biofortified plants. The use of almost all tested iodine compounds resulted in an average 1.69-fold increase in total polyphenol content and an average 1.32-fold increase in antioxidant activity in lettuce.

The research results clearly indicate that the exogenous use of iodoquinolines for the biofortification of these plants may be a potential strategy to combat malnutrition caused by iodine deficiency, while the increase in the content of bioactive components, such as vitamin C and polyphenolic compounds, may lead to the improvement of human health.

Effectiveness of herbal blends addition in calf nutrition

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Keywords: calves, herbs, biologically active compounds, rearing

In recent years, we observe the increasing frequency of the use of natural compounds stimulating the growth of young farm animals. Herbs used as an additive in basic calves' rations are undoubtedly materials with this type of activity. The phytochemical characteristics and activity of herbs and herbal preparations in animal nutrition depend on the content of compounds derived from plant secondary metabolism. The synergistic interactions of bioactive compounds in herbal plants with other substances contribute to more efficient absorption of nutrients and maintenance of physiological equilibrium in the animal organism. Simultaneously, those compounds can also stimulate animal immunity and health. For prophylaxis purposes, the use of these compounds provides comparable or even better therapeutic effects than synthetic substances administered to farm animals.

The use of phytobiotic additives with a potential immunostimulatory effect in livestock nutrition is especially important in young domestic cattle. In the prenatal period, the placenta is an anatomical barrier separating the offspring from the mother's organism. In the prenatal period, the placenta is an anatomical barrier separating the offspring from the mother's organism. In this period, due to an often insufficient transfer of colostrum, which results in the lack of passive immunity calves are prone to high morbidity and mortality. The most common problems are diseases of the di-

gestive or respiratory system. Hence, optimal conditions in the initial rearing period determine the further usability value and production performance of calves. The aim of the study was to assess the effect of herbal blends, targeted to improve the production indices, in calf nutrition.

Three herbal raw materials, i.e. oregano herb (*Origanum vulgare*), thyme herb (*Thymus vulgaris*), and sage leaves (*Salvia officinalis*), were selected to be used in varied proportions as powdered herbal blends. Limousin calves were randomly assigned to 4 nutritional groups, and both the cows and the calves received powdered dried herbal blends at a dose of 5% d.w. of concentrated feed. The production effects were determined based on the weight gain and feed intake per 1 kg of weight gain.

The results of the study on indirect (cows in the peri-calving period) and direct (calves in the early rearing period) supplementation of concentrated feed of the multi-component herbal blends oregano herb (*Origanum vulgare*), thyme herb (*Thymus vulgaris*), and sage leaves (*Salvia officinalis*) can be recommended.

Obtaining callus tissues and seedlings of *Ulmus laevis in vitro* – differences in micropropagation and morphogenetic abilities

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Keywords: *Ulmus laevis*, micropropagation, growth regulators, *in vitro*, *in vivo*

European white elm has been struggling with a high incidence of various fungal pathogens in recent years. Recently developed micro-propagation research has become crucial to their survival. In recent times, Dutch elm disease has been the most problematic for all elm species in Poland. It is caused by spores of the fungus *Ophiostoma novo-ulmi*, which are transmitted between trees by bark beetles. Improving resistance to one pathogen can potentially increase resistance to other fungal pathogens present. Research on callus tissue cultures and *in vitro* seedlings of *Ulmus laevis* allows the propagation of a small amount of material in a short period of time and continuous access to good quality material. Embryos were isolated from immature elm seeds. A suitable method of sterilising the plant material was used with 8% H₂O₂ for 15 minutes. Isolated embryos were plated on four culture media: DKW, LV, MS and WPM. Depending on the experiment, the growth regulators BA, TDZ, GA₃ and KIN were added to the medium in different combinations and concentrations. Callus tissues developed with high efficiency on WPM medium with the addition of 4.440 µM of BA and 4.646 µM of KIN. For differentiated tissues, WPM with

4.440 μM of BA and 1.444 μM of GA_3 proved to be the optimal medium. Rooting of seedlings was carried out in a stepwise form on WPM medium supplemented with 10.740 μM NAA. In order to adapt them to *in vivo* conditions, the concentration of micro-, macronutrients and vitamins was gradually reduced before transplanting from the medium to the soil-perlite mixture. Callus tissues were exposed to light as a stress factor. Tissues grown in the dark slightly increased in mass, causing them to rapidly dark brown colour and eventually die. In contrast, in the light, they were observed to increase significantly and tissue viability was enhanced, compared to growing in the dark. Significant differences in the micropropagation of the elm genotypes studied were also demonstrated. Despite breeding under identical conditions, only seeds from the Wisła possessed morphogenetic abilities, which may be related to the quality status of individual elm individuals. In the future, callus tissues obtained from seed-derived embryos will form the basis for genetic studies and on interactions with biotic factors.

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Spatial and temporal changes in the content of the major birch pollen allergen, Bet v 1 in Poznań and its vicinity

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Keywords: allergenic protein, birch, *Betula pendula*, Bet v 1, ELISA

Bet v 1 is the main allergen of birch pollen grains. The amount of Bet v 1 in pollen is not constant, but can vary markedly, likely due to effect of stress factors. The main aim of the study was to test the hypothesis about the positive effect of higher temperature and air pollution on the amount of Bet v 1. Therefore, the inter-population variability of Bet v 1 and the impact of the above-mentioned environmental factors on the level of Bet v 1 was determined.

Pollen grains were collected in 2022 from 37 (urban, suburban and semi-natural) populations of *Betula pendula* Roth located in Poznań and around it. Quantification of Bet v 1 was determined by enzyme-linked immunosorbent assay, and pollen grains were counted using hemacytometer. The content of Bet v 1 in pollen grains was expressed in pg Bet v 1/zp. The significance of differences in Bet v 1 content between population was determined by ANOVA, while influence of environmental factors (air temperature and humidity, PM2.5 and PM10 concentration) on the amount of Bet v 1 was established using correlation analysis. In addition, qualitative and quantitative test methods were performed to analyse pollen grain proteins during pollination of the silver birch (*Betula pendula*): ELISA and SDS-PAGE electrophoresis.

The amount of Bet v 1 in birch pollen grains ranged from 0.23 to 6.36 pg Bet v 1/zp. The highest average level of Bet v 1 was observed in urban sites (2.60 pg Bet v 1/zp),

and the lowest in semi-natural areas (1.77 pg Bet v 1/zp). However, these differences were not statistically significant. A statistically significant relationship was observed between the amount of Bet v 1 at urban sites and the concentration of PM_{2.5} and PM₁₀. There was no significant influence of temperature and air humidity on the amount of Bet v 1.

The conducted study has shown that the allergenicity of birch pollen grains is clearly spatially differentiated and likely there is a gradient between urban and semi-natural sites caused by the action of stress factors, e.g., air pollution. However, further analyzes are necessary, primarily with the use of local habitat data, to determine the exact role of stress factors in modifying the amount of Bet v 1 in birch pollen grains.

Effect of different fertilization combinations on yield structure and quality of maize grain

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Keywords: fertilization, sulfur, calcium, maize

Studies on the effect of fertilisation with Siarkomax fertiliser on yield parameters and grain quality traits in maize were carried out in 2015. The one-year experiment was set up at the University of Agriculture's Experimental Station, in Prusy near Krakow, on degraded chernozem. Was assessed the maize variety Ronaldinho, characterised by its versatility of use due to its optimum forage and grain quality. The variety is considered suitable for cultivation in unfavourable soil and climatic conditions. The fertiliser Siarkomax used in the experiment is granulated calcium sulphate with 18,40% S and 22,14% Ca, according to the manufacturer. The study scheme consisted of six fertilisation variants:

- 1) N1 (NPK – 160–124–271 kg · ha⁻¹ /potassium salt/)
- 2) N2 (NPK – 160–124–271 kg · ha⁻¹ /potassium sulphate/)
- 3) N1 + SM 300 kg · ha⁻¹ (Siarkomax 300 kg · ha⁻¹)
- 4) N1 + SM 500 kg · ha⁻¹ (Siarkomax 500 kg · ha⁻¹)
- 5) N2 + SM 300 kg · ha⁻¹
- 6) PK (124–271 kg · ha⁻¹)

The highest grain yields, compared to the object with fertilisation with phosphorus and potassium only (PK), were obtained with the variant with potassium in sulphate form, without the addition of Siarkomax (N2) and with its addition (N2 + SM 300 kg), respectively 12,34 t · ha⁻¹ and 12,30 t · ha⁻¹. It should be noted that, with

the exception of fertilisation limited to phosphorus and potassium (PK), all research facilities other did not differ significantly in terms of yield. The highest grain weight from maize cobs was produced at the N1 (132,63 g), N2 + SM 300 kg (126,79 g) and N2 (126,43 g) sites. Starch content in the grain, was significantly lowest with NPK fertilisation, and potassium was supplied in the form of potassium sulphate (N2). The grain from the objects fertilised with Siarkomax, contained similar amounts of starch and was not significantly different from the object with the highest starch content (N1). The highest amount of accumulated protein was recorded with NPK fertilisation including calcium sulphate at 300 kg · ha⁻¹ and was on average 1,5% higher than fertilisation with potassium and phosphorus only (PK). Application of Siarkomax fertiliser improved plant nitrogen nutrition, as evidenced by an increase in SPAD values. NDVI index was at a similar level with the exception of the site where was no nitrogen applied (PK) – the lowest value.

Assessment of genetic diversity and population structure of carrot accessions with novel *DcSto* Intron Length Polymorphism markers

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Keywords: *Daucus carota*, MITE, PCoA, germplasm characterization, carrot breeding

The carrot, known as one of the world's top ten important vegetables because of its high nutritive value, offers many health benefits to heart health, vision, digestion, and skin. Carrot breeding plays an important role in fulfilling the continuous growing demand for carrots, as the gene pool exhibits vast phenotypic and genotypic diversity. Germplasm characterization is crucial for the conservation and utilization of these genetic resources, aiding in the identification, and understanding of diversity, traits, and potential uses of germplasms. Eastern and Western carrots represent the major cultivated gene pools in carrots. Genotypic-level germplasm characterization provides more valuable insights into the genetic makeup and diversity of accessions as compared to phenotypic germplasm characterization. Therefore, in this study we used novel panel of markers developed based on Intron Length Polymorphisms (ILPs) originating from the presence or absence of *DcSto* miniature inverted-repeat transposable element (MITE) insertions. The main objective of this investigation is to utilize these novel ILP markers to elucidate the genetic diversity structure and assess their ability to differentiate carrot gene pools.

We utilized a total of 176 *DcS*-ILP markers to genotype 62 plants, including 32 eastern accessions (ten of which were Indian breeding lines provided by Dr. Sarvamangala Cholin from UHS Bagalkot, Karnataka, India, for those two plants per

line were sampled) and 20 accessions representing western cultivated carrots. Genetic diversity was assessed using STRUCTURE with parameters set as follows: 10^5 burn-in and 10^5 MCMC, performing ten iterations with the admixture model. Additionally, Principal Coordinate Analysis (PCoA) was conducted using GenAlEx.

STRUCTURE analysis revealed the most probable value of $K = 2$, representing two groups: western accessions and eastern accessions with Indian breeding lines. At $K = 3$, three groups emerged, including western, eastern, and Indian accessions. PCoA demonstrated the distribution of plants across different quadrants based on their origins. The first three coordinates explaining a total of 29.21% of the variation (16.48%, 8.94%, and 3.79% by the 1st, 2nd, and 3rd coordinates, respectively). The results of STRUCTURE and PCoA analysis confirmed the effectiveness of the *DcS*-ILP markers in distinguishing and differentiating the accessions. These markers hold potential for various plant breeding applications, such as genetic diversity assessment and germplasm characterization.

Effect of atropine on muscarinic receptor (CHRM3) activity in the small intestine of chicks (*Gallus gallus domesticus*)

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Keywords: acetylcholine, atropine, muscarinic receptors, immunohistochemistry, chicks

Acetylcholine (ACh) was the first neurotransmitter identified in the intestine, and is currently considered the best known neurotransmitter of the intestinal nerves. ACh acts through muscarinic (mAChRs) and nicotinic receptors (nAChRs). Atropine and hexamethonium are the most commonly used muscarinic and nicotinic receptor antagonists in scientific research to understand the role of acetylcholine. The aim of the study was to examine whether the use of the muscarinic receptor antagonist – atropine will affect the activity of the muscarinic receptor 3 (CHRM3) in a six-hour culture *in vitro*. *In vitro* studies were carried out on a model of birds – chicks Ross 308: 2 hours (Day 0) and 24 hours after hatching (Day 1). From chicks (n = 30) duodenal fragments were collected and used for histology. An immunohistochemical technique – immunofluorescence – was used to visualize the expression of the CHRM3. CHRM3 was localized in the duodenum of chicks on days 0 and 1. Immunopositive (cytoplasmic) reaction was obtained in intestinal villi, Lieberkühn crypts, goblet cells in tissue from control chicks on days 0 and 1. There was no difference in immunolocalization and CHRM3 expression between the day 0 and day 1 control groups. In contrast, atropine induced a reduction in muscarinic receptor immunocytochemical expression only on day 0, this effect in the duodenum collected from the chicks on day 1 was not observed. The obtained results clearly show the importance of the muscarinic receptors as early as 2 hours after hatching and the technique has been proven to be useful in demonstrating receptor activity in the chick's intestine.

Amplitude of soil requirements of selected diagnostic undergrowth plant species

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Keywords: amplitude, soil properties, ecological requirements, plant cover, habitat conditions

Mesotrophic habitats are the most difficult to identify typologically as they often exhibit disturbed topsoil. The vegetation cover associated with them is not characterized by adequate constancy, as well as being a combination of plants of trophically diverse habitats. This study deals with the problem of proper selection of diagnostic species for forest habitats. The aim of the study was to determine tolerance ranges for 17 selected undergrowth species towards the most important soil characteristics. Species were selected that do not fully have a defined role in habitat diagnosis or their diagnostic importance differs from the indicative role of phytosociological classification. The study included analyses of humus levels of soil profiles and phytosociological images from 225 research plots located in reserves and national parks in Poland. Within the framework of the study, data tables for each species were compiled, extreme and optimum values for plant growth were determined, all species were compared in relation to four important soil chemical features, and the influence of soil features on plant occurrence was checked using PCA analysis. The results obtained showed a wide amplitude of soil requirements for most of the discussed ground cover plant species. The study did not prove a strong correlation between plants and any of the soil characteristics. It was concluded that a single

species is not a good determinant of site diagnosis, but a properly selected set of plants will be useful as a criterion for the determination of forest site conditions. The undergrowth plant species discussed in this study should be further investigated by taking into account other environmental factors that would allow a complete picture of the ecological requirements of these plants.

EduGen – a new diagnostic biotechnology based on DNA markers of the circadian rhythm in the engineering of personalized education

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Keywords: circadian rhythm, DNA markers, personalized education

The circadian rhythm (CR) is a fundamental cyclic process that regulates the sleep-wake cycle in most living organisms. CR is influenced by both environmental and genetic factors, which can be utilized to customize education. There are at least three main CR chronotypes: the morning lark, undifferentiated type, and night owl. These chronotypes are defined by different internal biological clocks that exhibit interindividual variability and regulate preferred sleep and wake times, hormone secretion, and body temperature. Disruption of the circadian rhythm can not only lead to civilization-related diseases but also impair cognitive function, hinder psychosomatic development, and result in suboptimal educational outcomes with long-term implications, particularly in terms of future career opportunities.

Chronotypes are determined not only by the expression of circadian rhythm genes but also by a series of inherited mutations associated with early or late chronotypes, which cannot be changed. These mutations define preferences for being a ‘morning lark’ (ML) or a ‘night owl’ (NO). Genes such as CLOCK, BMAL1, CRY1 ect. exist in the population with multiple variants (alleles) that differ by small

changes in the DNA sequence. These genetic variants form well-described genotypes (sets of alleles) for the morning lark or night owl chronotype are documented in the literature.

Furthermore, recent studies have indicated that students with different early and late genetic chronotypes may achieve different academic results, especially in scientific subjects. This can be attributed to the fixed start and end times of classes for all students. Lower academic grades can have an impact on both academic success and overall psycho-physical well-being, including mood disorders. It can be anticipated that the effects of circadian rhythm disruptions during adolescence may have long-lasting consequences in adult life, particularly in terms of career development opportunities.

In conclusion, profiling gene variants that regulate the circadian rhythm may enhance productivity, self-esteem, and ultimately improve the quality of student's lives. Understanding these associations provides a unique opportunity to engineer personalized education based on the genetic profile of circadian rhythm-regulating genes.

Effect of kale (*Brassica oleracea* L. var. *sabellica*) biofortified with iodoquinolines on the viability of human breast cancer cells

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Keywords: kale, iodine, quinoline, breast cancer

The number of new cases of cancer, which is also the second leading cause of death in the world, continues to increase. For this reason, it is important to find new solutions that could be used, either as part of prevention or to support the treatment process. A number of plant products show many health-promoting properties, including anticancer. Kale is a natural source of many bioactive compounds, including polyphenols, antioxidant vitamins, minerals. Indole-3-carbinol and sulforaphane have proven anticancer effects. Also, iodine and quinoline derivatives exhibit a number of health-promoting properties, including anticancer. The aim of this study was to determine the effect of extracts obtained from kale (*Brassica oleracea* L. var. *sabellica*) fortified with KIO_3 and two iodoquinolines: 8-Hydroxy-7-iodo-5-quinolinesulfonic acid (8-OH-7-I-5QSA) and 5-Chloro-7-iodo-8-quinolinol (5-Cl-7-I-8-Q) on breast cancer cell viability. Extracts obtained from two cultivars of kale cultivated in a hydroponic system were used in the study: cv. „Oldenbor F₁’ (green kale) and cv. „Redbor F₁’ (red kale). The results of our study showed that extracts obtained from both cultivars of kale enriched with iodoquinolines and KIO_3 significantly reduced the viability of MCF-7 cells (hormone-dependent

human breast cancer line) and MDA-MB-231 cells (hormone-independent breast cancer line). The results suggest that kale biofortified with iodoquinolines (8-OH-7-I-5QSA and 5-Cl-7-I-8-Q) reduces the viability of cancer cells, and thus may become an important element of prevention and support for cancer treatment in the future. However, further research is needed to explain the mechanisms responsible for this effect.

Coagulase-negative Staphylococci resistant to β -lactam antibiotics, macrolides and lincosamides isolated from surface waters and artificial snow in mountain areas

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Keywords: Staphylococci, Antibiotic Resistance Genes (ARGs), Antibiotic Resistance bacteria (ARB), water environment

Coagulase-negative *Staphylococcus* spp. (CoNS) are common human opportunistic pathogens also isolated from the aquatic environment. The emergence of methicillin-resistant coagulase-negative staphylococci (MR-CoNS) in the environment as well as multi-drug resistant coagulase-negative staphylococci (MDR-CoNS), causing infections that are difficult to treat due to their resistance to beta-lactam antibiotics are of increasing concern. The second group of waterborne staphylococci that could pose a threat to public health are CoNS with a mechanism of resistance to macrolides, lincosamides and streptogramins B (MLS_B). Environmental bacteria are considered to play a role as drug resistance genes' reservoir that can enhance the resistance gene pool of pathogenic bacteria through horizontal gene transfer (HGT). One of the ways of using river water in the mountain environment is to retain it in water reservoirs and use it for artificial snow production on ski slopes.

In two following winter seasons, a total of 78 CoNS were isolated from artificial snow and water used for its production from the ski stations in Podhale, Beskid

Wyspowy, Beskid Śląski and the Western Tatras in Slovakia. The membrane filtration technique with Baird Parker selective medium was used for the isolation of staphylococci. Staphylococci were identified to the species level using Matrix-assisted laser desorption/ionization-time of flight mass spectrometry (MALDI-TOF). Antimicrobial resistance profiles of different species of CoNS and the prevalence of genes determining the antibiotic resistance mechanisms (MR, MLSb) were investigated.

The most frequent isolated staphylococcal species were: *S. warneri* (24%), *S. haemolyticus* (17%), *S. epidermidis* (15%) and *S. equorum* (12%). *S. haemolyticus* and *S. epidermidis* are the most clinically relevant CoNS, causing nosocomial infections, wound and bone infections and even sepsis. Moreover, two clinically significant strains of *S. lugdunensis* causing cardiovascular infections were isolated from artificial snow. MLSb, MSb and MR resistance mechanisms were identified among 14, 7 and 30 strains, respectively. Three strains of the species *S. lugdunensis* and *S. haemolyticus* have been identified as multidrug resistant. Among the tested bacteria, the following 9 genes determining MLSb mechanism were identified: *msrA* (44%), *msrB* (12%), *msrA1* (12%), *vga* (9%), *lnuA* (6%), *ereB* (3%), *vat* (2%), *vgb* (1%), *mphA* (1%). In addition, the *mecA* gene, which determines methicillin resistance, was detected among 10% of the strains.

The conducted research indicates the presence of antibiotic-resistant CoNS and ARGs in the mountainous aquatic environment, which has a negative impact on the environment and public health.

Compare the microclimate and sanitary conditions during hatching in the traditional system and the “on-farm system”

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Keywords: chicken broiler, hatchability, microbiology, microclimate

The welfare of the chick from the first day of life is one of the priorities of modern poultry production. For this reason, the latest solutions in hatching technology make possible feeding drinking of chicks in the hatcher. However, these solutions don't eliminate the distress that caused microclimatic factors and the risk of perinatal contamination present in the hatcher chamber. These risks seem to be avoided by another alternative hatching system, that of “on-farm hatching”. This solution eliminates the need for a hatcher, as hatching takes place in the chicken-house, where the embryoned eggs are delivered on day 19 of incubation. Therefore, it was interesting to compare the microclimate and hygienic conditions during hatching in the traditional system and the “on-farm system”.

Hatching eggs of 50 weeks old parental flock of chicken broiler Ross 308 (Avia-gen) were incubated in setter (Pas Reform) of commercial hatchery (DanHatch

Poland JSC.). The 2250 eggs were candled at 441 hour of incubation (h.i), and embryonated eggs were selected and randomly divided into three parallel groups. The incubation of the control group (5 baskets) was continued in the hatcher. The other eggs were transported (1 h) into the experimental chicken house (ZD Gorzyń, Poznan University of Life Science), and set on litter (L-litter group) or plastic trays (T-tray group).

The hatchability in the hatcher was 96.4% in compare to 93.9 and 95.8% for “on-farm” litter and tray groups, respectively ($P > 0.05$). More importantly, there were found only 0.1–0.3% crippled or dead chicks in the “on-farm system” but 2.1% in the traditional system ($P < 0.05$). Microclimatic parameters during “on-farm hatching” were: temperature 33.8 ± 3 °C, RH 18.4 ± 1.5 , litter surface temperature $32\text{--}34$ °C. Analysis of the quantitative and qualitative composition of the eggshell and litter microflora did not reveal the presence of *Enterobacteriaceae*, *Pseudomonas aeruginosa*, *Listeria monocytogenes*, *Staphylococcus aureus* and *Bacillus cereus*. The total number of mesophilic aerobic microflora on the surface of shells and litter after hatching in group “hatcher” was estimated at the level of 4–5 log CFU/g of shell, and about 5 log CFU/g of litter, which was about twice as large then “on-farm hatching” groups. However, after 7 days of rearing, there were no differences in the purity of the microbiological litter and its qualitative composition between the groups.

In summary the “on-farm hatching” in compare to tradition one seems to be more hygienic and friendly to chicks.

The impact of adding white clover flower flour to wheat flour muffins on starch digestibility and glycaemic index *in vitro*

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Keywords: starch digestibility, glycaemic index, white clover, muffins

Type 2 diabetes is nowadays a serious problem in many countries around the world and represents 90% of all types of chronic non-communicable diseases while being one of the five leading causes of death in the human population. Hence, new products with decreased glycaemic index are searched for. The aim of the study was to determine the impact of white clover flowers (*Trifolium repens* L.) addition in the lyophilised form to muffin biscuits on the starch digestibility and the value of the glycaemic index *in vitro*. The research material consisted of five types of muffins: (1) without the addition of white clover used as the control and with the following percentage share of white clover lyophilisates: (2) 2.5%; (3) 5%; (4) 7.5%; (5) 10%. The following parameters were measured: total starch (TS), as well as slowly digestible starch (SDS), rapidly digestible starch (RDS), rapidly available glucose (RAG), resistant starch (RS), and starch digestion index (SDI). The amount of RDS in the tested biscuits was in the range of 9.88–22.03 ($\text{g} \cdot 100 \text{ g}^{-1} \text{ d.m.}$) while the content of RAG in the frame of 19.86–34.67 ($\text{g} \cdot 100 \text{ g}^{-1} \text{ d.m.}$). Both parameters (RDS, RAG) were significantly lower for all muffins with an addition of white clover flowers compared to the control product ($p < 0.05$). The amount of SDS in the tested biscuits was in the range of 3.71–6.73

(g · 100 g⁻¹ d.m.). All muffins enriched with white clover flowers had statistically significantly greater amounts of this starch fraction compared to control muffins ($p < 0.05$), except the muffins with a 2.5% addition ($p > 0.05$). The amount of RS in the examined muffins was in the range of 16.54–28.57 (g · 100 g⁻¹ d.m.). All muffins enriched with white clover flowers had a statistically significantly greater amount of this starch fraction than control muffins ($p < 0.05$). SDI values were within the 29.44–64.45% range and were statistically significantly decreased upon adding white clover flowers ($p < 0.05$). The replacement of wheat flour with flour from *Trifolium repens* L. contributed to the production of functional muffins with lowered glycaemic index *in vitro*, which might be beneficial for people suffering from type 2 diabetes and for those, who would like to prevent the development of this disease.

Chemical composition, polyphenol content and antioxidant activity of durum pasta enriched with lion's mane (*Hericium erinaceus*)

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Keywords: antioxidant activity, polyphenol content, *Hericium erinaceus*, semolina durum

The biggest cause of many diet-related diseases is widely available deficient food. It is estimated that in Poland about 12 million people suffer from various diseases caused by a deficient diet. Stress, haste and diseases of civilisation are buzzwords that perfectly sum up these times. They are interconnected because the rush of everyday life will translate into prolonged stress. There are substances that have a neuroprotective effect, facilitate the management of anxiety and stress and support our wellbeing. One of the raw materials rich in these substances is the fungus, lion's mane. The numerous polysaccharides present in the fruiting body of lion's mane provide excellent support for our immune system and brain. This medicinal mushroom is also rich in biologically active substances including polyphenols that exhibit antioxidant properties.

One of the basic cereal products is pasta. Due to the development of diet-related diseases, an attempt has been made to enrich pasta with bioactive components and increase its nutritional value.

The aim of this study was to determine the effect of lion's mane on the chemical composition, polyphenol content and antioxidant activity of durum wheat pasta. A control pasta (100% semolina durum) and pasta enriched with 3, 6, 9 and 12%

lion's mane were produced in the semi-technical using the MAC 30S-Lab extruder (ItalPast) and EAC 30-Lab pasta dryer (ItalPast). The obtained pasta samples were tested for the chemical composition, polyphenol content and antioxidant activity.

The study showed that each percentage addition of lion's mane increased the amount of protein, fibre and raised the total polyphenol content of the pasta, which translated into an increase in the antioxidant activity of the product.

In conclusion, it is possible to use lion's mane to fortify durum pasta and obtain a product with higher nutritional value.

Inoculation of carrot (*Daucus carota* L.) seeds with endophytic bacteria (*Pantoea vagans*) as an ecological way of counteracting the effects of salinity on plant germination and growth

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Keywords: inoculation, endophytic bacteria, biostimulants, carrot, salt stress

In recent years, there has been an increasing research in the use of endophytic microorganisms in agriculture. These microorganisms, which naturally inhabit plant tissue, have a wide range of beneficial effects on the host's development, even in stressful conditions. Salinity is one of the stresses that most disturb plant life processes, though endophytes can be used as biostimulators and thereby contribute to the reduced use of chemicals in agriculture.

The aim of this study was to demonstrate the effect of endophytic bacteria on the germination and development of inoculated carrot seeds under salt stress.

The carrot seeds were disinfected and then inoculated with endophytic bacteria strain SRS89 of *Pantoea vagans* for 0 h, 1 h, or 3 h (Simlat et al. 2023). The seeds were germinated in pots with disinfected soil and watered with NaCl solutions in concentrations of 0 mM, 100 mM, and 150 mM. Observations of emergence were carried out for 30 days; then, 9 weeks from the beginning of the experiment, the morphological parameters of the obtained plants were assessed.

Germination of the carrot seeds was significantly weakened after watering with water containing NaCl at a concentration of 150 mM, where emergence was recorded at the level of 28%. However, seeds inoculated for 1 h showed a significant improve-

ment in germination even under saline conditions. Here, as much as 111% more emergence was recorded compared to non-inoculated seeds. The plants obtained under these conditions were also 63% taller and had 107% more fresh weight compared to the controls. Seed inoculation time of 3 h also yielded improved growth under control conditions (watering with water without NaCl). The plants obtained under these conditions were taller (30%) and of greater weight (120%) in relation to the seedlings obtained from non-inoculated seeds.

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The impact of herbal additives in broiler chicken nutrition on the fatty acid profile of muscles

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Keywords: herbs, poultry, fatty acid profile, meat

Due to its nutritional value, dietary benefits, and relatively low cost, poultry meat is an important component of sustainable human nutrition. Although chicken meat is a valuable source of nutrients such as protein, vitamins, and minerals, concerns often arise regarding its fat content, fatty acid profile, and cholesterol levels and their impact on health. Increasing consumer awareness of functional food and growing interest in products considered natural contribute to the continuous development of the poultry sector. To obtain high-quality meat that meets the requirements of potential customers, producers seek natural feed additives that can beneficially modify its chemical composition. Herbs used in poultry nutrition contain numerous biologically active substances, such as phenolic compounds and vitamins, which play a crucial role in preventing lipid oxidation in meat. Several scientific reports have also demonstrated the favorable effects of various herbs in broiler chicken diets on altering the fatty acid profile of the meat. The most desirable effects include an increase in the proportion of polyunsaturated fatty acids (PUFAs) and monounsaturated fatty acids (MUFAs), as well as a decrease in the content of saturated fatty acids (SFAs) in the muscles. This change in the fatty acid profile contributes to improving the nutritional quality of poultry meat. The aim of this study was to review the latest scientific findings regarding the impact of herbal additives in broiler chicken nutrition on the lipid profile of muscles.

Sorption properties of soils after afforestation with different tree species

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Keywords: sandy soil, sand mine, afforestation, sorption properties, reclamation forest

Sorption properties of soils refer to their ability to adsorb or retain substances such as water, nutrients, and contaminants. Afforestation plays a significant role in ecosystem restoration and land management, but its impact on soil properties, particularly sorption properties, remains poorly understood. This study aims to investigate the sorption properties of soils after afforestation with different tree species, focusing on four tree species: Scots pine (*Pinus sylvestris* L.), European larch (*Larix decidua* Mill.), Silver birch (*Betula pendula* Roth), and European oak (*Quercus robur* L.). The research area for this study was selected as a 40-year-old forest situated on an open-cast sand mine pit.

In this study, soil samples were collected from each horizon of the soil profile in the experimental plots to evaluate the sorption properties of the soil. To assess these properties, exchangeable cations were extracted from the soil samples using a 1M CH₃COONH₄ solution and quantified using the CP OES ICAP 6000

Series spectrometer. Additionally, the exchangeable acidity (Hh) was determined using the Kappen method, which involved extracting the soil with a solution of 1M $\text{Ca}(\text{CH}_3\text{COO})_2$. The obtained data were subjected to a descriptive analysis, and the results were interpreted to gain a better understanding of the soil's sorption characteristics.

Based on the WRB classification, the selected soils have been classified as Arenosols. The results demonstrate variations in the sorption properties of soils after afforestation with different tree species, indicating that afforestation can influence soil sorption processes.

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Evaluation of ECOSTRESS thermal data for the city of Krakow according to the land cover type

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Keywords: ECOSTRESS, Land Surface Temperature, land cover, Urban Heat Island

The assessment of thermal data plays a crucial role in spatial planning, environmental monitoring, and research on climate change. The increase in temperature in cities has a significant impact on the quality of life for residents. The urban heat island effect causes urban areas to be considerably warmer than surrounding rural areas. High temperatures result in a range of negative consequences, such as increased energy demand for cooling, heightened health risks, as well as adverse effects on the natural environment.

The objective of the conducted research is to analyze thermal differences for the city of Krakow, based on imagery from the ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) satellite, in the context of various land cover types. ECOSTRESS provides valuable information on Land Surface Temperature (LST) with high spatial resolution, enabling a detailed analysis of thermal urban patterns.

For classification and determination of vegetation indices, images from the Sentinel-2 and Planet missions were utilized in the research. The assessment of thermal impact was based solely on Land Surface Temperature values.

The analysis of thermal data allows for the identification of significant differences in the thermal characteristics of Krakow depending on the type of land

cover. The distribution of LST exhibits substantial variations, which result from the composition of land cover and the spatial configuration of different surface materials. High LST values are observed in impermeable areas such as buildings and roads, indicating the presence of the urban heat island effect. On the other hand, areas with vegetation and water bodies exhibit lower LST values, indicating a cooling effect.

The role of diet and lifestyle in women with breast cancer

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Keywords: breast cancer, lifestyle, nutrition in cancer prevention

Malnutrition is a significant concern for cancer patients, including breast cancer, due to the side effects of treatments like chemotherapy. Chemotherapy can lead to symptoms such as vomiting, diarrhea, and loss of appetite, which can contribute to malnutrition. On the other hand, hormone therapy may pose a risk of weight gain.

Diet plays a key role in both the prevention and treatment of cancer. Approximately 50% of cancer cases are believed to be related to lifestyle factors, including diet. It is important to pay attention to key nutrients in the context of breast cancer such as: proteins (adequate protein intake is essential for tissue repair and recovery), antioxidants (vitamins A, C, E, and D can help protect cells from damage), minerals (calcium, selenium, and zinc are important for various bodily functions and overall health), omega-3 fatty acids (found in fatty fish, flaxseeds, and walnuts, have anti-inflammatory properties and may be beneficial for breast cancer patients), dietary fiber (important for digestive health and may help maintain a healthy weight), polyphenols (plant compounds with potential anti-cancer and anti-inflammatory effects), phytoestrogens, (plant-derived compounds that can mimic or modulate the effects of estrogen in the body. Some phytoestrogens, like those found in soy, have been studied for their potential benefits in breast cancer).

A balanced and nutritious diet, individuals can potentially reduce their risk of developing cancer and support their overall health. However, it's important to note that diet alone cannot replace medical treatments but can complement them as part of a comprehensive approach to cancer care.

The aim of the study was to assess the nutritional status and food preferences of women suffering from breast cancer. The study involved 15 women staying in the „Ustroń” S.A. in the Amazon group.

To evaluate the nutritional status, anthropometric measurements such as body height and weight were taken using an electronic medical scale with a height indicator. The researchers also used an anonymous personal questionnaire consisting of 25 questions regarding body weight, height, nutritional preferences and lifestyle.

It was observed that respondents with a normal body weight consumed products with antioxidant properties. Women undergoing hormone therapy reported consuming silage more frequently compared to patients receiving other therapies. However, the majority of respondents were overweight, which is a risk factor for cancer and can have a negative impact on treatment. Chemotherapy was the most commonly used method among the participants.

The analysis revealed that the patients' diets were not optimal. Their diets were high in saturated fat, meat, and cold cuts, while lacking legume consumption and meal regularity. Additionally, only 30% of respondents reported engaging in physical activity more than once a week.

Based on a analysis of the research, it was concluded that nutritional education of patients is crucial for cancer prevention and therapy. By enhancing their awareness of the principles and impact of proper nutrition and physical activity on disease development, patients can improve their health and well-being.

Attending to prevailing environmental challenges through the adoption of sustainable innovative technology

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Keywords: peat, organic substrate, forest seedlings, chemical properties, fertilizer

There is no doubt that we live in moments when mind-boggling matters are going on at the same time in our climatic and geological zone. The problem of the availability and quality substrate for seedling growth in Polish forest nurseries and gardens has been identified to demand urgent attention with a high level of success recorded. However, crop survival beyond the nursery stage is another significant issue that is yet to be addressed. The study investigated the adaptability of forest tree seedlings of European beech (*Fagus sylvatica* L.) and English oak (*Quercus robur* L.) and their root system to innovative organic substrate (R20, R21 and R22) and fertilizer (solid and liquid) with the view to establishing the best method of seedling production under forest plantation. peat substrate used for this study was produced as an experiment at the forest nursery in Daleszyce. The quality of elements was calculated according to the schedule of fertilization of the state forest (SR20, SR21 and SR22) and the novel fertilizer concept of the University of Agriculture in Krakow (UR20, UR21 and UR22) while SC and UC stand as the control substrates (peat) in both cases respectively. The laboratory analysis was carried out in The Laboratory for Geochemistry of Forest Environment and Areas Intended for Reclamation. Although the trend of the study promises to be for an extended peri-

od, so far, however, substrates mediums developed under this study have proven; to possess qualities not worse than the substrate based on high peat, guarantee quantity and reliability of supplies. In addition, the technology is cheaper with readily available materials, obviously, the components would partially or completely replace high peat in the substrate formula.

Evaluation of biometric parameters of arugula seedlings (*Eruca vesicaria* L. subsp. *sativa*) treated with silver nanoparticles

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Keywords: nanotechnology, germination, seeds, gum Arabic, biotechnology

Nanotechnology is interdisciplinary field of science concerning the structures of elements whose dimensions range from 1 to 100 nm. Due to the various applications of metal nanoparticles in industry, it is necessary to assess the potential toxicity of these compounds to vegetable plants. The aim of the experiment was to evaluate the biometric parameters of arugula (*Eruca vesicaria* L. subsp. *sativa*) seedlings exposed to various concentrations of silver nanoparticles. The composite with silver nanoparticles (AgNPs) was obtained by chemical synthesis. The stabilizer used was gum arabic (2%), and the reducer: ascorbic acid. The starting concentration of nanosilver

was 500 ppm. Then, using distilled water, the composites were diluted in such a way as to finally obtain the following concentrations: 10 ppm, 20 ppm and 50 ppm. The gum arabic solution was diluted in the same way. Arugula seeds in the amount of 20 seeds per plate were placed on paper saturated with diluted test solutions with nanoparticles, and samples with water and aqueous solution of gum arabic without AgNPs were marked as controls. Each experimental object was repeated 3 times. Incubation was carried out for 10 days. After this time, the seed germination capacity was determined and the length of the root and stem of the seedlings was measured. High values of germination capacity were obtained in all samples. In the case of the average length of the stem, the highest values were obtained in the AgNPs test with a concentration of 10 ppm, and the lowest in the AgNPs test with a concentration of 50 ppm. In the case of the average length of the root, high values were obtained in all experimental samples, except for the tests with distilled water and a 5-fold diluted gum arabic solution. However, in the case of medium lengths of seedlings, the highest value was obtained in the case of the sample with nanosilver with a concentration of 10 ppm, and the lowest in the case of the control sample with distilled water. Based on the conducted research, it is concluded that the solutions of composites with silver nanoparticles did not disturb the growth of arugula seedlings due to the high values of biometric parameters.

Effect of polymer composites containing gold nanoparticles on the germination of red cabbage (*Brassica oleracea* var. *capitata* f. *rubra*)

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Keywords: AuNPs, chemical synthesis, seeds, red cabbage, nanotechnology

Gold nanoparticles are example of metal nanostructures that have found their application in medicine and cosmetology. Red cabbage is a leaf vegetable used for the production of various food products due to its numerous active compounds needed for the proper functioning of the human and animal body. The aim of the experiment was to evaluate the biometric parameters of red cabbage seedlings exposed to gold nanoparticles obtained by using maltose as a reducing agent. Polymer composites were synthesized using sodium alginate (2%). The reducing substance needed to obtain nanoparticles from salt containing gold was maltose solution (4%). The concentration of gold nanoparticles was 50 ppm. Then, the alginate gel with nanoparticles was diluted with distilled water five times and ten times, which resulted in water solutions with concentrations of nanogold: 10 ppm and 5 ppm. Then, 4 ml of the experimental solutions

were dropped onto paper plates, while the aqueous solutions with alginate and distilled water were designated as controls. Twenty red cabbage seeds were sown on each plate. Incubation was carried out for 12 days. After incubation, the average lengths of stems, roots and whole seedlings were measured. The highest average values for the stem, root and whole seedlings were recorded for the control sample with water, while the lowest for the solution with nanogold at a concentration of 10 ppm. Based on the conducted research, it is concluded that water solutions of polymer composites containing gold nanoparticles did not inhibit the growth of seedlings, however, the solution of nanoparticles at a concentration of 10 ppm limited the growth the most due to the lowest values of biometric parameters.

Evaluation of biochemical parameters of red cabbage seedlings (*Brassica oleracea* var. *capitata* f. *rubra*) treated with silver nanoparticles

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Keywords: green chemistry, biopolymers, tissue biochemistry, seedlings, red cabbage

Due to the wide application of metal nanoparticles in numerous branches of industry and economy, it is necessary to verify the impact of these structures on living organisms inhabiting the ecosystem. The aim of the study was to evaluate the effect of aqueous solutions of polymer composites containing silver nanoparticles on the content of biochemically active compounds such as: carotenoids, anthocyanins, chlorophyll a and chlorophyll b. Polymer composites were synthesized by using sodium alginate (1.5%). The reducer used to obtain the nanoparticles was fructose solution (4%). The final concentration of the obtained nanosilver was 150 ppm. The obtained compos-

ites were quantitatively diluted in such a way as to obtain water solutions containing silver nanoparticles with a concentration of 20 ppm and 60 ppm. Alginate composites without nanoparticles were diluted in the same way and designated as positive control. The negative control was distilled water. Then, 20 ml of the experimental solutions were spotted on the growth material on the surface of which red cabbage seeds weighing 1 g were sown. The seeds were incubated for 10 days. Each experimental object had 3 replicates. After incubation, 100 mg of red cabbage seedling tissue was collected and plant extracts were prepared, which were evaluated spectrophotometrically for the content of plant pigments: carotenoids, anthocyanins, chlorophylls a and chlorophyll b. The results obtained in the conducted tests showed no reduction in the production of plant pigments in the tissue of red cabbage seedlings, despite the presence of silver nanoparticles. Based on the conducted research, it is concluded that aqueous solutions of alginate composites containing two concentrations of silver nanoparticles; 20 ppm and 60 ppm, obtained with the use of fructose as a reducing agent, do not limit the processes of pigments synthesis in red cabbage tissue.

Effect of magnesium addition to feed on technological and dietary properties of edible snail meat and shells

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Keywords: animal production, edible snails, magnesium addition

A study was conducted to investigate the effects of magnesium supplementation on *Cornu aspersum* snails. Four different levels of magnesium oxide were added to the snails' feed to obtain certain levels of magnesium: 2.45 g/kg (KON – no addition), 3.26 g/kg (M3), 5.56 g/kg (M5), and 7.15 g/kg (M7). The snails were reared in plastic containers under optimal conditions for four months.

Snails in the M7 group exhibited the highest mean body weights at 2 and 3 months of age (5.39 g and 8.21 g, respectively), while the lowest weights were observed in the M3 group (4.32 g and 7.32 g). Post-slaughter measurements showed that the M3 group had the widest shells (30.79 mm), while the M7 group had the narrowest shells (29.03 mm). The M7 group also had the lowest body weight and the highest shell weight (29.03 g and 1.61 g, respectively). The M3 group had the highest body weight (8.45 g), while the KON group had the lowest shell weight (1.39 g). The percentage of carcass share in body weight was highest in the KON group (85.45%) and lowest in the M7 group (81.98%). The M3 group had the lowest shell massiveness index (20.26), while the M7 group had the highest (23.58). Significant differences were found only in the crude protein content of snail meat, with the KON group having the highest content (59.97% of dry matter) and the M3 group having the lowest (51.05%). The M5 and M7 groups showed a trend of increasing crude fat

content and decreasing crude ash compared to groups with lower magnesium levels. Lipid peroxidation was the highest in the M7 group, suggesting a pro-oxidative effect of high magnesium supplementation. The M3 group had the lowest levels of Ca, Cu, Mg, P, and Zn but the highest level of Fe in snails' meat. The M5 group had the highest shares of Mn and Si, while the M7 group had the lowest levels of Mn and Na. The KON group had the highest percentages of Ca, Cu, Mg, Na, P, and Zn and the lowest rates of Fe and Si.

In summary, the study demonstrated that different levels of magnesium supplementation in the feed of *Cornu aspersum* snails significantly affected their growth, shell characteristics, carcass composition, and nutrient content. The optimal level of magnesium supplementation for achieving desirable outcomes regarding body weight, shell parameters, and nutrient composition requires further investigation.

Evaluation of antifungal properties of rowanberries (*Sorbus aucuparia* L.) extracts against *Fusarium* spp.

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Keywords: *Sorbus aucuparia*, *Fusarium* spp., antioxidant properties, antifungal activity, ergosterol, supercritical fluid extraction

Fungal infections are among the most common diseases of crop plants. Various species of the *Fusarium* spp. are naturally prevalent and globally cause the qualitative and quantitative losses of farming commodities mainly, cereals, cereal-based products, fruit, and vegetables. In addition, *Fusarium* spp. can synthesize toxic secondary metabolites – mycotoxins under high temperature and humidity conditions. Among the strategies against *Fusarium* spp. and mycotoxin biosynthesis, The application of biological control specifically natural plant extracts has proved to be one of the solutions as an alternative to synthetic fungicides (Stępień et al. 2016).

Rowanberries taken from *Sorbus aucuparia* are a rich source of phytochemicals, such as vitamins, carotenoids, flavonoids and phenolic acids as well as minerals, iron, potassium, and magnesium. Moreover, in many studies, rowanberries exhibited significant antioxidant activity, which was comparable or in some cases even higher than that of many other edible berries, such as chokeberries and bilberries (Isaikina et al. 2018).

The aim of the study was to investigate the effect of rowanberries extracts, obtained by supercritical fluid extraction (SFE) under different conditions, on the growth of *Fusarium* (*F. culmorum* and *F. proliferatum*) and ergosterol content.

The results showed that the extraction conditions (40 and 70°C, 200 and 300 bars) had different effects on mycelium *Fusarium* growth and ergosterol content in comparison to the control (PDA without extract). These findings suggest that rowanberries extracts obtained by the CO₂ SFE method could be a natural alternative to synthetic fungicides for eradicating *Fusarium* pathogens in crops, particularly cereal grains. However, more research is necessary to evaluate their efficacy against other *Fusarium* species and *in vivo* applications before considering them as a viable alternative to synthetic fungicides.

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Impact of silver nanoparticles solution on *Pleurotus ostreatus* mycelium growth in analog moon habitat

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Keywords: fungi, mycelium, AgNPs, moon habitat, matter recycling

Fungi serve a significant purpose in matter circulation. It is on account of their ability to decompose complex substances into simple compounds. Strict isolation facilities, such as the International Space Station or Analog Astronaut Training Center Habitat were forced to develop efficient waste-management solutions, in order to generate as few spare substances as possible. It was hypothesized that *P. ostreatus* mycelium enriched with silver nano-particles can be included as a controller of an organic matter recirculation system. The aim of the experiment was to examine the impact of silver nanoparticles (AgNPs) on *P. ostreatus* mycelium growth in Habitat conditions,

as well as to determine if AgNPs can prevent *P. ostreatus mycelium* cultures against pathogens.

P. ostreatus mycelium cultivation was established onboard Analog Moon Habitat in Rzepiennik Strzyżewski, Poland. Petri dishes were filled with agar-based growing medium and AgNPs solutions with concentrations as follows: 5 ppm, 10 ppm, and 25 ppm. Distilled water was used in order to establish a control group. Images of each dish were taken every 24 hours and analyzed using MatLab Image Viewer software. The diameter of mycelium was measured and differences between treatments were tested statistically. The largest values have been observed for the control group, and lowest for the 25 ppm AgNPs group. Application of AgNPs did not reveal any visible toxicity towards mycelium. AgNPs were able to prevent development of pathogens during *P. ostreatus* cultivation.

P. ostreatus mycelium showed culturing potential in Analog Habitat conditions. Once a proper amount is harvested, it can also be used as an organic matter recirculation system mentioned before. The system may have increased efficiency due to AgNPs serving as anti- microbial substances.

Formulation and non-cytotoxic properties of edible chitosan-alginate based coatings enriched with tumeric and oregano additives

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Keywords: edible coatings, Alginate, Chitosan, Cytotoxicity, Proliferation

Nutrient dense food products are not only in demand by the consumers but also highly profitable for the agricultural sector. One of the most popular methods applied to reduce the risk of product spoilage is the use of single-use synthetic packaging, which is a major problem worldwide. Today, plastic pollution is so prevalent, it's microparticles can be found in human and animal bodies, oceans, soil, drinking water and air. This study aimed to develop and synthesize polysaccharide complexes in the form of edible chitosan/alginate coatings with and without the addition of two-phase equilibrium condensate from turmeric or oregano. We also aimed to evaluate the dose-dependent cytotoxicity of films. In the present study we obtained five different coatings. ATR-FTIR spectra verified the relationship between the polysaccharide components and, together with UV-Vis spectra, confirmed the introduction of the two-phase equilibrium condensate of oregano or turmeric into the chitosan/alginate complexes. Presented synthesis of polysaccharide complexes is environmentally friendly and non-toxic. In *in vitro* cytotoxicity testing based on

the measurement of lactate dehydrogenase (LDH) activity on HepG2 and BJ cell lines, they were shown to be non-cytotoxic materials (IC50% was not reached). In BrdU assay for HepG2 cells increase in cell proliferation was observed for 3, 4, and 7 mg/mL of OS3 ($124,79 \pm 32 \pm 9,21$; $162,4 \pm 10,46$; $165,37 \pm 18,44$) after 72 h. In BJ cells, no significant decrease in proliferation was noted after 24- and 48-hour exposure to OS0 and OS1 (1–7 mg/ml). The presented results suggest that the obtained coatings do not have significantly strong cytotoxic properties and do not negatively affect the proliferation of HepG2 and BJ cells, which may indicate their safety for use as edible coatings. However, further research is needed on other cell lines, animal models and food products.

The effect of vitamin D₃ on the embryonic development of carp (*Cyprinus carpio* L.)

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Keywords: vitamin D₃, common carp, embryonic development

This study aimed to investigate the effect of vitamin D₃ on embryonic development, survival and percentage of deformities in common carp (*Cyprinus carpio* L.) larvae. The research material consisted of oocytes obtained from seven sexually mature female carp and semen obtained from four sexually mature male carp. The collected eggs obtained from each female were divided into 70 Petri dishes (on average 150 grains per dish) and then fertilized with sperm, with a volume of 10 µL per dish. After fertilization, the water in the dishes was replaced with a water with the addition of vitamin D₃, with a concentration of 0 ng/mL in the control group and 1, 10, 50, 100 ng/mL in the experimental groups. During the 96-hour incubation, water with various vitamin D₃ concentrations was regularly changed and the survival of eggs was monitored every 24 hours. Hatching of carp larvae began after 93 hours of incubation, during which the frequency and type of deformed larvae were determined. Results of this study showed that tested concentrations of vitamin D₃ do not adversely affect the survival of eggs, embryonic development and an increase in the number of deformities occurring in newly hatched common carp larvae.

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Effects of Tree Species and Charcoal Removal on Soil Sorption Properties in Post-Fire Forest Recovery

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Keywords: soil sorption properties, forest reclamation, post-fire, tree species, charcoal presence

Forest fires are natural disturbances that have significant and lasting effects on soil properties and ecosystem dynamics. Understanding the long-term impact of fire on soil sorption properties is crucial for successful reclamation efforts. This study aims to investigate the soil sorption properties in a forest reclamation, 30 years after a fire, with a particular focus on the influence of tree species and the presence of charcoal. Four different tree species, namely pine (*Pinus sylvestris* L.), larch (*Larix decidua* Mill.), birch (*Betula pendula* Roth), and oak (*Quercus robur* L.), were selected as representative species for the study. Two distinct areas within the reclamation forest were identified: one where charcoal was present after the fire and another where charcoal was removed. These areas were chosen to examine the potential effects of charcoal remnants on soil sorption properties. Soil samples were collected from each horizon of the soil profile in the experimental plots. To assess soil sorption characteristics, exchangeable cations were extracted using 1M CH₃COONH₄ and quantified using the CP OES ICAP 6000 Series spectrometer. The exchangeable

acidity (Hh) was measured through the Kappen method involving extraction with 1N $\text{Ca}(\text{CH}_3\text{COO})_2$. The preliminary findings indicated notable variations in soil sorption properties among the different tree species and charcoal presence. Visual examination of the results suggested potential trends and patterns. These observations underscore the potential influence of tree species and the presence of charcoal remnants on soil sorption properties in forest reclamation. This study contributes to the understanding of long-term soil dynamics in post-fire reclamation forests. The results emphasize the importance of considering tree species and charcoal presence when assessing soil sorption properties. Further research is warranted to validate and expand upon these preliminary findings.

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Comparison of bioactive compounds in fermented mushrooms

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Keywords: lactic fermentation, bioactive compounds, vitamins B₁ & B₂, antioxidant activity, polyphenols

Mushrooms are recently gaining spotlight for their nutritional and medicinal properties. Due to their short shelf life they have to be processed within 3–5 days of harvest and the processing method affects the sensory properties and the content of bioactive compounds in the end product. Lactic fermentation is one of the oldest and traditional methods of preservation that enhances the flavor profile and increases the nutritional value of the food product. Fresh caps of brown *Agaricus bisporus* and *Imleria badia* were blanched in water for 2 min as pretreatment and fermented at 21°C or 26°C until pH ≤ 4.5 (3 days) and then at 4°C for the next 14 days with/without addition of probiotic bacteria: *Lactobacillus acidophilus* strain LA-5 (Hansen) and *Lactobacillus plantarum* strain SWA016 (Swanson). After fermentation, the pH of all products reached below 4.5 and were analyzed for vitamin B₁ and B₂ by HPLC methods, antioxidant activity by ABTS, DPPH and FRAP methods; and phenol profile was analyzed by spectrophotometric method. *A. bisporus* had higher contents of both vitamin B₁ and B₂ compared to *I. badia*, ranging from 0.50 to 0.85 mg/100 g dm and 3.08 to 4.63 mg/100g dm, respectively. ABTS and FRAP activities in both species were similar, but *I. badia* showed an increase of 15–43% of DPPH activity compared to *A. bisporus* under similar fermentation conditions. *I. badia* had higher

total phenol contents than *A. bisporus*, particularly in products fermented at 21°C. Products added with *L. plantarum* had the highest contents of anthocyanins and phenylpropanoids, and those added with *L. acidophilus* strain LA5 had the highest contents of sum of total phenols and flavonoids in *I. badia*. Although fermentation at 21°C had higher contents of phenolic compounds than 26°C, there were no clear trends discerned for either temperature of fermentation or the strain of probiotic bacteria added. Both cultivated (*A. bisporus*) and the wild species (*I. badia*) of mushroom were suitable for fermentation and had increased content of bioactive compounds.

Iodine – thermal treatment

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Keywords: iodine, heat treatment, biofortification

Iodine is an element of fundamental importance to human health, playing a key role in the normal functioning of the thyroid gland and the production of thyroid hormones. Heat treatment is one of the main processes used in food processing that can affect the stability and bioavailability of iodine. In the present study, the effect of heat treatment on the chemical composition of curly kale (*Brassica oleracea* var. *Sabellica* L.) biofortified with 5,7-diiodo-8-quinoline was investigated. Particular attention was paid to the stability of iodine in iodine-rich curly kale during different home cooking procedures (blanching, steaming, boiling). The effect of temperature on iodine depends on various factors such as processing time, type of food and initial iodine content. Heat treatment can lead to loss of iodine in foods, particularly in the case of boiling, blanching or steaming, which can result in significant iodine loss. In addition, interactions between iodine and other food components, such as fats, proteins and starches, can affect the bioavailability of iodine during heat treatment. In general, steaming is the best cooking method as it contributes to the least iodine loss in curly kale. The red kale variety 'Redbor F1' biofortified with 5,7-diiodo-8-quinolinol showed better iodine stability during heat treatment than the green variety 'Oldenbor F1' biofortified with 5,7-diiodo-8-quinolinol. The fortification of vegetables with iodine is promising and offers hope for an alternative and safe way of supplementing the diet with this deficient element.

Active Pure technology improves zoohygienic conditions in the animal house without affecting the homeostasis of the mouse's organism

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Keywords: RCI, air quality, animal husbandry, oxidative stress, catalyst

Introduction: Radiant Catalytic Ionization (RCI) technology offers several advantages for animal husbandry buildings. It effectively improves air quality and promotes a healthier environment for animals and humans. RCI technology aids in various ways:

- odor control: RCI employs a catalyst to break down odour-causing molecules, effectively reducing unpleasant smells commonly found in animal husbandry buildings,
- airborne pathogen reduction: by targeting bacteria, viruses, and mould spores, RCI technology minimizes the spread of airborne pathogens, mitigating the risk of disease outbreaks among animals,
- dust and particulate matter removal: RCI captures and neutralizes dust and particulate matter, thereby reducing respiratory issues for animals and workers,
- ammonia reduction: animal waste produces ammonia, which can harm enclosed spaces. RCI technology breaks down ammonia molecules, improving air quality and reducing potential health risks,
- enhanced animal health and productivity: RCI technology's creation of a cleaner and healthier environment helps reduce stress, respiratory problems, and animal diseases. This, in turn, leads to improved productivity and growth rates.

The study aimed to confirm the safety of using Active pure technology (based on RCI) installed in the animal house. In this study, we assessed the technology's effect on oxidative stress markers in mouse tissues.

Materials and methods: Animals were placed in two rooms, one equipped with the Active Pure in ventilation system. Tissue from culled animals was used for the experiments.

The following parameters were tested:

- microbiological parameters in the animal house,
- total antioxidative potential (TAC) in plasma by spectrophotometry (Tecan Infinite plate-reader),
- lipid oxidation state (TBARS) in the brain, liver, heart, lungs and plasma by spectrophotometry (Tecan Infinite plate-reader),
- superoxide dismutase (SOD) in the liver by enzyme immunoassay (ELISA).

The results showed that Active pure technology in the animal facility did not increase oxidative stress in the mice. This indicates that the technology is safe in animal facilities that keep mice. Further research is needed to confirm these conclusions.

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