POZNAŃ UNIVERSITY OF LIFE SCIENCES

INTERNATIONAL STUDENT ASSOCIATION

FREE ENTRY

Special Awards & Certificates

2nd PULS-ISA CONFERENCE

Join us for an insightful course-based presentation conference designed to educate and foster togetherness!

COURSE BASED PRESENTATIONS

in Agri-food Economics and Trade
in Agronomy
in Animal Production Management
in Biotechnology
in Crop Plant Biology and Production
in Economics and Finance Management in Agri-food Sector
in Environmental Engineering and Protection
in Food Science and Nutrition
in Forestry
in Geoinformation and Spatial Management
in Horticulture: Seed Science and Technology
in Land Resource Management
in Wood Science

30 May 2025

Biocentrum: Hall A, Dojazd 11, Poznań
From 11.00 a.m. to 4.00 p.m.

Honorary patronage of the Authorities of the Poznań University of Life Sciences
Prof. Krzysztof Szoszkiewicz, Rector
Prof. Karolina Pawlak, Vice-Rector for International Relations
Prof. Piotr Ślósarz, Vice-Rector for Studies
Prof. Piotr Goliński, Vice-Rector for Science
Prof. Krzysztof Adamowicz, Vice-Rector for Staff and University Development

The Conference is open to all students at PULS from all courses. Including Scientific Clubs too!
Presentations are only in English.

Contact: puls-isa@up.poznan.pl +48 692 058 754

MSc (BSc, Erasmus+) based abstracts

2nd PULS-ISA CONFERENCE

Horticulture: Seed Science and Technology

Ummesara

TITLE: INDIAN AGRICULTURE AND EXPLORING OKRA: A NEW CROP POSSIBILITY FOR POLAND?

Key words: Indian Agriculture, Okra (Abhelmoschus esculentus), Importance of Okra in India, Okra in Poland

Abstract:

Background. Okra (**Abelmoschus esculentus**) is a tropical and subtropical vegetable widely grown in countries like India due to its culinary, medicinal, and economic importance. It thrives in warm climates and well-drained soils, making it an ideal crop in regions with specific climatic conditions. However, its potential for cultivation in temperate regions, such as Poland, remains largely unexplored. This study investigates the adaptability of okra for seed production in Poland, a climate with cooler temperatures and varying seasonal conditions compared to its traditional growing regions.

Objectives. The primary objective of this study was to evaluate the adaptability of okra for seed production under the climatic and soil conditions of Western Poland. The study also aimed to determine the seed yield and quality of okra produced in Poland and compare it with standard cultivars from India. Additionally, the potential of okra as a viable vegetable crop in temperate regions for future cultivation and research was assessed.

Materials and Methods. The experiment was conducted at the **Marcelin Experiment Station (PULS)**, Poznań, Poland, from **April to September 2024**. Two hybrid cultivars of okra, **Radha** and **Kavya**, were grown under field conditions. The design followed a **Randomized Complete Block Design (RCBD)** with four replications. Soil conditions, weather data, and irrigation systems were carefully monitored throughout the experiment. A drip irrigation system was used to ensure consistent water delivery, and a preventive insecticide treatment was applied to avoid pest damage. Seed quality parameters were analyzed, and the harvested seeds were compared to Indian standards.

Results. The results showed that okra adapted well to the climatic conditions in Poland, with the plants reaching full maturity in **90-100 days**. Despite lower rainfall in **May, July, and August**, which helped with seed setting and drying, the okra plants demonstrated robust growth and high seed yield. Comparative analysis revealed that okra seeds produced in Poland met the quality standards for Indian cultivars, indicating that it could be a potential crop for temperate climates. The temperature, radiation, and humidity conditions in 2024 were generally favorable for okra cultivation.

Conclusions. This study suggests that okra can be successfully cultivated for seed production in Poland, with quality comparable to traditional Indian cultivars. The findings support further research into expanding okra cultivation in temperate regions as a potential agricultural venture for Poland. Okra's adaptability to varying climates and its nutritional and economic value make it a promising crop for future agricultural diversification.

2nd PULS-ISA CONFERENCE

Agronomy

Boaz Wilium Samo

TITLE: HERBICIDE EFFICACY IN WEED CONTROL IN AGRICULTURE

Key words: cultivation, resistance, plants, yield, weed

Abstract:

Weed management is a crucial component in sustainable agriculture, directly influencing crop yield and quality. This presentation explores the efficacy of various herbicides in controlling different weed species across major crop systems. It reviews both pre-emergence and post-emergence herbicides, examining factors such as application timing, mode of action, environmental impact, and resistance development. By highlighting recent studies and field trial data, the discussion aims to inform best practices and decision-making for agronomists and farmers. Emphasis is placed on integrating herbicides within broader Integrated Weed Management (IWM) strategies to ensure long-term effectiveness and environmental protection.

2nd PULS-ISA CONFERENCE

Biotechnology

Marta Sobczak, Zuzanna Sawicz

TITLE: MOLECULAR CHARACTERIZATION OF THE SOX9 GENE IN FRENCH BULLDOGS WITH DISORDER OF SEX DEVELOPMENT (DSD)

Key words: SOX9, DSD, dog, polymorphism

Abstract:

The SOX9 gene encodes a key transcription factor involved in sex determination process. Its expression depends on the presence of the protein encoded by the Y-linked SRY gene. In cases where the SRY gene is absent but an active SOX9 gene is present, the development of male characteristics in individuals with a female XX karyotype can occur. Such a disorder can result in the formation of ovotestes and/or testes, as well as virilization of the external genitalia in chromosomal females. The aim of this study was to analyze the sequence of the coding and the 5' UTR region of the SOX9 gene and to determine its copy number in French Bulldogs. The study included 26 French Bulldogs diagnosed by veterinarians as individuals with disorder of sex development (XX DSD). Among them a single DSD dog had also the skeletal abnormalities. To identify DNA variants, Sanger sequencing was performed for all three exons of the SOX9 gene and the 5'UTR region. To determine the copy number of SOX9, a droplet digital PCR (ddPCR) method was used in relation to HSD17B7 reference gene. Three nucleotide polymorphisms were detected in the studied population. In a single dog (with both, the reproductive tract abnormalities and skeletal malformations) an additional copy of SOX9 gene (three copies) was observed. It was demonstrated that variants in the coding sequence of the SOX9 gene are not responsible for a disorder of sex development in French Bulldogs. Variations in non-coding regions are rare and their potential causative nature require verification in a control group of French Bulldogs. However, an abnormal copy number of the SOX9 gene is probably the cause of both reproductive and skeletal developmental defects.

2nd PULS-ISA CONFERENCE

Biotechnology

Celine Niyirora, Oskar Szczepaniak

TITLE: BIOACTIVE PHYTOCOMPOUNDS OF Allium ursinum L. LEAVES AS POTENTIAL INHIBITORS OF ACETYLCHOLINESTERASE: in vitro STUDY

Key words: Ache, Antioxidants, Alzheimer, Allium ursunum L

Abstract:

Allium ursinum (wild garlic), a native plant of Central Europe, is known for its potent antioxidant and anti-inflammatory properties due to its high levels of phenolic and sulfur-containing compounds. Neurodegenerative diseases like Alzheimer's involve impaired cholinergic function, often managed with synthetic acetylcholinesterase inhibitors (AChEIs), which may cause adverse effects and are costly. This study explores A. ursinum leaves as a natural alternative source of AChEIs. Studied were extracts of Allium ursinum leaves under their content of total phenolics flavonoids, and total anthocyanins . Antioxidant activity was determined, as well to visualise the functional potential of the leaves. The cholinesterase inhibition was determined for different doses of the extracts using Ellman's spectrophotometric method. The findings revealed notable concentrations of bioactive constituents and high AChE inhibition. The results could have the therapeutic potential in future, and A. ursinum could be used as potent carrier of compounds preventing the risk of neurodegenerative disorders.

PULS-ISA

POZNAŃ UNIVERSITY OF LIFE SCIENCES

2nd PULS-ISA CONFERENCE

Food Science and Nutrition

Taiwo O. Idowu, Agata Chmurzynska

TITLE: LEP GENE POLYMORPHISM AND ASSOCIATION WITH MULTIFACTORIAL AND MONOGENIC OBESITY

Key words: Obesity, LEP gene, Polymorphism, Monogenic Obesity, Polygenic Obesity

Abstract:

Obesity results from both single gene mutations or prevalent polygenic variants, which create an individual genetic risk of obesity modified by environmental factors and gene x environment interactions. This research investigates the polymorphisms in the LEP gene by making use of data from ClinVar, OMIM and the GWAS catalogue in order to comprehend their implications in multifactorial and monogenic obesity. The rare variants of LEP (such as p.Gly132fs and p.Arg105Trp) present in ClinVar and OMIM databases exhibit autosomal recessive inheritance pattern and lead to congenital leptin deficiency, early-onset obesity, and disrupted leptin signaling. Conversely, analysis of GWAS data show common single nucleotide polymorphisms (like rs10487505-C and rs4731419-C) which are significantly correlated with early-life body mass index reductions showing a possible protective role. The results reveal the dual role of LEP — pathogenic mutation in monogenic obesity and regulatory polymorphisms in multifactorial obesity — emphasizing its importance in early detection and precision obesity prevention and treatment strategies.

PULS-ISA

POZNAŃ UNIVERSITY OF LIFE SCIENCES

2nd PULS-ISA CONFERENCE

Biotechnology

Medi Patria, Maciej Jarzębski, Joanna Perła-Kaján

TITLE: INFRARED SPECTROSCOPY IN SEARCH OF EARLY MARKERS OF NEURO-DEGENERATION IN MOUSE MODEL OF AMYOTROPHIC LATERAL SCLEROSIS

Keywords: ALS, biomarker, infrared spectroscopy, protein aggregation, homocysteine

Abstract:

Background: Amyotrophic Lateral Sclerosis (ALS) is a progressive incurable neurodegenerative disorder with challenging diagnosis. Fourier Transformed Infrared (FTIR) spectroscopy enables the analysis of the molecular composition of biological samples, and has been used to distinguish diseased from healthy tissues and fluids. However, its application in marker analysis of ALS remains limited.

Objective: The aim of the study was to investigate (1) biomolecular composition of samples for the identification of biomarkers, (2) the extent of protein aggregation, and (3) changes in tHcy levels in mouse model of ALS, to assess their usefulness in discriminating mutated individuals from controls and identify potential biomarkers of neurodegeneration.

Methods: Plasma, brain, liver, and spleen of transgenic mice carrying the ALS-linked mutation (SOD1G93A) (SOD1, n=5-12) and controls (WT, n=8-9), we used in the study. FTIR, thioflavin T assay and HPLC were used to analyze molecular composition, protein aggregation and tHcy levels, respectively.

Results: The FTIR spectra analysis revealed changes in the 3050–2800 cm^{-1} (C–H stretch) and 1700–1740 cm^{-1} (carbonyl) regions caused by ALS-related mutation. ThT fluorescence assay revealed no statistically significant differences in protein aggregation between SOD1 and WT animals. Quantification of tHcy showed significantly elevated levels in the spleen and liver of SOD1 mutant mice compared to WT controls, whereas the increase observed in brain tissue did not reach statistical significance.

Conclusion: Spectral changes of molecular composition identified with FTIR analysis are promissing biomarkers candidates of neurodegeneration and FTIR analysis could be a non-invasive method supporting ALS diagnosis.

Acknowledgment: Supported by National Science Centre grant 2021/43/B/NZ4/00339. The study was also financed by the Polish Minister of Science and Higher Education as part of the Strategy of the Poznań University of Life Sciences for 2024-2026 in the field of improving scientific research and development work in priority research areas.

2nd PULS-ISA CONFERENCE

Agri-food Economics and Trade

Titilope Mabel Otemuyiwa

TITLE: ECONOMIC DIVERSIFICATION BEYOND FARMING: A CASE STUDY OF NIGERIA

Key words: Agriculture, Africa, Economic, Diversification and, Value Chain

Abstract:

Economic diversification is a major conversation in Africa, especially in Nigeria where there's heavy reliance on crude oil. Agriculture still contributes strongly to GDP and job creation, and it links to industries like food processing and biofuels, proving it has real potential when seen through a value driven lens.

This study encourages a mindset shift, especially for Africans and investors, to view agriculture as a serious driver of economic growth. Using a qualitative approach, it draws on sources like FAO reports, scientific papers, and statistical references from Nigeria's Bureau of Statistics to show that there's more to agriculture than we've tapped into—and real value can be created at every stage, from production to waste.

2nd PULS-ISA CONFERENCE

Agri-food Economics and Trade

Godwin Oloche Adanu

TITLE: RELATIONSHIP BETWEEN FOREIGN DIRECT INVESTMENT (FDI) AND GROSS DOMESTIC PRODUCT (GDP) IN V4 COUNTRIES

Key words: Foreign Direct Investment (FDI), Gross Domestic Product (GDP), Visegrád Group (V4), Economic Growth, Panel Regression

Abstract:

This study examines the relationship between Foreign Direct Investment (FDI) and Gross Domestic Product (GDP) in the Visegrád Group (V4) countries—Poland, Hungary, the Czech Republic, and Slovakia — between 2004 and 2023. Using data from the OECD and World Bank, the analysis employs panel regression and Granger causality tests to identify patterns and directions of influence. Results reveal a strong, though uneven, relationship between FDI and GDP, with institutional and sectoral differences shaping outcomes across countries. The paper argues that while FDI remains a critical growth driver, its impact is contingent on domestic absorptive capacity, governance, and economic structure. Recommendations are offered for designing policies that channel FDI toward sustainable, inclusive growth.

2nd PULS-ISA CONFERENCE

Agronomy

Niyanta Chettri, Elena Fernández-Vizcaíno, Manuel E. Ortiz-Santaliestra, Mario Fernández-Tizón, Rafael Mateo, Pablo R. Camarero, François Mougeot

TITLE: BIRD EXPOSURE TO FUNGICIDES THROUGH THE CONSUMPTION OF TREATED SEEDS: A STUDY OF WILD RED-LEGGED PARTRIDGES IN CENTRAL SPAIN

Key words: Treated seeds, Triazole fungicides, Pesticide risk assessment, Diet, Alectoris rufa

Abstract:

Sown seeds are a key component of many farmland birds' diets due to natural food shortages in autumn and winter. Because these seeds are often treated with pesticides, their ingestion by birds can result in toxic effects. For risk assessment, data on treated seed toxicity should be combined with information about exposure risk for wild birds and the factors that modulate it. We characterized the exposure of red-legged partridges to pesticide-treated seeds through the analysis of digestive contents of birds shot by hunters (n = 194) in an agricultural region in central Spain. We measured the contribution of sown seeds to the partridges' diet and how it related to pesticide exposure. Moreover, we evaluated the influence of landscape composition on the intake of sown seeds and pesticides by partridges. During peak sowing time, seeds constituted half (50.7%) of the fresh biomass ingested by partridges, which consumed mostly winter cereal seeds (42.3% of biomass). Residues of seven fungicides and one insecticide (active ingredients) were detected in 33.0% of birds. The presence of pesticides in digestive contents was linked to the ingestion of cereal sown seeds. Moreover, dietary exposure of birds to pesticides was modulated by landscape characteristics, being lower in areas with heterogeneous landscapes, greater habitat mosaic, and more natural vegetation. The estimated dietary intake of pesticides resulting from our field observations, in combination with experimental data on pesticide toxicity, raise concerns about the risks that pesticide-treated cereal seeds pose to granivorous bird populations. Our results highlight the importance of farming landscape composition and diversification, which should be considered as a priority in the agricultural policy to mitigate pesticide risks to farmland birds through the consumption of treated seeds.

2nd PULS-ISA CONFERENCE

Biotechnology

Alicja Szychulska

TITLE: APPLICATION OF CARBON NANOTUBES IN DYE ADSORPTION AND TRANSPORT PROCESSES

Key words: Carbon nanotubes, light conversion, fluorescent dyes

Abstract:

Carbon nanotubes (CNTs) offer a promising foundation as carriers for delivering dyes to plants to enhance photosynthesis efficiency and biomass production. The use of carbon nanomaterials, such as CNTs, enables the confinement of dyes within their nano- and micropores, allowing for controlled delivery to plant tissues. Rhodamine 6G and Thioflavin T, used as model dyes, are the focus of this research due to their energy transfer capabilities and potential applications in improving photosynthetic processes. The adsorption and encapsulation of Rhodamine 6G and Thioflavin T into single-, double-, and multi-walled carbon nanotubes were carried out under controlled pH, temperature, and concentration. The results demonstrated effective adsorption and stability of the dyes within carbon nanotube structures. This indicates that the CNTs can be effectively applied to enhance photosynthetic efficiency, leading to improved plant growth and increased biomass production.

2nd PULS-ISA CONFERENCE

Agri-Food Economics and Trade

Dama Laksita Apta Sukaton, Asaph Abraham

TITLE: HUMAN CAPITAL, AGRI-FOOD TRADE COMPETITIVENESS AND ENVIRONMENTAL EFFICIENCY CONDITIONS IN THE WORLD

Key words: Human capital, Agri-food trade competitiveness, Environmental efficiency, Sustainable agriculture, Doughnut economics

Abstract:

This study explores the intricate relationship between human capital, agri-food trade competitiveness, and environmental efficiency in the global context. It highlights the dual role of agricultural production in driving economic growth while contributing to environmental challenges such as land degradation, greenhouse gas emissions, and biodiversity loss. The adoption of green technologies, including green pest control; water-saving irrigation; and soil testing, is examined as a pathway to enhance environmental efficiency, though challenges like high costs and farmer characteristics persist. The paper underscores the importance of human capital in fostering sustainable economic growth and pro-environmental behaviors, emphasizing that higher education and socioeconomic stability correlate with greater environmental concern. By integrating ecological aspects into economic assessments, as proposed by doughnut economics, the study advocates for policies that balance trade competitiveness with environmental sustainability.

2nd PULS-ISA CONFERENCE

Finance and Accounting

Wojciech Kuźniar

TITLE: VOLUME AND STRUCTURE OF FOREIGN DIRECT INVESTMENTS IN POLAND

Key words: foreign direct investment, FDI, foreign capital, economic development

Abstract:

Foreign direct investment (FDI) plays an important role in Poland's economic development, supporting technology modernization, job creation and integration into global value chains. Since the political transformation, Poland has become one of the main recipients of FDI in Central and Eastern Europe, which has significantly contributed to economic growth. The purpose of this study is to compare the volume of foreign direct investment (FDI) in Poland by region and country of origin of investment capital, as well as the sectoral structure of investment. To achieve the purpose of the study, data on the size and structure of FDI in Poland and the prospects for further inflows of investment capital were analyzed. The scope of the study covers the years 2004-2023. The basis of the analysis was data from the UNCTAD (United Nations Conference on Trade and Development) database and the National Bank of Poland, thematic reports and literature on the subject. A comparative method was used, supported by tabular and graphical presentation of the results.

PULS-ISA

POZNAŃ UNIVERSITY OF LIFE SCIENCES

2nd PULS-ISA CONFERENCE

Agri-food Economics and Trade

Zofia Bartkowiak, Weronika Majchrzak

TITLE: UKRAINE'S EU MEMBERSHIP – A REAL OPPORTUNITY OR A THREAT TO POLISH FARMERS? AN ASSESSMENT OF THE COMPETITIVENESS OF SELECTED UKRAINIAN AGRICULTURAL MARKET

Key words: Agricultural competitiveness, European Union, accession, protests, farmers

Abstract:

The aim of this study is to evaluate the competitiveness of Ukraine's agricultural sector in relation to the European Union and to identify potential implications of this phenomenon for Poland in selected areas of agricultural production. The analysis focuses on the grain and oilseed sectors—products in which Ukraine plays a key role in the global agricultural production system, mainly due to the high quality of its soils and the resulting export potential. Ukraine's possible accession to the European Union raises questions about the potential impact of this process on the competitiveness of Polish agriculture. The research applies both quantitative and qualitative methods, particularly selected indicators of international competitiveness. The analysis is based on a multidimensional comparative approach, taking into account factors such as production volume, export and import levels, and the dynamics of change. The results of the study make it possible to formulate conclusions regarding the extent to which the growing position of Ukraine in the EU market—especially in the context of its potential EU membership—may pose a threat to the competitiveness of selected Polish agricultural products. The data used in the analysis were sourced from international databases such as the World Bank, Eurostat, FAOSTAT, „Agriculture of Ukraine" – State Statistics Service of Ukraine, and the CEMA report. The study also draws upon both domestic and international literature, including works by Misala, Bożyk, Budnikowski, and others.

2nd PULS-ISA CONFERENCE

Horticulture: Seed Science and Technology

Kareem Adesope

TITLE: THE EFFECT OF SELECTED ESSENTIAL OILS ON GERMINATION, VIGOUR, AND HEALTH OF CARROT (Daucus carota L.) SEEDS

Key words: Essential oils, seed quality, clove oil, thyme oil, lemongrass oil

Abstract:

The increasing demand for sustainable agricultural practices has led to the exploration of natural seed treatments as alternatives to synthetic chemicals. This study investigated the effects of three essential oils (clove, lemongrass, and thyme) on the germination, vigour, and health of carrot (Daucus carota) seeds. Two seed samples with differing initial qualities were subjected to treatments with each essential oil at five dosages: 12, 18, 24, 30, and 36 µL per gram of seeds. The essential oils were applied in volatile form. For each treatment, a blotter paper sized 4 cm2 (2 × 2 cm) was soaked with a specific dose of essential oil and suspended in a glass flask above the surface of the seeds, ensuring no direct contact. The sealed containers were maintained at 20°C for 24 hours. Untreated seeds served as controls.

Germination test was carried out according to the International Seed Testing Association (ISTA) rules. Germination at first count (number of normal seedlings) was assessed on the 7th day, while germination at final count (the total percentage of normal seedlings), percentages of abnormal seedlings (both deformed and diseased), dead seeds, and fresh seeds were assessed on the 14th day. Seed vigour was evaluated on the basis of speed and uniformity of germination. Seed health was assessed using the deep-freeze blotter method, as prescribed in the ISTA rules. The percentage of seeds infested with a particular fungus and seeds free of fungi were determined.

Results indicated that clove essential oil significantly improved germination and vigour, particularly at the doses 12 and 18 µL/g, and demonstrated antifungal properties, significantly reducing Fusarium spp. in sample 2. Thyme oil exhibited notable antifungal effects, particularly against Alternaria spp. and Fusarium spp., although it did not improve germination or vigour parameters. Lemongrass oil also showed antifungal activity but negatively impacted seed quality on the basis of germination and vigour across both samples.

This study highlighted the potentials of clove and thyme essential oils as effective, environmentally friendly seed treatments. However, further research is advised focusing on refinement of the application protocols of these oils.

2nd PULS-ISA CONFERENCE

MSc in Food Technology and Human

Kimia Dalvand

TITLE: ASSESSMENT OF ANTIBIOTIC RESISTANCE IN UNPASTEURIZED GOAT CHEESES

Key words: Antibiotic resistance, goat cheese, MIC, multidrug resistance, food safety

Abstract:

Unpasteurized goat cheese, often produced under non-standard hygienic conditions, can harbor antibiotic--resistant bacteria that pose a public health risk. This study aimed to assess the resistance profiles of bacterial isolates obtained from unpasteurized goat cheese samples using the Minimum Inhibitory Concentration (MIC) method. A panel of 12 antibiotics, including penicillin, oxacillin, trimethoprim, streptomycin, and eight additional agents, was tested across five bacterial isolates. The results revealed a high prevalence of resistance, particularly to β-lactam and aminoglycoside antibiotics. Several isolates showed resistance to multiple antibiotics, with some exhibiting multidrug resistance patterns. These findings underscore the importance of monitoring traditional dairy products for antibiotic resistance, especially given their widespread local consumption and lack of strict microbial control.

PhD based abstracts

PULS-ISA

POZNAŃ UNIVERSITY OF LIFE SCIENCES

2nd PULS-ISA CONFERENCE

Food Science and Nutrition

Paula Żakowicz, Lidia Radko, Tatiana Wojciechowska

TITLE: EFFECTS OF CANNABIDIOL ON TOXICITY VETERINARY DRUG USING HepG2 CELLS

Key words: Cannabidiol, doxycycline, interaction, human

Abstract:

Background. Growing awareness and the need to protect public health, including food safety, call for a thorough investigation of the mechanism of action of veterinary drugs in consumers and the reduction of their adverse effects on humans. Improper use of veterinary drugs such as doxycycline leads to the appearance of residues in animal tissues and the occurrence of adverse effects in consumers. The use of natural substances of plant origin, extracted from the seeds of the hemp plant (Cannabis sativa L.) such as cannabidiol (CBD) is one solution to minimize the negative effects of doxycycline.

Objectives. The study aimed to determine the effect of CBD on the cytotoxic effect of doxycycline in consumers using in vitro tests.

Materials and Methods. The cytotoxic activity of doxycycline and the effect of CBD were tested after 72-hour exposure to human liver cells, HepG2 line. Two concentrations of cannabidiol showing no toxic activity were selected for the study. The cytotoxic concentrations (IC50) of the test drug in combination with CBD were evaluated using four biochemical endpoints: mitochondrial activity (MTT assay), lysosomal activity (NRU assay), proliferation (TPC assay), and cell membrane integrity (LDH assay). Effects on DNA synthesis (BrdU assay), oxidative stress, and cell death were also evaluated. The nature of the interaction between the veterinary drug and CBD was assessed by isobolographic analysis. Statistical analysis was performed using GraphPad software.

Results. The long-term action of doxycycline disrupted lysosomal activity and inhibition of synthesis DNA. Decreased cell viability was observed from a concentration of 12.5 µg/ml of the drug. IC50 values were ranged from 13.4 to 200 µg/ml. IC50 values for the veterinary drug in combination with CBD were higher from 16.5 to >200 µg/ml. The decreased cell DNA synthesis and reduced levels of oxidative stress after the mixture was demonstrated. An increased percentage of apoptotic cells was shown in the mixture with a low concentration of CBD. Interactions between the veterinary drug and CBD showed a concentration-dependent nature, ranging from synergistic to additive effects at high drug concentrations.

Conclusions. The increased human health risks associated with the presence of the veterinary drug in food products and the protective nature of CBD use underscore the importance of these studies in food toxicology and require further research.

Ministry of Science and Higher Education
Republic of Poland

Project financed from the state budget funds granted by the Minister of Science and Higher Education within the Program “Student Scientific Clubs Create Innovations” SKN/SP/569523/2023.

PULS-ISA

POZNAŃ UNIVERSITY OF LIFE SCIENCES

2nd PULS-ISA CONFERENCE

Biotechnology

Łukasz Mencel, Joanna Perła-Kaján, Hieronim Jakubowski†

TITLE: HOMOCYSTEINE AND ITS METABOLITES CONTRIBUTE TO ALZHEIMER'S DISEASE VIA DYSREGULATION OF AMYLOID-β PRECURSOR PROTEIN PROCESSING IN MOUSE NEUROBLASTOMA N2a-APPswe CELLS

Key words: Homocysteine, Homocysteine thiolactone, Alzheimer's disease, Amyloid-β precursor protein

Abstract:

Background: Homocysteine (Hcy), a sulfur amino acid, is formed from methionine supplied with food. It may be converted back into methionine by remethylation, used for cysteine synthesis via transsulfuration, or give rise to homocysteine thiolactone (HTL). HTL can modify proteins in the N-homocysteinylation reaction. Hcy and its metabolites are linked to neurodegenerative diseases, including Alzheimer disease (AD). AD is characterized by the accumulation of amyloid-β (Aβ) plaques. Aβ is formed from amyloid-β precursor protein (APP) via amyloidogenic pathway, involving β-secretase BACE1 and γ-secretase complex (Nicastrin, PSEN1, PEN2, APH-1). The impact of Hcy and its metabolites on the development and progression of AD is not fully understood.

Objective: We tested the hypothesis that Hcy and its metabolites affect APP processing pathways in mouse neuroblastoma N2a-APPswe cells.

Design: Neuroblastoma N2a-APPswe cells harboring a human transgene with mutation in the APP gene were grown on the complete DMEM/F12 medium. Cells were treated with different concentrations of Hcy, HTL or N-Hcy-proteins in media without methionine for 24 h. Proteins involved in APP metabolism pathway, i.e. APP, phospho-APP, BACE1, PSEN1, PEN2 and Nicastrin were quantified by Western blotting. The expression of APP, Bace1 Psen1, Psenen and Ncstn mRNAs was analyzed by RT-qPCR.

Results: Hcy increased APP, its active form phospho-APP, BACE1 and PSEN1. At mRNA level, Hcy downregulated the expression of the Psen1 gene. HTL increased protein levels of APP, BACE1, PSEN1 and Nicastrin. This treatment decreased also the expression of Psenen gene (encoding PEN2). Treatments with N-Hcy-proteins increased level of PSEN1 protein and downregulated the expression of Psenen gene. There was no significant impact of treatments on PEN2 protein level.

Conclusion: Hcy, HTL and N-Hcy-protein resulted in dysregulated APP processing in N2a-APPswe cells, suggesting their association with AD progession.

Acknowledgement: Supported by NCN grant 2021/43/B/NZ4/00339.

2nd PULS-ISA CONFERENCE

Biotechnology

Mayuri Bhosale, Joanna Perla-Kaján, Hieronim Jakubowski†

TITLE: HYPERHOMOCYSTEINEMIA AND Blmh DEFICIENCY INDUCE ER Stress, UPR ACTIVATION IN MOUSE NEUROBLASTOMA N2a-APPswe CELL MODEL OF ALZHEIMER'S disease

Key words: Bleomycin hydrolase, Hyperhomocysteinemia, ER stress

Abstract:

Background: Alzheimer's disease (AD) is the most prevalent neurodegenerative disorder characterized by endoplasmic reticulum (ER) stress and unfolded protein response (UPR). Hyperhomocysteinemia (HHcy), a condition of elevated plasma total homocysteine (tHcy) levels and related metabolites such as Hcy thiolactone (HTL) and N-homocysteinylated (N-Hcy)-protein, as well as lower activity of BLMH, a HTL detoxifying enzyme, are associated with AD. However, how BLMH deficiency, Hcy, and its metabolites influence ER stress, UPR response remains to be elucidated.

Objective: The aim of the study was to investigate the effects of Blmh gene silencing and homocysteine (Hcy), HTL, and N-Hcy-protein exposure on the expression of ER stress and UPR pathway-related genes at the protein and mRNA levels in mice neuroblastoma N2a-APPswe cells.

Methods: Mouse neuroblastoma N2a-APPswe cells harbouring a human APP transgene with the K670N and M671L Swedish mutations were grown on complete DMEM/F12 medium. Cells were treated with different concentrations of Hcy, HTL, and N-Hcy-protein for 24 hrs in methionine-free media with dFBS. For the gene silencing experiment, Blmh-targeting siRNAs were transfected into cells kept in Opti-MEM medium for 48 h using Lipofectamine RNAi Max. Changes in ER stress and UPR pathway-related markers were quantified by western blotting and the corresponding mRNAs by RT-qPCR.

Results: We found that the Blmh gene silencing and treatment with Hcy, HTL, and N-Hcy-protein in N2a-APPswe cells significantly upregulated the expression of ER chaperone GRP78, UPR-responsive ATF3 and CHOP, which may lead to apoptosis. RT-qPCR analysis confirmed that mRNA expression changes mirrored protein level changes, reinforcing the transcriptional regulation of ER stress and UPR activation.

Conclusion: Our findings suggest that Blmh deficiency and HHcy may promote the development of AD by contributing to ER stress, UPR activation, and promoting CHOP-driven apoptosis. Given the role of ER stress in AD progression, Blmh may be a potential therapeutic target for reducing neuronal apoptosis in AD.

Acknowledgment: Supported by National Science Centre grant 2021/43/B/NZ4/00339.