LITHUANIAN UNIVERSITY OF HEALTH SCIENCES
FACULTY OF PHARMACY

ABSTRACT BOOK

international conference

Contemporary Pharmacy: Issues, Challenges and Expectations 2024

March 22
Lithuania, Kaunas

Contemporary Pharmacy: Issues, Challenges and Expectations 2024

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2024, Kaunas

Dear Participants and Guests of the Conference,

It is my great pleasure to welcome you to the International Conference “Contemporary Pharmacy: Issues, Challenges and Expectations 2024” organized by Lithuanian University of Health Sciences, Faculty of Pharmacy. The conference is dedicated to the initiator of Pharmacy studies in Kaunas, professor Petras Raudonikis (1869-1950), this year we celebrate his 155th birth anniversary. Prof. Petras Raudonikis was invited to teach Pharmacy disciplines and head the Pharmacy section in the Higher Courses, the precursor institution of the University of Lithuania, in 2021. He was the first to teach Pharmacy in Lithuanian at the University. The achievements of the Pharmacy Professor and the challenges he has overcome are a source of strength for us.

The International Conference “Contemporary Pharmacy: Issues, Challenges and Expectations 2024” is focused on the novelties of pharmacy science and practice in response to contemporary challenges within the historical background. It will bring together scientists, pharmacists and other healthcare workers, providing the international research community in research and learning with an opportunity to present, discuss and publish recent research results and approaches to develop new ideas and collaborations.

Today we meet to share best pharmacy practice, innovation and problems so that we can solve them together – as pharmacists, pharmacy educators, researchers and pharmacy students.

On behalf of the organising and scientific committee,

Prof. Ramune Morkuniene

Dean of the Faculty of Pharmacy

Lithuanian University of Health Sciences

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PLENARY SESSION *Moderators: prof. Ramunė Morkūnienė and prof. Victoriya Georgiyants, auditorium 202*	
8:30-9:00	**Registration**
9:00-9:10	**Opening ceremony** Prof. Vaiva Lesauskaitė, Vice Rector for Research, LSMU, Lithuania Edgaras Narkevičius, Adviser of Minister of Health of the Republic of Lithuania, Ministry of Health Lithuania
9:10-9:25	**Kaunas Luminary: Prof. Petras Raudonikis - Pioneer, Architect, and Visionary in Pharmacy Education** Assoc. Prof. Vilma Gudienė, Faculty of Pharmacy, LSMU, Lithuania
9:25-9:40	**Advancements in Pharmaceutical Integration: A Comprehensive Analysis of the Interplay Between Scientific Research, Studies, and Industrial Development** Prof. Jurga Bernatonienė, Faculty of Pharmacy, LSMU, Lithuania
9:40-9:55	**Challenges of Education in the 21st Century: Navigating the Path to Learning in a Digital Age** Dr. Gaurav Bhadauria, Maharana Pratap Group of Institutions, India
9:55-10:10	**Education Regulation of Pharmacy in India** Prof. Vikram Kumar Sahu, Maharana Pratap College of Pharmacy, India
10:25-10:40	**Revision of EU's General Pharmaceutical Framework Legislation- towards a future-proof and crisis-resistant medicines regulatory system** Jūratė Švarcaitė, Director General at the Association of the European Self-Medication Industry (AESPG), Belgium
10:40-11:00	**Pharmacy Experiential Learning Meets the Future: Successes, Challenges and Innovation** PhD Vilius Savickas, University of East Anglia, UK
11:00-11:15	**The advantages of scientific interdisciplinary cooperation in estimating the maturity of technologies** Prof. Nijolė Savickienė, Faculty of Pharmacy, LSMU, Lithuania
11:15-11:30	**Botanical Garden Collection of Medicinal Plants as a scientific research tool for the development of sustainable professional medicine, pharmacy and public health in Lithuania** Prof. Ona Ragažinskienė, Vytautas Magnus University, Botanical Garden, Lithuania
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SCIENTIFIC SESSION I *Moderators: prof. Valdas Jakštas and prof. Lina Raudonė, auditorium 202*	
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12:15-12:30	**Can metabolites of polyphenolic compounds serve as templates for novel antiplatelet drugs?** Prof. Přemysl Mladěnka, Charles University Faculty of Pharmacy in Hradec Kralove, Czech Republic
12:30-12:45	**Two-Sided Coated Cotton Nanotextiles with Enhanced Antimicrobial Properties** Assoc. Prof. Agnė Giedraitienė, Institute of Microbiology and virusology, LSMU, Lithuania

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12:45-13:00	**Valorization of agro-industrial by-products into versatile functional ingredients by emerging extraction technologies** Assoc. Prof. Vaida Kitrytė-Syrpa, Faculty of Chemical Technology, Kaunas University of Technology, Lithuania
13:00-13:15	**Search for innovative CNS agents: successes and prospects** Victoriya Georgiyants, National University of Pharmacy, Kharkiv, Ukraine
13:15-13:30	**Pharmacological targeting of microglial NMDA receptors and mitochondrial ROS in Alzheimer's disease** Prof. Ramunė Morkūnienė, Faculty of Pharmacy, LSMU, Lithuania
13:30-13:45	**Longevity as a Rising Trend in the Pharmaceutical Industry: Status Quo and Future Perspectives** Eglė Pavydė, LSMU; UAB LONGEVERSE, Lithuania
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SCIENTIFIC SESSION II *Moderators: Prof. Nijolė Savickienė and PhD Gabrielė Balčiūnaitė-Murzienė, auditorium 202*	
15:15-15:30	**Long story short: from plant to scientific interest and technologies** PhD Lauryna Pudžiuvelytė, Faculty of Pharmacy, LSMU, Lithuania
15:30-15:45	**European cross-border ePrescription service: Estonian and Finnish pharmacists' first experiences with pharmacist-patient interaction and safe use of medications** Prof. Daisy Volmer, Institute of Pharmacy, Faculty of Medicine, University of Tartu, Estonia
15:45-16:00	**Facets of the tinctures elaboration of *Thymus vulgaris* herb of different origin** Prof. Natalia Hudz, Department of Pharmacy and Ecological Chemistry, University of Opole, Poland; Department of Drug Technology and Biopharmacy, Danylo Halytsky Lviv National Medical University, Ukraine
16:00-16:10	***In vitro* study of cyano-phycocyanin release from semisolid forms and *ex vivo* study of skin penetration** PhD student Daiva Galinytė, Faculty of Pharmacy, LSMU, Lithuania
16:10-16:20	**Characterisation and Protein Composition Analysis of *Cucumis sativus* L. Plant-derived Nanovesicles** PhD student Emilija Mikalauskienė, Faculty of Pharmacy, LSMU, Lithuania
16:20-16:30	**Investigation of Plant-Derived Nanovesicles' Impact on Mitochondria in Skin Cells Under Psoriasis-Like Inflammation** PhD student Gabrielė Kulkovienė, Faculty of Pharmacy, LSMU, Lithuania
16:30-16:40	**Anti-dementia effects of mansonone G and mansorin A in the zebrafish model of Alzheimer's Disease induced by okadaic acid** PhD student Iasmina Honceriu, Alexandru Ioan Cuza" University of Iasi, Romania
16:40-16:50	**The impact of several types of excipients used in ultrasound-assisted extraction of *Artemisia annua* L.** PhD student Emilija Nemickaitė, Faculty of Pharmacy, LSMU, Lithuania
16:50-17:10	**Poster session awards** **Closing ceremony**

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HISTORY OF PHARMACY SESSION *Moderators: PhD Ramūnas Kondratas and assoc. Prof. Vilma Gudienė, auditorium 438*	
12:00–12:15	**The Joint Professorship of Chemistry and Pharmacy in 1802-1843 at the University of Tartu, Estonia** Ain Raal, University of Tartu, Estonia, Oleh Koshovyi, National University of Pharmacy, Kharkiv, Ukraine
12:15–12:30	**Pharmacy Studies at the Faculty of Mathematics and Natural Sciences of the University of Lithuania** Judita Puišo, Kaunas University of Technology, Lithuania
12:30–12:45	**Educational and Methodological Work at the Pharmacognosy Department of the National University of Pharmacy, Kharkiv, Ukraine** Oleh Koshovyi, Alla Kovaleva, The National University of Pharmacy, Kharkiv, Ukraine Tetiana Ilina, Ivano-Frankivsk National Medical University, Ivano-Frankivsk, Ukraine Ain Raal, University of Tartu, Estonia
12:45–13.00	**The role of the Riga Society of Pharmacists and Chemists in the development of natural sciences in the Baltic region** Elvigs Kabucis, Inta Vegnere, Inguna Cīrule, Pharmacy Museum, Riga, Latvia
13:00–13:15	**Ethnopharmacology of Ukraine: From Local Use to Global Commodities** Olha Mykhailenko, Victoriya Georgiyants, National University of Pharmacy, Kharkiv, Ukraine, Michael Heinrich, UCL School of Pharmacy, London, United Kingdom
13:15–13:30	**Natural Medications as a Source of Pharmacologically-active Compounds: from Empirical Healing Practices to Modern Medicines** PhD Gabrielė Balčiūnaitė Murzienė (Lithuanian University of Health Sciences, Lithuania)
13:45-15:15	**Lunch break**
15:15–15.30	**Pharmaceutical Chemistry in Ferrara since 1801** Chiara Beatrice Vicentini, L. Altieri, University of Ferrara, Italy
15:30–15:45	**The Topic of Chemical Weapons in the Lithuanian Interwar Press** Viktorija Šimkutė, Aistis Žalnora, Vilnius University, Lithuania
15:45–16:00	**Chemical Warfare Training of Soldiers and Paramedics in Interwar Vilnius and Kaunas** Aistis Žalnora, Viktorija Šimkutė, Vilnius University, Lithuania
16:00–16:15	**Comparative Assessment of Pharmacy Curricula in Lithuania, Latvia, Estonia, and the USA (1922-1940)** Aurelija Gegnerytė, Vilma Gudienė, Lithuanian University of Health Sciences, Lithuania
16:15–16:30	**Pharmacy Collection at the Museum of the History of Medicine of the Vilnius University Faculty of Medicine** Irma Kušeliauskaitė Vilnius University, Lithuania, Zenona Šimaitienė Museum of the History of Lithuanian Medicine and Pharmacy
16:30	**Closing of the session**

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Abstracts
Oral session

Kaunas Luminary: Prof. Petras Raudonikis - Pioneer, Architect, and Visionary in Pharmacy Education

V. Gudienė

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Background: Prof. Raudonikis began his academic career in Kaunas in 1920 as the head of the Pharmacy Section of the Higher Courses, the precursor institution to the University of Lithuania, established in 1922. He played a pivotal role in the establishment of the Faculty of Medicine at the University of Lithuania, where he headed the Department of Pharmacy until 1939. During 1924-1929, Prof. Raudonikis served as the secretary of the Faculty of Medicine Council, and from 1929-1933, as the secretary of the University Council and the Senate.

Aim(s): To evaluate Prof. P. Raudonikis's efforts and the educational vision he created in shaping higher pharmacy education in Kaunas.

Methods: Analysis of literature and archive documents

Results: During the interwar period, Prof. P. Raudonikis emerged as a pioneer and visionary in pharmacy education. Drawing on his pedagogical and scientific experience, he meticulously crafted a pharmacy study program by analyzing the experiences of European countries and presenting his vision to the pharmacy community. Prof. P. Raudonikis particularly emphasized the importance of chemistry knowledge and competencies in studying pharmacy, proposing the issuance of chemist-pharmacist diplomas to pharmacy graduates. Throughout the era of interwar independence, the pharmacy study program changed, including modifications to admission requirements and a gradual increase in expectations for students' research work.

Conclusion: The pharmacy studies program created by Prof. P. Raudonikis in Kaunas had a distinctly European direction, placing significant emphasis on chemistry sciences, laboratory research, and practical experience in the pharmacy. Chemist-pharmacists trained at Vytautas Magnus University were notably more actively engaged in the advancement of pharmaceutical scientific knowledge than their predecessors who studied in Imperial Russia.

Pharmacy Experiential Learning Meets the Future: Successes, Challenges and Innovation

V. Savickas [1,2]*

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Background: the abstract reviews new approaches to developing experiential learning opportunities for Master of Pharmacy (MPharm) students in the UK.

Aim: to describe the successes and challenges encountered during the rapid evolution of clinical placements within the new MPharm degree at the University of East Anglia.

Materials and methods: MPharm degree study programme at the University of East Anglia.

Results: assessed how an effective recruitment strategy, regional partnerships and modern technology can help undergraduate students become competent independent prescribing pharmacists at the end of a five-year training period. The benefits of simulation-based education have been identified along with its role in preparing students for practice and interprofessional learning.

Conclusion: MPharm students as core members of healthcare teams in community pharmacies, hospitals, and general practice surgeries, maximising their professional learning whilst contributing to improvements in the quality of patient care and the delivery of crucial public health services, such as seasonal influenza vaccinations.

References

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The Advantages of Scientific Interdisciplinary Cooperation in Estimating the Maturity of Technologies

N.Savickienė[1]*

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Background: Interdisciplinary science is an integrated approach that synthesizes the perspectives of multiple individual disciplines during all phases of the research to investigate and answer a question or solve a problem.

Aim: to present the advantages of scientific interdisciplinary cooperation after receiving the results of the international projects: Horizon 2020 M-ERA.NET Call 2016 PELARGODONT, EUREKA project E!13474 ECO-AQUA-RECYCLE.

Materials and methods: the final reports of projects - Horizon 2020 M-ERA.NET Call 2016 PELARGODONT, EUREKA project E!13474 ECO-AQUA-RECYCLE.

Results: the interdisciplinary activities of pharmacists, odontologists, biochemists, biotechnologists, microbiologists in the project PELARGODONT were the basis for designing and approving an innovative medical device prototype for the treatment of periodontal diseases. The result of the scientific cooperation of biologists, ecologists, pharmacists, technologists, biochemists, veterinary specialists in the EUREKA project made it possible to submit a European patent application for the invention of a functional fish feed additive from wild algae biomass, which promotes ecological aquaculture, increases the number of fish, and has benefits for fish health.

Conclusion: research synergies have opened up a great advantage of collaboration between scientists of different scientific profiles in the development of competitive technologies, prototypes and strategies for an even wider profile of developer consortia.

References

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Botanical Garden Collection of Medicinal Plants as a Scientific Research Tool for the Development of Sustainable Professional Medicine, Pharmacy and Public Health in Lithuania

O. Ragažinskienė[1]

[1]*Vytautas Magnus University, Botanical Garden, 46324 Kaunas, Lithuania*

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Background: Medicinal (aromatic) plants (MAPs) are playing an important role for the solution of WHO problem Health for everyone in 21st Century (WHO Regional Office for Europe, 2012).

Aim(s): To reflect on how the Medicinal (aromatic) plants and bioactive compounds diversity scientific research can contribute to the sustainable development of territories, with a cross-cutting approach through interventions related to education, community participation.

Methods: MAPs collection creation (Ragažinskienė, Rimkienė, 2003) and on secondary metabolites and antioxidant activity of raw material analysis are carried out using integrated sample preparation, spectrophotometric, chromatographic and microanalysis techniques (Maruška, Kornyšova, 2006; Baranauskienė et al., 2022). The experimental research data were evaluated using mathematical statistical methods (Raudonius, 2017).

Results: Currently the research of MAPs is classified into fundamental and applied researches. These are carried out on the basis of various national and international projects and correspond to the priority directions of European and Lithuanian scientific researches and experimental development.

Conclusion: Complex, interinstitutional and interdisciplinary co-operation is important in historical and scientific MAPs researches for the development of sustainable professional medicine, pharmacy and public health.

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Next-Generation Proteomics (NGP) in Basic and Clinical Biomedicine

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Background: Mass spectrometry is one of the most advanced, universal and continuously developed analytical methods today. It is the methodological heart of modern proteomics - a method of comprehensive analysis of proteins (proteome). Currently, proteomic methods are an important contributor of modern research on drugs and their mechanisms of action (pharmacoproteomics). Moreover, detailed studies on the mechanisms of disease progression, especially those with complex etiology, can identify new, promising and unexplored targets for pharmacological intervention. In recent years, we have successfully employed proteomics techniques in projects related to the establishment of new methods of diagnosis and treatment of civilization and age-related diseases (including atherosclerosis and nonalcoholic fatty liver disease).

Aim: The aim of our study was to comprehensively evaluate the influence of prolonged treatment with the ACE2 activator, diminazene aceturate (DIZE) on the development of atherosclerotic lesions and hepatic steatosis in apoE−/− mice fed a high-fat diet (HFD).

Methods: Immunohistochemical and histological evaluation of atherosclerosis in the apoE−/− mice model was accompanied by proteomic and molecular biology techniques to unravel the mechanisms of DIZE action.

Results: We have shown that DIZE stabilized atherosclerotic lesions and attenuated hepatic steatosis in apoE−/− mice fed an HFD. Such effects were associated with a decreased total macrophage content and increased α-smooth muscle actin levels in atherosclerotic plaques. Furthermore, DIZE changed the polarization of macrophages toward an increased amount of anti-inflammatory M2 macrophages in atherosclerotic lesions. Interestingly, the anti-steatotic action of DIZE in the liver was related to the elevated levels of HDL in the plasma, decreased levels of triglycerides, and increased taurine biosynthesis and concentration in the liver of apoE−/− mice.

Conclusion: The ACE2 activator, DIZE, provides a potentially novel therapeutic approach to the treatment/prevention of atherosclerosis and fatty liver diseases by influencing macrophage polarization and taurine biosynthesis.

Can Metabolites of Polyphenolic Compounds Serve as Templates for Novel Antiplatelet Drugs?

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Background: Epidemiological studies reported that higher nutritional intake of flavonoids is associated with lower incidence of cardiovascular diseases including ischemic stroke. As flavonoids have low bioavailability, rather their metabolites can be the active forms.

Aims: a) To test if parent (iso)flavonoids or their known metabolites can at biologically achievable concentrations modify platelet aggregation, b) to assess the mechanism of action, and c) to investigate structure-activity relationship

Methods: Series of (iso)flavonoids, their known colonic metabolites and chemically related derivatives were incubated with whole human blood or platelet rich plasma. Platelet activity was tested *ex vivo* by different methods (standard turbidimetry, impedance aggregometry, ELISA). Generally healthy persons as well as patients suffering from hypercholesterolemia and diabetes were also included in the investigation.

Results: Many (iso)flavonoids were active as antiplatelet compounds but the clinical relevance is rather low for most of them. Only 4 out of 29 metabolites appeared to have a clinically relevant effect with 4-methylcatechol (4MC) being the most active by far. It inhibited platelet aggregation with an IC_{50} of approximately 3 µM, which is about one order of magnitude lower than that of the standard antiplatelet drug acetylsalicylic acid (aspirin, ASA). These results were confirmed in groups of generally healthy persons as well as in patients. Future mechanistic investigation revealed that 4MC did not block cyclooxygenase 1 or thromboxane synthase at achievable concentrations but affected coupling of these enzymatic reactions. Structure analysis uncovered that catechol ring is not needed for a strong antiplatelet effect.

Conclusion: 4MC, a common metabolite of many polyphenolic compounds, is a potent antiplatelet substance with higher potency than ASA and can be employed as a template for novel antiplatelet drugs.

Acknowledgement: This work was supported by the Czech Research Health Council (NU21-02-00135).

Two-Sided Coated Cotton Nanotextiles with Enhanced Antimicrobial Properties

A. Giedraitienė[1*], M. Ružauskas[1], R. Šiugždinienė[1], Ž. Laureckas[2], S. Tučkutė[3], D. Milčius[3]

[1]Institute of Microbiology and Virology, Lithuanian University of Health Sciences, Kaunas, Lithuania; [2]Lithuanian University of Health Sciences, Kaunas, Lithuania; [3]Center of Hydrogen Energy Technologies, Lithuanian Energy Institute, Kaunas, Lithuania.

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Background: Cotton fabric coated with metal oxide nanoparticles gains antimicrobial properties against a variety of bacterial and fungal strains, which depend on the nanoparticle's structure and morphology [1]. Antibacterial textiles can help prevent infections from antimicrobial-resistant pathogens without using antibiotics [2]. Thus, it can be used in environments that are sensitive to microbes, such as hospitals, laboratories, and pharmaceutical factories [3].

Aim(s): The aim of this study was to enhance the cotton fabric's antimicrobial properties by depositing Fe_2O_3, ZnO or WO_3 nanoparticles on both sides of its surface.

Methods: The metal oxide Fe_2O_3, ZnO or WO_3 nanoparticles were deposited using low-temperature plasma technology in a pure oxygen atmosphere on both sides of the cotton material. Antimicrobial activity of the coated nanotextiles were evaluated against 16 different bacterial and fungal strains.

Results: The most efficient nanomaterial of all materials tested was a two sided coated with Fe_2O_3 cotton fabric. It exhibited a high antimicrobial activity against a wide spectrum of microorganisms –eleven strains of bacteria and one strain of fungus by up to 90%. A modified fabric with ZnO was less effective against gram-positive than gram-negative bacteria. It inhibited three strains of gram-negative rods very effectively – by 94% or more. The WO_3 treated cotton material showed high antibacterial activity against only three strains of bacteria. Gram-positive bacteria *Corynebacterium spp.* was moderately resistant to all modified two-sided coated with Fe_2O_3, ZnO or WO_3 nanoparticles materials (inactivation, respectively, by 57%, 61% and 39%).

Conclusion: two sided-coated cotton with Fe_2O_3, ZnO or WO_3 textiles showed high antimicrobial effectiveness against bacteria and fungus. Thus, there is a great potential for cotton nanotextiles to be used widely in biomedical applications.

References:

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Pharmacological Targeting of Microglial NMDA Receptors and Mitochondrial ROS in Alzheimer's Disease

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Background: Alzheimer's disease (AD) is the most common cause of dementia in older adults, with an estimated 55 million cases worldwide, predicted to reach 150 million by 2050 [1]. AD pathology involves abnormal amyloid beta (Aβ) accumulation, and the link between $A\beta_{1-42}$ structure and toxicity is of major interest. There is insufficient knowledge about the role of Aβ species on microglial NMDA receptors (NMDAR) and mitochondrial redox state in brain cells, which may be critical in developing Aβ-caused neurotoxicity.

Aim: To investigate whether different $A\beta_{1-42}$ species are capable of producing neurotoxic effects via microglial NMDAR activation and changes in mitochondrial redox state in brain cell cultures.

Materials and methods: Primary rat brain cultures were treated with various $A\beta_{1-42}$ species, monomers, small oligomers, large oligomers, and fibrils. Intracellular calcium concentration was assessed by fluorescence microscopy using the Fluo-3AM dye, mitochondrial superoxide – with the MitoSOX Red. Neuronal viability was assessed by propidium iodide and Hoechst33342 staining. Microglial cells were identified by isolectin GS-IB4 -AlexaFluor488. Extracellular glutamate was measured using the Amplex red glutamic acid/glutamate oxidase assay kit. The pharmacological inhibitors - NMDAR blockers (Memantine, MK801 and D-2-amino-5-phosphopentanoic acid (DAP5)), BAPTA, N-Acetyl L-Cysteine, Apocynin, MitoTEMPO and Frentizole were added before the Aβ treatment.

Results: Small $A\beta_{1-42}$ oligomers induced a concentration- and time-dependent increase of intra-cellular Ca^{2+} and necrotic microglial death. These changes were partially prevented by NMDAR inhibitors MK801, memantine, or DAP5. Neither microglial intracellular Ca^{2+} nor viability was significantly affected by larger $A\beta_{1-42}$ species or monomers. In addition, the small $A\beta_{1-42}$ oligomers caused mitochondrial reactive oxygen species (mtROS)-mediated mitochondrial depolarisation, glutamate release and neuronal cell death. In microglia, the $A\beta_{1-42}$ -induced mtROS overproduction was mediated by intracellular calcium ions and Aβ-binding alcohol dehydrogenase.

Conclusion: The data suggest pharmacological targeting of microglial NMDAR and mtROS may be a promising strategy for AD therapy.

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Longevity as a Rising Trend in the Pharmaceutical Industry: Status Quo and Future Perspectives

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Background: Aging is a biological process modulated by genetic factors, lifestyle choices, and environmental conditions. Due to the advances in healthcare and economic developments, there has been a notable global surge in the elderly demographic. The increasing prevalence of age-related diseases presents a critical and urgent challenge to global health systems, necessitating prompt and effective intervention strategies.

Aim(s): The aim was to provide a comprehensive review of the scientific data on interventions currently available for prolonging healthspan.

Methods: A total of 42 review, systematic review and meta-analysis scientific publications were collected and analysed primarily using the PubMed database. Articles that were published in the last 5 years (i.e. form 2019) were included.

Results: The elucidation of cellular mechanisms underpinning the extension of lifespan by natural compounds has predominantly focused on nutrient-sensing pathways. Critical among these pathways are the sirtuin, AMP-activated protein kinase (AMPK), mammalian target of rapamycin (mTOR), p53, and insulin/insulin-like growth factor-1 (IGF-1) signaling pathways, which have been extensively investigated. Entities like vitamins, minerals, polyunsaturated fatty acids (PUFA), essential amino acids, probiotics, nutritional supplements, polyphenols, saponins, alkaloids, polysaccharides, etc., are being researched looking to find geroprotective agents. These compounds are recognized for their capacity to enhance health and extend lifespan through a multitude of mechanisms.

Conclusion: Longevity, healthspan prolongation and preventative interventions are becoming a core focus of research in the age-related diseases space. Pharmaceutical interventions play an important role in slowing aging, along with lifestyle and behavioural changes.

European Cross-Border ePrescription Service: Estonian and Finnish Pharmacists' First Experiences with Pharmacist-Patient Interaction and Safe Use of Medications

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Background: The European cross-border ePrescription (CBeP) system was first implemented in 2019 in Estonia, followed by Finland in 2020. As of February 2024, seven European countries have joined the CBeP system.

Aim: To explore the experiences of Estonian and Finnish pharmacists with CBeP regarding pharmacist-patient interaction and safe use of medications.

Methods: an electronic survey was forwarded to community pharmacies with experience of CBeP dispensing in Estonia (n=289) and in Finland (n=375). Descriptive statistics and content analysis were used to analyse the data.

Results: in total, 84 responses from Estonian and 154 responses from Finnish pharmacists were included in the study. Less than 45% of the respondents agreed that the patients are well informed about CBeP. Majority of Estonian (61%) and Finnish (73%) respondents had never encountered any problems with identifying the patient. Approximately 70% of the respondents reported having problems with patient counselling due to language barrier. The same proportion of respondents encountered difficulties with patient counselling because of non-translated free text dosage instructions. Problematic drug interaction monitoring was reported by 56% of Estonian and 62% of Finnish respondents. Approximately 55% of the respondents somewhat agreed that the CBeP ensures the safe use of medications.

Conclusion: The pharmacists were able to identify the patients mostly without problems. However, patient knowledge on CBeP could be improved. Patient counselling is disrupted by language barrier and lack of data on other medications and therefore may not always support a safe use of medications.

Facets of the Elaboration of Extracts of *Thymus vulgaris*

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Background: Thymus vulgaris is used as an antimicrobial, expectorant, and antitussive preparation in traditional medicine [1].

Aim: The aim of our studies was to elaborate and standardize extracts of the *Thymus vulgaris herb.*

Methods. The aerial parts of *Thymus vulgaris* were used (0.25-2 mm, gathering 2021 and 2022, Poland). Two extracts were obtained in a ratio of the herbal substance to a final product of approximately 1 to 5. 70% ethanol was used as a solvent for remaceration which was performed at room temperature for 24 hours, 6 hours and 12 hours.

Results. The analytical procedure of aluminum chloride colorimetric method for the total flavonoid contents (TFC) determination for the quality evaluation of the elaborated extracts of *T. vulgaris* herb with the focus on precision considered at two levels: repeatability and intermediate precision (different days and different spectrophotometers) [2]. The repeatability was evaluated as a relative standard deviation and was in the range of 1.85% to 9.76%. The TFC for extract 1 was 2011.5 mg/L and 2061.9 mg/L. The difference between the results was less than the full uncertainty of analysis (2.48% vs 3.2% at the range of 90-110% for the difference in TFC). Therefore, the results obtained on the two spectrophotometers were the same. The TFC for extract 2 was measured in different days on the same spectrophotometer and in different days on different spectrophotometers and was 2551.8, 2590.0 and 2474.6 mg/L (rutin-equivalents). The difference between the results (2551.8 and 2590.0 mg/L) was less than the full uncertainty of analysis (1.46% vs 3.2%), therefore, the results obtained on the two spectrophotometers can considered the same. The difference between the results (2590.0 and 2474.6 mg/L) was less than the full uncertainty of analysis (4.39% vs 4.8% at the range of 85-115%), therefore, the results obtained in different days could be regarded as the same as well. The antimicrobial activity of the two extracts was observed against *Staphylococcus aureus*.

Conclusion. The analytical procedure of measuring TFC was developed and evaluated statistically. This procedure is working well at the range of 85-115% for the difference in TFC. In addition, the extracts of *T. vulgaris* are rich in flavonoids and can be considered as herbal preparation for the complementary treatment of diseases of the upper respiratory tract.

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In Vitro Study of Cyano- Phycocyanin Release from Semisolid Forms and *Ex Vivo* Study of Skin Penetration

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Background: Cyano-phycocyanin (C-PC) is a hydrophilic high molecular weight biliprotein. These properties of C-PC pose challenges in the development of technological formulations for external exposure (1, 2). In this study the *in vitro* release of C-PC from two semisolid formulations, and the *ex vivo* skin penetration of C-PC was evaluated.

Aim: Evaluation of C-PC release *in vitro* from two semisolid forms: 1 % C-PC hydrogel and 1 % C-PC oleogel and *ex vivo* skin penetration.

Methods: *In vitro* release studies were performed (n = 3) using modified Franz-type diffusion cells with a polyvinylidene difluoride dialysis membrane Durapore® and diffusion area - 1.33 cm^2. The study was carried out at a temperature of 32 ± 0.1°C. Acceptor medium samples were taken after 0.5, 1, 2, 4, and 6 hours and analyzed by the spectrophotometric method. *Ex vivo* skin permeation studies were performed (n = 3) using Bronaugh-type diffusion cells with the effective diffusion area- 0.64 cm^2. The human skin was used for ex vivo research. The study was carried out at a temperature of 37°± 0.1°C for 24 hours. The samples were examined by confocal laser scanning microscopy.

Results were statistically processed by using SPSS version 29.0. The release of C-PC (3.40 (0.49) %) from the hydrogel was quantitatively identified after 2 hours. Within 6 hours 9.57 (0.28) % of C-PC was released from the hydrogel (flux 728.07 (19.35) mcg/cm^2). Meanwhile, C-PC was not released from the oleogel even within 6 hours. The results of *ex vivo* penetration studies showed that within 24 hours, most C-PC form hydrogel accumulated in the outermost skin layer- the stratum corneum. In contrast, C-PC from oleogel did not penetrate the skin. These results correlate with the *in vitro* release of phycocyanin from the semisolid form.

Conclusion: C-PC releases and penetrates the skin better from hydrogel than oleo gel semisolid form.

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Characterisation and Protein Composition Analysis of *Cucumis sativus* L. Plant-derived Nanovesicles

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Background: It has been discovered that the cargo of plant-derived nanovesicles (PDNVs) contains a large amount of protein [1,2]. Due to the specific structure of PDNVs, their cargo is encapsulated and protected from enzymes, allowing more potent effects than crude extracts. Due to all these characteristics, PDNVs have recently gained much attention as promising active ingredients to produce cosmetics, medicines, or food supplements. However, the protein content of PDNVs is not well-studied yet, and this prevents PDVN practical applicability. Results of preliminary studies show that cucumber PDNVs can increase skin regeneration, but to define the mechanism of the action, the composition of PDNV cargo needs to be determined.

Aim: To isolate PDNVs from cucumber fruits and leaves, characterise them, and determine the composition of proteins.

Methods: Isolation of PDNVs by polymeric precipitation method; Bradford method; Nanoparticle Tracking Analysis; Gene ontology (GO) analysis by g:Profiler.

Results: PDNVs were isolated from cucumber fruits and leaves. In both samples, the peak of the particle size values distribution curve was around 100 nm. The size distribution profile showed an orderly Gaussian pattern in the leaf PDNVs sample, while it was more heterogeneous in the fruit PDNVs sample. A larger number of particles per 1 mg of protein was observed in fruit PDNVs than in leaf PDNVs. Approximately 500 different proteins were identified in the leaf sample, while in fruit PDNVs, only 150 proteins were found. There were 117 proteins commonly expressed in both samples. GO analysis revealed that both samples of PDNVs were enriched with intracellular and cytoplasm-origin proteins. Proteins of extracellular origin were found in leaf PNDVs. GO terms of molecular functions indicate that proteins are involved in catalytic processes, and GO terms of biological processes show that proteins participate in metabolic processes.

Conclusions: In summary, most proteins detected in cucumber fruit and leaf PDNVs are involved in catalytic and metabolic processes. These results are essential for further investigating PDNVs' biological properties on targeted cell models.

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Investigation of Plant-Derived Nanovesicles' Impact on Mitochondria in Skin Cells Under Psoriasis-Like Inflammation

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Background: Recent data has shown that mitochondrial dysfunction can contribute to psoriasis, a chronic inflammatory skin disease [1]. Extracts from *Melissa Officinalis* demonstrate notable anti-inflammatory properties, while their derived nanovesicles (NVs) present promising therapeutic capabilities by facilitating the targeted delivery of bioactive molecules to recipient cells [2]. However, their impact on mitochondrial function in psoriatic keratinocytes and fibroblasts, key players in psoriasis, is unclear.

Aims: This work aimed to investigate metabolic response and mitochondrial network morphology in psoriatic keratinocytes and fibroblasts. Additionally, we aimed to test how NVs affect the mitochondrial function of these cells.

Methods: The psoriasis-like inflammation (PLI) in human HaCaT keratinocytes and dermal fibroblasts were induced by cytokines IL-17, IL-22, and TNF-α. The psoriasis-related biomarkers were measured using qRT-PCR and Luminex xMAP to validate the model. Real-time measurement of cellular bioenergetic activity was assessed using Agilent Seahorse XFp analyzer, mitochondrial network was determined by STED microscopy. PDNV isolation was based on polymer-based precipitation; their size and concentration were evaluated using Nanotracking analysis.

Results: After 24-hour cytokine treatment, both cell types had increased expression of the psoriasis-related gene PI3 and the augmented release of IL-6, IFN-β, IL-1α, IL-18, and CCL5 in their supernatants. Investigation of bioenergetic activity revealed a significant decrease in the overall respiration and glycolysis efficiency in psoriatic keratinocytes but not fibroblasts, suggesting the cells were energetically disabled. Interestingly, both cell types exhibited decreased mitochondrial structure integrity, however, *Melissa Officinalis*-derived NVs were able to restore it in psoriatic fibroblasts.

Conclusions: Although keratinocytes exhibited greater sensitivity to PLI, both keratinocytes and fibroblasts displayed alterations in mitochondrial morphology. Notably, despite shared mitochondrial structural decline, *Melissa Officinalis*-NVs uniquely restored integrity in psoriatic fibroblasts, suggesting a potential therapeutic strategy for addressing cellular dysfunction in psoriasis. Further investigation into mitochondrial alterations during inflammatory conditions could provide insight into the underlying mechanisms of psoriasis pathogenesis.

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Anti-Dementia Effects of Mansonone G and Mansorin A in the Zebrafish Model of Alzheimer's Disease Induced by Okadaic Acid

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Background: Dementia is a multifaceted clinical syndrome characterized by progressive cognitive deterioration with Alzheimer's disease (AD) as its most common form. The rising number of AD cases annually emphasizes the critical need for novel treatments against dementia. Mansonone G (MG) and mansorin A (MA) have shown antioxidant properties in the central nervous system. Considering the strong link between oxidative stress and AD progression, MG and MA could potentially mitigate AD-like symptoms in animal models.

Aim(s): To explore the potential anti-dementia effects of MG and MA, their abilities to improve memory, reduce anxiety, and act as antioxidants were examined in an animal model of AD.

Methods: An AD zebrafish model was created *via* immersion in okadaic acid 10 nm, leading to cognitive impairment, anxiety-like behavior, and increased oxidative stress. MG and MA were subsequently administered through chronic immersion at concentrations of 1, 3, and 6 µg/L. Behavioral assessments, namely Y-maze and Novel Object Recognition tests, were conducted to measure memory enhancement effects, while Novel Object Approach and Novel Tank Diving tests were utilized to assess anxiety-reducing effects. Biochemical analysis was conducted to evaluate oxidative stress levels and cholinergic status in the brain.

Results: The findings indicate that MG and MA enhanced short-term spatial and recognition memory while alleviating anxiety-like behavior in the zebrafish model. Additionally, MG and MA effectively mitigated oxidative stress induced by okadaic acid by increasing the activity of catalase, superoxide dismutase, reduced glutathione, and glutathione peroxidase. Moreover, they reduced malondialdehyde levels and acetylcholinesterase activity in the brain.

Conclusion: These combined promnesic, anxiolytic, and antioxidant effects underscore the potential of mansonone G and mansorin A as promising therapeutic agents for dementia management.

The Impact of Several Types of Excipients Used in Ultrasound-Assisted Extraction of *Artemisia annua* L.

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Background: *Artemisia annua* L., commonly known as Sweet wormwood, belongs to the *Asteraceae* family and it is predominantly found in Asia, Europe and North America [1,2]. The plant is known for its unique chemical profile and anti-inflammatory, antioxidant and anticancer properties [2,3]. The plant contains various phytochemicals which include polyphenols (chlorogenic acid, 4-O-caffeoylquinic acid), flavonoids (apigenin, luteolin), coumarins and terpenes [3]. These intricate compounds underscore the plant's potential in contributing to the development of innovative anticancer pharmaceuticals.

Aim(s): To determine the effect of the excipients used in the extraction process of *Artemisia annua* L. on its phytochemical profile.

Methods: Herbal extracts of *Artemisia annua* L. were prepared using ultrasound in conjunction with various excipients, centrifugation, and an 80% (V/V) ethanol solution as the solvent. The extraction process involved the utilization of β-cyclodextrin, titanium dioxide, L-glutathione, propylene glycol, and a control group. The solutions were sonicated at frequency of 38 kHz for 30 minutes at 25 ^{o}C and then centrifuged for 15 min at the speed of 3000 rpm. The analytes were subsequently analyzed with high-performance liquid chromatography (HPLC).

Results: The extracts of *Artemisia annua* L. revealed the presence of several phytochemicals, including apigenin, luteolin, neochlorogenic acid, and 4-O-caffeoylquinic acid. Extractions without excipients exhibited concentrations of 4,495 ± 0.225 µg/g of apigenin and 775,679 ± 38,784 µg/g of luteolin. In contrast, extractions with propylene glycol demonstrated concentrations of 6,357 ± 0.318 µg/g of apigenin and 1,114 ± 0.056 mg/g of luteolin. Notably, extracts with L-Glutathione as the excipient exhibited the highest concentrations, with apigenin at 7,268 ± 0.363 µg/g and luteolin at 1,246 ± 0.062 mg/g.

Conclusion: The study found that L-Glutathione as an excipient significantly enhances the phytochemical yield in *Artemisia annua* L. extractions, particularly increasing apigenin and luteolin concentrations.

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LITHUANIAN UNIVERSITY OF HEALTH SCIENCES
FACULTY OF PHARMACY

Abstracts
History session

Natural Medications as a Source of Pharmacologically-active Compounds: from Empirical Healing Practices to Modern Medicines

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Background: The earliest information on medical materials/substances (*materia medica*) used in healing practices was recorded in writing between 4000-6000 B.C., marking the beginning of medicine. Over the millennia, empirical research has taught humanity how to treat illnesses by using active ingredients derived from plants, minerals, or animals. But because healing was closely associated with rituals and magical practices, medical professionals had to deal with patients' beliefs about the efficacy of their treatments. The great advancements in science and technology during the 1800s allowed medicine to quickly advance to contemporary ideas. Novel approaches to therapeutic interventions utilized evidence-based hypotheses propelled by pharmacological mechanisms. Herbal medicine practice had to adapt to these new concepts as well.

Aim(s): To provide insight into the empirically-used medicinal plants whose phytochemical constituents became precursors to modern medicines.

Methods: Literature analysis.

Results: Herbal ingredients were the primary source of many modern medicines. Strong opioid painkillers, like codeine or morphine, were mostly traditionally utilized as *Papaver somniferum* L. plant preparations. Many of the active ingredients in chemotherapy drugs were sourced from natural substances, including vinca alkaloids vinblastine and vincristine, which were isolated from the *Catharansus rosea* L. plant, and taxols, which were mostly found in the bark of *Taxus brevifolia* L. Key cardiovascular medications were mostly obtained from plants. For example, *Digitalis purpurea* L. herb is the primary source of digoxin, while captopril was created from a component found in the venom of the deadly Brazilian viper (*Bothrops jararaca*).

Conclusion: Herbal remedies are being used as the primary therapeutic approach, or as a supplemental medication, for primary pharmacotherapy even in the present day. Additionally, researchers are consistently finding new phytochemical substances that could lead to the development of novel treatments for chronic illnesses. Research on ethnopharmaceuticals and the traditional (empiric) approach to healing may be crucial in generating novel active drug substance research concepts.

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Comparative Assessment of Pharmacy Curricula in Lithuania, Latvia, Estonia, and the USA (1922-1940)

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Background: Vytautas Magnus University in Lithuania witnessed the graduation of 158 pharmacists between 1922 and 1940, with changes occurring in the duration, curriculum, subjects, and research project requirements.

Aim(s): To compare the Lithuanian pharmacy study program with those in Latvia, Estonia, and two universities in Washington DC (USA).

Methods: A comparative analysis of higher pharmacy study programs was made.

Results: After the Baltic countries declared their independence in 1918, national universities were established. They included pharmacy programs. The program creators were mostly graduates of Imperial Russian universities, but their aim was to align the study programs with Western standards. Lithuanian, Latvian, and Estonian pharmacy study programs exhibited more similarities than differences. However, when comparing pharmacy study programs in Washington DC universities with those in the Baltic countries, significant differences emerged. US pharmacy students had more study directions, longer lecture and laboratory hours.

Conclusion: Pharmacy study programs in Baltic and Washington DC universities shared about 60% similar disciplines. Notably, US pharmacy students studied additional subjects such as psychology, posology, and foreign languages, which were absent in Baltic programs. Washington DC students had to choose foreign languages, unlike their Baltic counterparts. In addition, anatomy was not included in the curriculum of Washington DC universities.

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The Role of the Riga Society of Pharmacists and Chemists in the Development of Natural Sciences in the Baltic Region

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Background: Historically, interactions between chemistry and pharmacy are intricate and have evolved over centuries. The 17th and 18th centuries saw the emergence of pharmaceutical chemistry as a distinct discipline. Pharmacists and apothecaries began to systematize the preparation of medicines, incorporating chemical principles. Today, medicine discovery is a highly interdisciplinary field involving chemists, biologists, pharmacologists, and other specialists.
On February 2, 1803, David Hieronymus Grindel (1776-1836) and his associates founded the Riga Pharmacists and Chemists Society (Riager Pharmazeutisch-Chemische Sozietät), the first such society in Russia. Its activities were scientific in orientation, and its aims were to: unite local pharmacists, promote original research, propagate knowledge, etc.
In 1834, the Riga Pharmacists and Chemists Society founded the first artificial mineral water establishment in Riga in the Vērmanes Garden. This activity created a continuity in mineral water research that is still relevant today.

Aim(s): As the custodian of cultural heritage, the Museum of Pharmacy aims to study and provide the public with insights into the history of the pharmaceutical industry and its importance in the development of today's science.

Method(s): This paper uses historical descriptive, comparative, and summary methods.

Results: The Museum of Pharmacy exhibits more than 3,000 objects tracing the history of pharmacy and chemistry in Latvia from the 18th century to the present.

Conclusion: Pharmaceutical and chemical sciences in the Baltic region developed on a par with Europe's most important discoveries, including the study and use of healing mineral waters, which were equally important in Europe and the Baltics.

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Pharmacy Collection at the Museum of the History of Medicine at Vilnius University Faculty of Medicine

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Background: The History of Medicine Museum at Vilnius University is dedicated to the history of the Vilnius University medical faculty, which was established in 1781. The museum was formed in 1998 from various collections held by different departments of the medical faculty.

Aim(s): To provide an overview of the pharmacy collection at the Museum of the History of Medicine at Vilnius University and parts of the collection that were transferred to the Museum of the History of Lithuanian Medicine and Pharmacy in Kaunas.

Method(s): Identification and discussion of artifacts within the pharmacy collections housed in the Vilnius and Kaunas museums.

Results: The pharmacy collection spans the interwar and Soviet periods. It includes pharmaceutical artifacts from esteemed faculty members, teaching aids, archival photographs, documents, and books. Notable are Jan Kazimierz Muszyński's collection of medicinal plants and a segment of the pharmacopeia authored by German pharmacologists, including the inaugural volume of Hager's *Handbuch der Pharmazeutischen Praxis*.

Conclusion: This presentation emphasizes the significance of the pharmaceutical collection within the Faculty of Medicine at Vilnius University in enriching our understanding of medical history. The highlight is Jan Muszyński's pharmacological collection which is now housed and exhibited at the pharmacy museum in Kaunas.

Educational and Methodological Work at the Pharmacognosy Department of the National University of Pharmacy, Kharkiv, Ukraine

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Background: Pharmacognosy is a branch of pharmacy that deals with herbal and animal products. It's very important in the training of pharmacists.

Aim(s): The aim was to study retrospectively the changes in pharmacognosy teaching at the Pharmacognosy Department of the National University of Pharmacy, Kharkiv, Ukraine.

Methods: Analysis of documents, curriculums about pharmacognosy teaching at the National university of pharmacy.

Results: From 1805 until 1930 pharmacognosy was taught according to the commodity classification system of herbal raw materials. From 1939, objects were classified based on phytochemicals. The number of pharmacognosy teaching hours changed over the years. In 1930, (4 years study) pharmacognosy was taught for three semesters (IVth, Vth, VIth); from 1953 (5 year training) pharmacognosy – for three semesters (3rd and 4th years); in 1966 (4.5-year study) pharmacognosy – for Vth and VIth semesters; from 1973 (5 year period), pharmacognosy has been taught during the 3rd year. The 1981-1982 syllabus showed a new discipline: "Resource Science of Medicinal Plants".

Since Ukraine independence (1991), the development of programs and methodological support for them was begun. Computer technologies were introduced into the education process and have been significantly upgraded since implementation of distance learning at the University (2014). Since 2003-2004, methodological support in English has increased. The national textbook *Pharmacognosy with the Basics of Plant Biochemistry* (2000) was published. The number of places for education internships in pharmacognosy increased: Varna (Bulgaria); Medical University of Warsaw (Poland); Institute of Pharmacy, University of Tartu (Estonia). Transition to the credit-module system in 2008-2009 increased hours of independent student learning and decreased lecture hours in pharmacognosy. That system has been continually supported methodologically.

Conclusion: Over the years, 14 monographs; 8 standard training programs; 25 textbooks, practical handbooks and training manuals; 47 lecture notes; 113 educational and methodological recommendations were created. This is a strong basis for further development.

Ethnopharmacology of Ukraine: From Local Use to Global Commodities

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Background: Phytotherapy can achieve its greatest impact through the integration of scientific approaches and traditional medical practices. The available records show that Ukrainian local medicine developed from the ancient times of Kyivan Rus to modern times with changes in the harvesting dates, preparation, and use of plants (1).

Aim: Determination of critical points in the historical development of traditional medicine in Ukraine and its transformation from traditional knowledge to evidence-based scientific knowledge and to modern herbal medicinal products (HMP) on the pharmaceutical market.

Method(s): A systematic search and analysis of available historical data on traditional medicine in Ukraine and the State Register of medicines of Ukraine; analysis to assess the HMP market.

Results: Currently in Ukraine almost 4,600 medicinal medicines are registered, and 15% of them are HMP with a tendency to expand the range. Several plants from Ukrainian traditional medicine have reached wider markets thanks to scientifically-based processes, among them the famous ones are Echinacea, Calendula, Chamomile, St. John's Wort. Now these plants are widely cultivated in the country to meet production needs (3). However, many plants, such as *Epilobium angustifolium*, *Ruta graveolens*, *Lespedeza bicolor*, *Rosa damascene*, *Marrubium vulgare* etc., which are used in informal (traditional) medicine, have not yet been introduced into general medicine. Most traditional medicinal plants are harvested from the wild. Modern knowledge and analytical capabilities allow us to determine the optimal place for plant collecting/growing, the plant harvesting time, the processing methods, and the best ways to obtain extracts with the maximum content of active metabolites.

Conclusions. Today, the Ukrainian pharmaceutical market includes HMP and the interest in natural remedies is growing. Regulatory bodies emphasize the need for scientific verification, ensuring the safety and efficacy of herbal products. This reflects a balance between the preservation of cultural practices and the integration of modern pharmaceutical standards.

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Pharmacy Studies at the Faculty of Mathematics and Natural Sciences of the University of Lithuania

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Background: One hundred years ago, compulsory subjects for pharmacy students of the Department of the Faculty of Medicine of the University of Lithuania were taught by professors of the Faculty of Mathematics and Natural Sciences.

Aim: To provide an overview of the professors from the Faculty of Mathematics and Natural Sciences at the University of Lithuania who taught pharmacy students.

Methods: An overview and analysis of historical archival sources is provided.

Results: Pharmacy students took courses in physics, analytical chemistry, and plant systematics. They took place in the Laboratory of Organic Chemistry and Technology at the Faculty of Technology, headed by Prof. Jonas Šimkus. The laboratory work was organized in separate groups of 8 people each. The Physics Laboratory, headed by Prof. Vincentas Čepinskis, was situated in one of the rooms of Building I of the University. The Laboratory of Inorganic and Analytical Chemistry was headed by Prof. Filypas Butkevičius. The Laboratory of Organic Chemistry, supervised by Prof. Antanas Purėnas, occupied two rooms in the basement of Building I of the University. Pharmacy students were required to investigate 13 qualitative inorganic and 29 quantitative inorganic analysis problems. In the Laboratory of Organic Chemistry, headed by Prof. Antanas Purėnas, they were required to do 15 synthesis and 4 qualitative analysis problems, respectively.

Conclusion: Pharmacy students were taught by famous professors who spent as much time as possible not only on lectures but also on practical work.

The Joint Professorship of Chemistry and Pharmacy in 1802-1843 at the University of Tartu, Estonia

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Background: After the Northern War, there was a longer break in the history of the University of Tartu (1710-1802), which started operating in 1632.

Aim(s): The aim was to retrospectively study the contributions of different holders of joint professorships of chemistry and pharmacy at the University of Dorpat (Tartu), Estonia, in 1802-1843.

Methods: Collection and analysis of biographical data of professors at the mentioned time (1-3).

Results: In 1802, the joint professorship of chemistry and pharmacy was established at the University of the Tsarist Russia period, and E.H.G. Arzt was invited to fill it (in Tartu 1800-1802). After his tragic death, A.N. Scherer (1803-1804), known as the introducer of Lavoisier's trend in Tartu chemistry, continued as a professor of chemistry and pharmacy. For a longer time (1804-1814), D.H. Grindel worked as a professor, teaching pharmacy, pharmaceutical chemistry, and pharmacognosy. His successor (1814-1821) was a pharmacist J.E.F. Giese, the author of several pharmaceutical textbooks and a phytochemist. The next professor, G.W. Osann (1823-1828) was known as a physical chemist. Until the Institute of Pharmacy became independent, the joint professorship of chemistry and pharmacy was held by the pharmacist C.T.F. Goebel (1828-1843, until 1851, professor of chemistry), who founded the institute. After that, the chemistry professors started teaching and researching chemistry, and the pharmacist C.F.E. Siller (1843-1850) from Danzig, Germany, was invited to be the first professor of the independent Institute of Pharmacy. Later, the institute developed into one of the most important pharmaceutical research centers in Europe.

Conclusion: The holders of the joint professorship of chemistry and pharmacy who worked in Tartu in the first half of the 19th century were internationally famous; their contributions provided a strong foundation for both chemistry and the birth of the independent Institute of Pharmacy at the University of Tartu.

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The Topic of Chemical Weapons in the Lithuanian Interwar Press

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Background: World War I marked a new era in 20th century warfare. The massive use of chemical weapons completely changed the specifics of conflicts. The 1925 Geneva Convention and other documents banned the use of chemical weapons, but their development continued. During the interwar period, sensing the threat of another upcoming war and the possibility that chemical weapons will be used again, the topic of chemical warfare began to be disscused in Lithuanian public space.

Aim(s): To find out what topics related to chemical warfare were the most relevant in the interwar Lithuanian press and what sentiments about a possible next war were expressed.

Method(s): During this research, the periodicals Medicina, Farmacijos žinios, Karys, Mūsų žinynas, Lietuvos aidas and Lietuvos žinios were examined.

Results: In the second half of the interwar period (the 1930s), articles about a probable future war were increasing in the Lithuanian press. It was written that due to the rapid development of chemical science and aviation, the next war would be a chemical one. Although scaremongering and pacifist articles could be found in the public press, the professional press of military and health care professionals took the prospect of chemical warfare very seriously. The pharmacists and doctors wrote extensive texts about chemical weapons, their effects on health, prevention and treatment measures. Both military and medical texts distinguished the role of the chemist, pharmacist and medic in preparing for and providing assistance in the event of chemical warfare. Nevertheless, many texts were at an educational level, lacking a real presentation of Lithuania's preparation for chemical warfare

Conclusions: Our research showed that the topic of chemical weapons was widely discussed in interwar Lithuanian press. However, the texts are more theoretical and do not represent Lithuania's preparation for a possible chemical war. Therefore, it is likely that the analysis of archival documents will be necessary to expand the research on this issue.

Pharmaceutical Chemistry in Ferrara since 1801

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Background: Archival documents provide an historical account of the establishment of pharmaceutical chemistry in Ferrara dating back to 1801. This includes details such as the Decree of October 9th, 1801; the appointment of Antonio Campana as the course instructor; the search for a suitable location; the setup of laboratories at St. Anna Hospital; and the comprehensive inventory of equipment, chemicals, instruments, and valuable books.

Aim(s): To explore the origins and early development of pharmaceutical chemistry in Ferrara, Italy, particularly focusing on the key events, individuals, and the initial setup of educational and laboratory facilities.

Method(s): An in-depth analysis of archival documents related to the establishment of pharmaceutical chemistry in Ferrara.

Results: The results of this study reveal significant insights into the early history of pharmaceutical chemistry in Ferrara. Detailed information is presented regarding the Decree of 1801, the appointment of Antonio Campana, the selection of a suitable location, and the establishment of laboratories at St. Anna Hospital. The inventory of equipment, chemicals, instruments, and valuable books is also outlined.

Conclusion: In conclusion, the historical account of pharmaceutical chemistry in Ferrara sheds light on its foundational elements, key contributors, and the early infrastructure that laid the groundwork for its subsequent development. This exploration enhances our understanding of the historical context in which pharmaceutical education and research began in Ferrara.

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Chemical Warfare Training of Soldiers and Paramedics in Interwar Vilnius and Kaunas

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Background: World War I was the first time when weapons of mass destruction were used. Since several categories of battle gas were used, it made warfare a nightmare for the soldier and the paramedic. The risks from this new kind of attack became a strategic concern to the Lithuanian and Polish governments. Therefore, training for both soldiers and paramedics was organized in Kaunas, Lithuania as well as in Polish-occupied Vilnius.

Aim(s): To find out what kind of chemical warfare training was given to soldiers and paramedics in Kaunas and Vilnius.

Method(s): The training programs for soldiers, paramilitary organizations and paramedics from Vilnius and Kaunas were analyzed.

Results: Our research revealed that active steps towards getting ready for eventual chemical weapon attacks began in Vilnius during the 1930's. Students of medicine and pharmacy at the University of Stephen Bathory in Vilnius received military training as paramedics. The instructions they received covered numerous scenarios of conventional warfare as well as new threats, including chemical weapons. Similarly, during the 1930's in Kaunas, textbooks of instructions for soldiers and for members of the paramilitary organization "Šauliai" were published. The instructions included general information about the different types of war-related traumas, including those from chemical weapons, and their action mechanisms, as well as information about the ways in which to prevent, or at least minimize, damage in case of chemical warfare.

Conclusions: Our research revealed that soldiers and paramedics were well-informed about chemical warfare issues. The chemical warfare related information to some extent was also accessible to civilians, since it was clear that this was in the strategic interest of the state.

LITHUANIAN UNIVERSITY OF HEALTH SCIENCES
FACULTY OF PHARMACY

Abstracts
Poster session

Composition Nodeling, Selection and Evaluation of Physical Properties of Oil-Water Microemulsion Gels

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Background: Microemulsions are a promising pharmaceutical form due to its capacity to carry both hydrophilic and lipophilic active pharmaceutical ingredients (1), also its manufacturing cost-effectiveness due to being self-assembling also known as self-micro-emulsifying drug delivery system (SMEDDS) (2), and its enhanced penetration due to surface active ingredients (3), while a gel form helps it stay on the skin longer ensuring efficacy due to longer exposure.

Aims: To design, evaluate and select oil-water microemulsion gels based on the physical properties.

Methods: Surfactant, cosurfactant and oil have been selected from the literature based on their reported effectiveness and non-toxicity. Oil-water microemulsions have been evaluated and selected considering average particle size (APS) and polydispersity (PDI) index determined by zeta-sizer, oil-water microemulsion gels have been evaluated and selected considering the complex viscosity and thixotropy determined by rheometer and pH determined by pH-meter.

Results: The optimal constitution of a microemulsion gel, having the lowest APS (< 100 nm) (4) and PDI (< 0.4), the most stable (variability index < 20%) and in the range of 10 – 10000 Pa complex viscosity between 2 – 40 °C temperature interval, as well as the best thixotropy measurements (recovery index > 20%) has been between 18.54 and 20.61% of hydroxypropyl methylcellulose (HPMC) (M.N. 86 000 viscosity 4 000 cP (2% solution)) in a 3:5:1:1 respectively water, surfactant (Labrasol©), cosurfactant (1,2-propanediol), oil (isopropyl myristate). All microemulsion gels had a pH in the range of 5.5 – 6.5, which is acceptable for dermatological use.

Conclusion: Oil-water microemulsion, gelled with HPMC, has the most desirable physical properties, when water, surfactant, cosurfactant, and oil ratio is 3:5:1:1 respectively, and gelling agent is in the 18.54 – 20.61% range.

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Microorganisms, Statins, and Host Biomarkers in Patients with Myocardial Infarction

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Background: Viruses like HSV, Hepatitis viruses, and potentially parvovirus B19V can trigger endothelial dysfunction and atherosclerosis. However, the pathogenesis during B19V infection remains unclear. Host inflammatory biomarkers like selenoprotein P (SELENOP), myeloperoxidase (MPO) and neutrophil elastase are linked to microbial defense and inflammation regulation, yet their relationships with statins are unknown.

Aims: The study explores the effect of microorganism (parvovirus B19V, bacteria) and statin use on host biomarkers in patients with myocardial infarction (MI).

Methods: 341 blood samples from MI patients and 87 healthy subjects were used. Bacterial and B19V genes were examined by RT-PCR and Agarose gel electrophoresis. B19V sequences were sequenced with Sanger sequencing and analyzed with BLAST®. The activities of the three biomarkers were measured by ELISA (Cayman Chemical, US or Abbexa, UK). The nonparametric Kruskal-Wallis test was used for statistical analysis.

Results: B19V DNA was detected in 1 patient out of 270 samples with high total blood cholesterol, CRP, creatinine, and troponin levels during MI. Sequences from the patient and the B19V positive control contain a silent mutation. Bacterial gene detection was not successful. SELENOP levels were higher in atorvastatin users than in rosuvastatin users, respectively 43 (30-54) vs 37.5 (28-59) ng/ml, p=.002. MPO levels were lower in rosuvastatin than in atorvastatin users or no-users, respectively 10 (7.8-21.1) vs 17.6 (4.1-21.8) ng/ml, p=.019. Neutrophil elastase was not significantly related with statin use.

Conclusions: B19V may persist in the blood and participate in atherosclerosis and MI. While Rosuvastatin may better control MI due to lower MPO levels, further investigation is needed to determine the appropriate range of SELENOP. Additional studies are required to reveal the described impacts of these inflammatory biomarkers in atherosclerosis and to clear the effect of statins on cardiovascular status in cardiovascular disease patients.

Enhancing Technological Specifications for a Solid Pharmaceutical Formulation with Dry *Acorus calamus* Extract and Quercetin Solid Dispersion

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Background: Addressing technological challenges in tablets with Acorus calamus and quercetin is pivotal. Our research focuses on excipient selection to improve tablet integrity and dissolution, crucial for efficacy and stability.

Aim: To optimize the solid dosage form incorporating Acorus calamus leaf extract and quercetin solid dispersion.

Methods: Pharmacotechnological methods of tablet research were used. Tablet abrasion was assessed with the PJ-3 tester, disintegration time with the "PTZ AUTO" tester (Pharma Test, Germany), and tablet strength through the Monsanto tester (Bexco, Belgium).

Results: Given that Kollidon CL, the carrier for Acorus calamus leaf dry extract, also functions as a capillary disintegrant, we added swelling disintegrants Primojel and Ac-Di-Sol to complement its properties. Concentrations (1-12%) were set based on literature and manufacturer advices. Primojel failed to meet disintegration criteria and weakened tablets (79 N to 40 N). In contrast, 10% Ac-Di-Sol achieved desired disintegration (9 minutes) with minimal strength reduction (79 N to 60 N. Lubripharm SSF (0.156%) as a lubricant notably improved abrasion resistance, ensuring an optimal balance of tablet properties without adversely affecting disintegration or strength.

Conclusion: The study concluded that the optimal solution for correcting the abrasion of tablets containing dry Acorus calamus leaf extract, quercetin solid dispersion, and filler (Microcel 200 and Kollidon CL) is the use of Lubripharm SSF as a lubricant and Ac-Di-Sol as a disintegrant. This combination of excipients not only significantly reduces the abrasion of tablets but also maintains an optimal balance of other key pharmacotechnological parameters, such as disintegration time and strength, thereby ensuring high quality and stability of the combined tablets at various stages of their production and storage.

Formulation and Evaluation of Herbal Shampoo Enriched with Allantoin and Patchouli extract

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Background: Hair care, an ancient practice evolving from animal fats to modern shampoos, now witnesses a shift towards herbal alternatives due to concerns about synthetic chemicals [1, 2]. This research addresses the demand by formulating a stable herbal shampoo with natural ingredients.

Aim: To investigate the impact of technological procedures on the quality of a herbal shampoo formulation.

Methods: Evaluation encompassed potentiometric, texture analyzes, foam volume and stability, surface tension using a Traube stalagmometer, ink residue in foam to determine dirt dispersion and detergency abilities determination methods. A consumer study involved distributing shampoo samples and questionnaires (Nr.BEC-FF-52) to gather performance feedback from participants.

Results: Over 5 months, pH variations remained statistically insignificant. No ink in foam during dirt dispersion test. A slight increase in cleansing action (from 20.22 ± 0.09 to 20.27 ± 0.06) ($p>0.05$). Wetting time reduced from (75.32 ± 1.459 sec.) to (74.5 ± 1.025 sec.), ($p>0.05$). Surface tension reduced (from 28.67 ± 0.02 mN/m to 27.08 ± 0.02 mN/m) ($p<0.05$). Foam volume increased (from 175.87 ± 3.01ml to 179.24 ± 0.79ml) ($p>0.05$). After 5 months at room temperature (25 ± 2°C), all texture parameters significantly changed. Consumer survey indicated overall satisfaction with the shampoo, despite some concerns about thickness.

Conclusions: The addition of 1% allantoin and 0.5% patchouli extract improved shampoo quality, enhancing cleansing action, reducing wetting time, decreasing surface tension, slightly increasing foam volume, and ensuring overall stability.

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Preliminary Phytochemical Studies of *Salvia splendens* Flowers Anthocyanins

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Background: Anthocyanins are secondary metabolites of plants and play a role in plant reproduction. Also, these substances have a value as a source for the pharmacological industry. It is known that flowers of *S. splendens* contain such anthocyanins as: Pelargonidin-3-(6-caffeoylglucoside)-5-(4,6-dimalonylglucoside) (salvianin); Pelargonidin-3-(6-Caffeoylglucoside)-5-(6-malonylglucoside); Pelargonidin-3-(6-Caffeoylglucoside)-5-glucoside; Pelargonidin Pelargonidin-3-(6-p-Coumaroylglucoside)-5-(4,6-dimalonylglucoside) (monardaein); Pelargonidin-3-(6-p-Coumaroylglucoside)-5-(6-malonylglucoside); Pelargonidin-3-(6-p-Coumaroylglucoside)-5-glucoside; Delphinidin-3-(6-caffeoylglucoside)-5-(4,6-dimalonylglucoside) (salviadelphin); Delphinidin-3-(6-Caffeoylglucoside)-5-(6-malonylglucoside); Delphinidin-3-(6-Caffeoylglucoside)-5-glucoside; Delphinidin-3-(6-p-Coumaroylglucoside)-5-(4,6-dimalonylglucoside); Delphinidin-3-(6-p-Coumaroylglucoside)-5-glucoside (awobanin) (1).

Aim: Preliminary phytochemical study of flowers of *S. splendens.*

Methods: qualitative reactions, thin-layer chromatography

Results: The flowers of *S. splendens* are weakly drooping, on short red glandular peduncles; the perianth double, the calyx is red, tubular-double-lipped; the upper lip is triangular-ovate with a sharp tip, the lower lip is slightly longer than the upper one, deeply bidentate; corolla is red, 4 cm long, pubescent, tube elongated, 2-2.5 times longer than calyx; the upper lip is straight, slightly concave, the lower lip is slightly shorter; two well-developed stamens, stamen filaments are long, anthers are red, pistil with two-lobed stigma and a long thread-like column. A study of the flowers reveals that parenchyma cells and hairs in the throat contain anthocyanins. Qualitative reactions with alkali and lead acetate basic and thin-layer chromatography confirmed the presence of anthocyanins in flowers. To prepare the test solution, flowers crushed into powder were ground in a mortar with 70% ethanol for 5 minutes, then infused for 20 minutes, filtered, and applied in strips to a chromatographic plate, dried in air and chromatographed in the solvent system ethyl acetate-acetic acid- formic acid-water (100:11:11:25). The resulting chromatograms were investigated.

Conclusions: As a result of the study in flowers of *S. splendens*, 5 anthocyanins were detected by qualitative reaction and thin-layer chromatography method.

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Problems of Medical Devices Standardization for the Ukraine Market in View of European Integration

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Background: Medical devices (MD) are an integral part of providing high-quality medical care. Their standardization problems are becoming a challenge that hinders the safety and effectiveness of their distribution and use for the Ukrainian market and for the global pharmaceutical market.

Aim(s): The main aspects of this problem are the heterogeneity of the formulations and types of medical devices, and heterogeneity of the standards that describe the requirements for those MDs. It is important for Ukraine to resolve these issues in the context of the European integration process.

Methods: An urgent issue is the adaptation of the main regulatory legislative act regarding the MD of Ukraine (Technical Regulation No. 753) to comply with the current regulation in the EU MDR (REGULATION (EU) 2017/745).

Results: When comparing the regulatory requirements of the EU and Ukraine, key differences were identified. First, the MDR changes the rules for the classification of MDs, reclassifying several devices with an increase in their risk class, separates the concepts of MDs and devices non-medical use. Second, the products that were never previously classified as "medical devices", are now subject to MDR regulation. These products include liposuction equipment, high intensity radiation equipment used for tattooing and hair removal, etc. And thirdly, the implementation of Unique Device Identification System (UDI) provides improved traceability of a product throughout its life cycle. This helps to improve the accuracy and quality of supervision and monitoring.

Conclusion: In overcoming the problems of MDs standardization for the Ukrainian market, it is important to recognize that this task can be solved through the cooperation of all departments and industries related to MDs. Shared responsibility will contribute to the creation of an effective standardization system, and as well as European integration in the development of new monographs of the Ukraine State Pharmacopoeia and legislation on MDs.

Emulsion-based Encapsulation of *Thymus vulgaris* L., *Citrus sinensis* L. Osbeck or *Betula lenta* L. Essential Oils, Their Analysis and Effect on *Lactobacillus plantarum*

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Background: In an emulsion, essential oils can simultaneously function as an oil phase, active ingredient, and preservative. For this reason, they are an effective choice to produce cosmetics. Even bigger effectivity can be achieved using nanoemulsion which promotes controlled release of lipophilic compounds. However, sometimes essential oils can act against beneficial skin bacteria and promote inflammatory processes within the skin. Thus, there is a need to balance the benefit-harm ratio while making cosmetics with essential oils.

Aims: Using the method for obtaining nanoemulsions, encapsulate essential oils of *T. vulgaris* L., *C. sinensis* L. Osbeck or *Betula lenta* L., perform a qualitative analysis of the encapsulated essential oils and determine their effect on *L. plantarum*.

Methods: Emulsions were obtained using phase inversion composition technique. Gas chromatography with mass spectrometry was used to perform analysis of essential oils. Agar diffusion method was used to evaluate the effect of emulsions on *L. plantarum.*

Results: 24 components were identified in the encapsulated (1 % (v/v)) essential oil of *T. vulgaris.* The dominant component – p-cymene. 5 components were identified in the encapsulated essential oil of *C. sinensis*. The dominant component – limonene. Only methyl salicylate was identified in the encapsulated essential oil of *B. lenta*. The encapsulated (up to 5 % (v/v)) *B. lenta* essential oil did not have an effect on *L. plantarum*, while the rest essential oils had a bacteriostatic effect (mostly weak).

Conclusion: After the encapsulation of essential oils, the number of identified components decreased. Encapsulated essential oils of *T. vulgaris* and *C. sinensis* had a bacteriostatic effect on *L. plantarum*, while the pure ones had a bactericidal effect.

Evaluation of Solid Dispersions with Etodolac Obtained by Ball Milling Method

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Background: Many substances are characterized by low solubility in water, what is a limiting factor to obtain necessary form of drug and to achieve the therapeutic effect. Various approach to improve drug solubility are applied. One of them, solid dispersions (SD) are the mixture of drug and hydrophilic carrier (1,2). Etodolac (ETD) is a non-steroidal anti-inflammatory drug, selective cyclooxygenase-2 inhibitor. It is characterized by anti-inflammatory, analgesic and antipyretic properties and in medicine it is used in solid drug forms (tablets, capsules) (3).

Aim: The aim of this study was to prepare solid dispersions with etodolac (ETD-SD) by using ball milling method and then to evaluate properties of designed SD.

Methods: In the study, SD formulations were prepared: S1-S6 were the 3rd generation of SD (ETD, carrier and poloxamer), S7-S9 were the 2nd generation (ETD, carrier) and S10 contained only ETD and poloxamer. The solid dispersions were tested for drug content, drug solubility, for dissolution profiles and characterized by scanning electron microscopy (SEM), differential scanning calorimetry (DSC), thermogravimetric analysis (TGA) and Fourier transform infrared spectroscopy (FTIR).

Results: The solid dispersions provided better ETD solubility in water and dissolution profile in comparison with the pure drug. Especially, the addition or use of poloxamer as a single carrier significantly improved these properties. DSC analysis indicated possible amorphization of ETD, while FTIR test confirmed the compatibility of ETD with the carriers.

Conclusion: The ball milling process can be used as relatively simple method to obtain ETD-SD. It can be concluded that ETD-SD containing amorphous polymers such as hypromellose, PVP/VA and poloxamer provided a significant improvement in the solubility and dissolution rate of the active substance.

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Formulation, Optimization and Evaluation of Andrographis Paniculata-loaded Sesame oil Nanoemulsion for Endometrial Cancer

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Background: Replacing synthetic drug by natural alternatives when formulating nanoemulsion has gained attention as a sustainable approach for cancer.

Aim(s): The ultimate goal is to enhance Andrographis Paniculata's therapeutic potential for the treatment of endometrial cancer. Andrographis (AG)-loaded nanoemulsion (AG-NE) was prepared using sesame oil, egg lecithin, and solutol HS-15 by overnight solvent evaporation and high-pressure homogenisation method.

Methods: The formulation was optimized using three factors by Box-Behnken design. The formulated AG-NE were prepared using the three independent variables Pressure, Homogenisation time and Concentration of Egg lecithin on three dependent variables size, PDI and zeta potential. The optimum composition and methods parameters were selected on the basis of point prediction method of the software.

Results: The optimized AG-NE showed the particle size of 126.8 ± 3.43 nm with an encapsulation efficiency of 98.323% with PDI and zeta potential value of 0.124 and -35.5 ± 1.02 respectively. Optimized AG-NE was further characterized for TEM, in-vitro release, stability study and in-vitro cytotoxicity study on endometrial cancer cell lines.

Conclusion: The evaluation result revealed the particle image in TEM, Enhanced AG release in both SGF and SIF medium as compared to pure AG, good stability at 4±1°C, AG-NE (2.07 µm) showed a significantly 2.06 folds lower IC_{50} value than that of pure AG in DMSO solution (4.27 µm). From the study, it can be concluded that the prepared optimized AG-NE was found to be an alternative to synthetic drug for endometrial cancer.

Protein Content and Meeting Protein Requirement in the DASH, Low-Carb and Hashimoto's Daily Food Rations in Meal Kit Delivery Services

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Background: Protein is the main building element of the body. In addition, it has regulatory and transport functions. In the recommendations for healthy people, the diet should provide from 0,8 to 1,2 g protein/kg body weight/day (approximately 10-20% of energy). The high-protein diets contain more than 20% energy from proteins, and the therapeutic use and safety of these diets are currently under investigation.

Aim: The aim of the study is to determine the protein content in daily food rations (DFR) provided from meal kit delivery services and to assess their contribution to the implementation of human nutrition standards.

Methods: The research included a qualitative analysis of meals offered from meal kit delivery services in the city of Bialystok, Poland. Forty-five DFR with a daily caloric content of 2,000 kcal (Av.2000±67 kcal), consisting of 3 or 5 meals, were examined. The DFR were delivered for 3 consecutive days from 15 different catering companies. During the study, protein content was assessed using the Kjeldahl method with a kit from Buchi (Switzerland), consisting of a digestion oven and a steam distiller.

Results: The protein content of the DFR ranged from 48,4 to 208,8 g/2000kcal, and provides from 9,5 to 41,6% of the dietary energy. Also, 24,4% of the daily rations contained more protein than declared by the manufacturer (more than 120%), while 11,1% of the diets contained less (less than 80%). More than half (55.6%) of DFR are a high-protein diet, because proteins covered more than 20% of energy.

Conclusion: In 35,5% of the DFR the protein content was inconsistent with the manufacturer's declaration, and more diets containing a higher amount of protein. The largest differences between the manufacturer's declaration and the actual protein content were determined in the low-carb diet. DFR provide protein in amounts above the dietary standards.

Investigation Chemical Composition and Antioxidant Activity of Dietary Supplements with Pomegranate

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Background: Nowadays, dietary supplements are a perspective area for pharmaceutical and food industries as a lot of consumers are interested in their health. The dietary supplements may offer opportunities to reduce health risk factors and risk of diseases in combination with prescription medicines [1,2].

Aim: Determine the total content of phenolic compounds, flavonoids, antocyanins, catechins and antioxidant activity in dietary supplements with pomegranate.

Methods: The object of our study was dietary supplements with pomegranate: «Extract of pomegranate» (manufactured by Source Naturals), «Extract of pomegranate» (manufactured by Puritan Pride), «Extract of pomegranate» (manufactured by Vitacost). The total content of phenolic compounds was measured by the Folin-Ciocaltau assay. The vanillin reagent assay was applied to find out the total catechins. The total flavonoids were determined using an assay of complex formation with $AlCl_3$. The total anthocyanin content was measured by molecular adsorption spectrophotometry at 528 nm. The level of antioxidant activity was evaluated by potentiometric method.

Results: The total phenolic compounds content was 201.00±6.03, 159.00±4.77 and 29.73±0.89 mg/tab; the total content of flavonoids was 30.15±0.90, 29.44±1.00 and 18.21±0.55 mg/tab; the total content of anthocyanins was 43.00±1.29, 32.00±0.88 and 22.00±0.66 mg/tab; the total content of catechins was 16.10±0.50, 11.60±0.50 and 7.33±0.50 mg/tab for dietary supplement «Extract of pomegranate» manufactured by Source Naturals, Puritans Pride and Vitacost, respectively. The level of antioxidant activity was 266.11±5.32, 212.12±4.24 and 150.81±3.02 mmol-eqv./m_{extr} for dietary supplement «Extract of pomegranate» manufactured by Source Naturals, Puritans Pride and Vitacost, respectively.

Conclusion: The dietary supplement «Extract of pomegranate» manufactured by Source Naturals had the highest amount of biological active compounds and the level of antioxidant action.

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Quantitative Analysis of Proteins Isolated from *Cladophora glomerata* Algal Biomass Using Bradford and Lowry Methods

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Background: *Cladophora glomerata* (*C. glomerata*) is a branched green alga belonging to the *Cladophoraceae* family [1]. The content of amino acids in *Cladophora* macroalgae is higher than in *Spirulina* cyanobacteria and *Porphyra* red seaweeds. Algal blooms caused by *C. glomerata* reduces biological diversity, as this species of green algae forms accumulations that decrease the recreational value of water bodies, thus causing harmful ecological and economic effects [1,2]. Therefore, excess biomass of *C. glomerata* could be collected as a source of proteins, and the waste could be adapted as raw material, creating a sustainable production chain. In this study, protein concentration was evaluated using Bradford and Lowry spectrophotometric microplate methods.

Aim: To determine the protein content in *C. glomerata* biomass using Bradford or Lowry methods.

Methods: *C. glomerata* biomass samples were collected from the Dūkšta river in Lithuania on August 25, 2023, and prepared for analysis by scientists at the Laboratory of Algology and Microbial Ecology (Nature Research Centre). Methods: extraction with 7.4 pH PBS aqueous buffer solution 0.01 M, protein precipitation method using ammonium sulfate salt, resuspension method using 7.4 pH PBS aqueous buffer solution (ratio 1:10), preparation of protein samples using the dialysis process [3]. For protein quantification analysis - spectrophotometric Bradford and Lowry methods [3]. The obtained research results were processed using the Microsoft Office Excel data analysis program (Microsoft Corporation, USA).

Results: Using the Bradford spectrophotometric microplate method, it was determined that 1g of *C. glomerata* biomass material contains 0.833 (0.012) mg of proteins. Using the Lowry spectrophotometric microplate method, it was determined that 1g of *C. glomerata* biomass material contains 0.146 (0.002) mg of proteins.

Conclusion: The Bradford method is more suitable for quantitative determination of proteins isolated from *C. glomerata* biomass material (0.833 (0.012) mg).

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Influence of Dietary Habits on the Concentration of Zinc in the Serum of Patients with Age-Related Cataract

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Background: Zinc (Zn) is a trace element that exhibits multidirectional effects on the human body. Globally, more than two billion people are affected by Zn deficiency [1]. Disturbances in serum Zn concentrations may have a negative impact on the redox balance, thereby indirectly implicating lens alteration, especially in the population of elderly [2,3]. Cataract, as an opacification of the lens, is a leading cause of vision loss and impairment worldwide [3,4]. Starting from the age of 40, the risk of developing aged-related cataract (ARC) increases with every decade of life [5]. Despite progress in surgical treatment methods, it is dietary modifications that may be particularly beneficial in prevention or delaying the progression of ARC.

Aim: The objective of the study was to estimate Zn concentration in the serum of patients with ARC in relation to their dietary habits.

Methods: A total of 64 patients with ARC (aged 48–93 years) and 74 healthy people (aged 42–83 years), were studied. A food-frequency survey as well as 72-hour nutrition interview were conducted to collect the dietary data. The concentration of Zn in serum samples were determined by the flame atomic absorption spectrometry method (Hitachi, Z-2000, Japan).

Results: Statistical analysis showed significant differences between Zn concentration in ARC patients and healthy controls (Me_1=0.750, Me_2=0.848; $p<0.00002$). The results of stepwise multiple regression analysis showed a positive statistically significant association in context of 6 of them (legumes, cured meat, white bread, whole wheat bread, fish, honey) and negative one in another 5 of the examined dietary habits (butter, jam, potatoes, beer, offal), (R^2=0.53).

Conclusion: There is an association between Zn concentration and dietary habits of ARC patients. Identifying potential links between Zn concentrations and visual impairment could be used in the prevention of ARC and should therefore be the subject of further studies.

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Has Dandelion Root Gained Attention for Its' Antioxidant Activity?

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Background: *Taraxacum officinale F. H. Wigg root (TOR)* or commonly known as Dandelion has been studied extensively due to biological actions: antioxidant, anti-inflammatory, antimicrobial and antiviral. Recently, Dandelion root has gained attention for its antioxidant activity (1).

The aim of the present study was the establishment of the optimal conditions for the extraction of the bioactive compounds from the Dandelion roots and their characterization of biological properties.

Material and methods: The Dandelion roots were harvested from a natural habitat of Republic of Moldova. The raw material was desiccated in the laboratory at room temperature for 2 weeks and pulverized. The process of extraction from the investigated vegetal material has been realized by using the maceration for 24 hours. The extraction has been realized at a room temperature in 3 consecutive steps for each method using as a solvents: 80%, 50%, and 20% of ethanol. Have been investigated the antioxidant properties of the obtained extracts by using the ABTS (2.2 azino-bis 3-ethyl-benzothiazoline-6-sulfonic acid) method described by Re et al. (1999), with some modification in our laboratory. As antioxidant standard was used Rutin (Quercetin-3- rutinoside hydrate; Sigma-Aldrich).

Results: The highest antioxidant properties in the ABTS test from Dandelion roots are: the extraction with EtOH 50% (91.81%), EtOH 20% (75.74 %) and the extract with EtOH 80% (74.51%). These biologically active compounds capture an efficient radical ABTS concentration with several junctions, compared to the reference substance - Rutin.

Conclusion: We applied this procedure to select the most efficient method for extracting bioactive molecules with the highest antioxidant activity from Dandelion root extracts in the ABTS free radical capture assay.

Key words: Dandelion root extracts, antioxidant activity, ABTS free radical capture assay.

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Impact of Glycemic Management on Redox Status Among Adolescents with Type 1 Diabetes Mellitus

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Background: Appropriate glycemic management is an essential element in preventing the progression of diabetic complications, affecting redox status [1]. Real time (rtCGM) or intermittently scanned (isCGM) continuous glucose monitoring systems are becoming widely used and are the foundation of glycemic management [2-3].

Aim(s): The aim of the study was to evaluate the impact of glycemic management on the balance of redox status among adolescents with type 1 diabetes mellitus (T1DM).

Methods: The study consisted of 125 participants aged 11-16 years old (T1DM group n=75, control group n=50). The questionnaire was conducted with the respondents. Total antioxidant status (TAS), total oxidant status (TOS) and glycated hemoglobin (HbA1c) in blood were determined. Oxidative stress index (OSI) was calculated.

Results: About 50% of diabetics had an episode of hypoglycemia at least several times a week and also experienced unconscious hypoglycemia. Among the most commonly observed symptoms were: trembling, hunger and sweating. Almost half reached for juices and soft drinks, only 27% for glucose. Comparing a group of healthy peers with those with T1DM, the former showed statistically significantly higher TAS concentration (1.627 vs. 1.322mmol/L, $p<0.001$) and lower TOS concentration (4.809 vs. 7.541µmol/L, $p<0.001$) and OSI (0.281 vs. 0.533, $p<0.001$). The group of diabetics using glucometer-only measurements demonstrated statistically significantly lower TAS concentration (1.276mmol/L, $p<0.05$) than those using isCGM (1.380mmol/L) and rtCGM (1.394mmol/L). Moreover, the correlation between HbA1c and TAS ($r=-0.3$, $p<0.01$), as well as OSI ($r=0.4$, $p<0.001$), was also found to be statistically significant. Patients with better glycemic management (HbA1c<7%) showed higher TAS (1.445 vs. 1.286mmol/L, $p<0.01$) and lower TOS (6.205 vs. 7.857µmol/L, $p<0.01$) and OSI (0.431 vs. 0.613, $p<0.001$) compared to patients with HbA1c>7%.

Conclusion: Improper glycemic management can promote an unbalanced redox status. This condition in adolescent body has the potential to result in the development of diabetic complications in the future.

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Investigation of Plant Nanovesicles and Their Potential for Skin Treatment

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Background: Extracellular vesicles are nanosized particles that are released from cells and have been studied widely. Plant-derived nanovesicles have shown promises both as biocarriers and as treatment agents; however, their characterization and use in skin disorders are still little studied.

Aim: We studied the properties of nanovesicles obtained from differently agrobiologically-treated *Cannabis sativa* plants and investigated their impact on human fibroblasts with an induced psoriasis model.

Methods: Plant treatments and material preparation were performed by the Lithuanian Research Centre for Agriculture and Forestry. *Cannabis sativa* plants were treated with cytokinin, BlackJack fertilizer and KAS (urea-ammonium nitrate). After harvesting, leaves and flowers were freeze-dried. Nanovesicles were obtained by polymer-based precipitation method and characterized according to size (nanoparticle tracking analysis), protein (Bradford assay) and total RNA amount (Trizol isolation and absorption). Human dermal fibroblasts (normal and with induced psoriasis) were treated with *Cannabis* nanovesicles. Metabolic activity of fibroblasts was assessed by PrestoBlue assay. Psoriasis model was induced using cytokines (Interleukin-17, -22 and Tumor necrosis factor alpha).

Results: We have found that characteristics of nanovesicles from *Cannabis* plants were treatment- and plant part-dependent. The BlackJack fertilizer increased the concentration of *Cannabis* nanovesicles in flowers, KAS increased RNA concentration in leave nanovesicles and Cytokinin significantly increased protein concentration in flower nanovesicles. *Cannabis* nanovesicles were protective and significantly increased human psoriatic fibroblasts' metabolic activity.

Conclusion: Our study demonstrates that biochemical characteristics (size, protein and total RNA amount) and bioactivity of *Cannabis sativa* plant nanovesicles can be controlled by external agrobiological treatments and reveals the anti-inflammatory and regenerative potential of *Cannabis* nanovesicles against skin diseases.

Microencapsulation *Melissa officinalis* Extract by Spray-drying and Evaluation of the Physicochemical Properties

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Background: Extract of Lemon balm, or Melissa officinalis L. is widely used to relieve nervous disturbance and functional gastrointestinal disorders. However, extending the shelf life of its extracts has remained a challenge [1]. To enhance the physical properties and extend the shelf life of these extracts, various encapsulation techniques have been explored.

Methods: water, methanol, and ethanol extracts from Melissa officinalis leaves were obtained by ultrasonic extraction. The extract was then subjected to purification with vacuum and centrifugation. Spray-drying with different wall materials was performed on the Büchi Mini Spray Dryer B-290 apparatus. Total phenolic content, antioxidant activity, moisture content and wettability, solubility, Hausner ratio, and Carr index were evaluated.

Results: 15 powders of different combinations were obtained during spray-drying. Bulk and tap density, moisture content, solubility, total phenolic content, and antioxidant activity of the powders were determined.

Conclusions: The results obtained indicate that the most effective composition for encapsulation of Melissa officinalis is pure skim milk. This composition of wall materials resulted in the highest levels of total phenolic compounds, antioxidant activity, Carr index, as well as improved wettability. The spray-drying process significantly increased the shelf-life of the extracts allowing them to be stored at least for 6 months at room temperature, but presumably much longer, when proper storage requirements are met.

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The Choice of Mucoadhesive Polymer in the Oromucosal Spray Formulation

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Background: One of the most common forms of drugs use for infectious and inflammatory processes in the oral cavity are oromucosal sprays, the prolonged effect of which can be achieved due to the inclusion of mucoadhesive polymers in their compositions.

Aim: To choose of mucoadhesive polymer in the oromucosal spray formulation.

Methods: Research objects: APIs – clove extract, lavender and grapefruit essential oils; mucoadhesive agents – hydroxyethylcellulose (HEC), hydroxypropylcellulose (HPC), sodium carboxymethylcellulose (Na-CMC), sodium alginate, xanthan, polyvinylpyrrolidone (PVP), polyvinyl alcohol (PVA); sweeteners – sorbitol and xylitol; flavouring – grape flavour powder; preservatives – sodium benzoate, potassium sorbate; solvents – water purified, ethanol 96%. The stability, pH, viscosity, film-forming and textural properties of the sprays were studied. The spray angle, the structure of the spray plume, and its imprint were investigated using a photo camera.

Results: According to the results, pH of all 7 samples corresponded to the pH of the oral cavity range. Sprays based on sodium alginate and PVA were found to be unstable, and samples with xanthan and PVP had low film-forming ability, so they were excluded from further studies. According to the textural characteristics, the sample based on HPC had the lowest values of firmness, spreadability and adhesiveness. The largest area of irrigated surface with a uniform distribution of finely dispersed drops of equal size and a "full cone" shape, characteristic of the drop type of spraying, was created by a sample based on HEC.

Conclusion: Considering the results of all studies, sample of oromucosal spray with hydroxyethylcellulose as a mucoadhesive polymer was chosen as the final one.

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Synthesis of C-3 Modified Fluoroquinolones as a Promising Way for Overcoming Antimicrobial Resistance

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Background: Four modern generations of fluoroquinolones (FQs) are widely and successfully used in clinical practice, including cure of bacterial pneumonia that develops due to COVID-19 [1]. A wide spectrum of action together with high bioavailability and good tolerability make this group of antibiotics especially appreciated [2]. However, there have already been cases of resistance to these medicines and this fact stimulates further search for new antimicrobials based on the core molecules. The latter can be modified in several ways [3,4], which provides ample opportunities for medicinal chemists. For instance, we investigated hybridization of C-3 position as promising and insufficiently researched at the same time.

The aims of current investigation were as follows: to synthesize the key precursor for further cyclization reactions and obtain a range of new 3-heterocyclic substituted FQ derivatives; to determine the structure of the compounds synthesized and optimize the synthetic techniques used in the research.

Methods of organic synthesis were utilized. The structures of the obtained compounds were determined using ^{1}H NMR, ^{13}C NMR, LC/MS spectroscopy and X-Ray diffraction studies.

Results: At the first stage of the study, 1-benzyl-6-fluoro-4-oxo-7-(piperidin-1-yl)-1,4-dihydroquinoline-3-carbonitrile has been synthesized based on the 6,7-difluoroquinolin-4-one according to the procedures described in paper [5]. This key intermediate was utilized for further cyclization reactions and obtaining of a range of FQ derivatives hybridized with heterocycles at C-3. Namely, it reacted with hydroxylamine with subsequent cyclization with substituted carboxylic acids in the presence of N,N'-carbonyldiimidazole. The compounds synthesized were purified and their chemical structure was determined using modern instrumental methods of analysis.

Conclusion: The key precursor and a series of novel 3-heterocyclic substituted FQ derivatives were obtained via a convenient synthetic technique. Their structures were determined using modern instrumental methods. These molecules are considered promising for further in vitro research of antimicrobial activity to combat antimicrobial resistance.

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Development of the Composition and Technology of Creams with Antimicrobial and Wound Healing Properties

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Background: The wounding process is a complex of biological reactions that develop in response to infections and tissue destruction. The development of wound-healing creams is a highly relevant topic in conditions of the large-scale war of the russian federation against Ukraine.

Aim: The aim of the study was to develop different creams with reparative and antimicrobial properties, which promote wound healing.

Methods. Some methods were used: technological, mathematical for the calculation of hydrophile-lipophile balance (HLB) of emylsifiers and emulsion systems and microbiological one for the determination of the preservative activity.

Results. The composition and technology of the different creams were developed (10% of sunflower oil and 20% avocado oil). Cetostearyl alcohol (CSA) (4-8%) and glycerol monostearate (0.3% and 1%) served as emulsifiers w/o and thickeners of the emulsion systems. Twin 80 or tween 20 were emulsifiers o/w (3%). The healing activity of a semi-solid formulation of avocado oil was revealed [1]. Vitamin E and other tocopherols are important sunflower oil components [2]. The added vitamins E and A were used as lipophilic antioxidants affecting biochemical processes in the skin. The biopharmaceutical studies were directed at the choice of the optimal concentrations of the preservatives like phenoxyethanol and Leucidal. Some formulations contain snail mucus (17-19%) of Ukrainian origin, which has potential wound-healing properties [3]. The desired HLB was about 9.5 for the cream of 10% of sunflower oil, 4% of CSA and 2.5% of the oleaginous solution of the vitamins and for the cream of 20% of avocado oil and 7 or 8% of CSA. The biopharmaceutical studies demonstrated that phenoxyethanol in a concentration of 1% (2%) and leucidal in a concentration of 4% had antimicrobial activity against Staphylococcus aureus, Pseudomonas aeruginosa and Escherichia coli.

Conclusion: Some formulas for the creams were developed. Next studies will be directed at establishing expiration dates.

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Ukrainian Lavender: Dependence of the Chemical Composition on the Growing Region

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Background. The area of Ukraine is ca. 600 thousand km² and it is conditionally divided into three agroclimatic zones: steppe, forest-steppe and forest. Usually, farmers cultivate lavender for photo shoots, decorations, cosmetic purposes, etc. Some of them use lavender for the production of essential oil. Our research extends the range of lavender herb uses for the pharmaceutical industry, which also leads to the comprehensive use of raw materials.

Aim: conduct a comparative study of the chemical composition of lavender herb from different regions of Ukraine, assessing the influence of the zone type on the compound's composition.

Materials and methods: *Lavandula angustifolia* Mill. herb samples were collected in Kharkiv (combined climate zone: steppe and forest-steppe), Kherson (steppe zone), Kyiv, Vinnitsa, Lviv (forest-steppe zone) and Uzhgorod regions (mountainous area) in 2021. Determination of the polyphenolics content in samples was carried out by HPLC method by Nexera X2 LC-30AD HPLC system (Shimadzu, Kyoto, Japan) at wavelength 350 nm. The terpenoid composition was carried out by HPTLC according to modified method "Lavander flowers" from Ph. Eur. 6.7 [1].

Results. The HPLC results showed that the highest total polyphenolics content was in samples from Kyiv (OLawander farm and Hryshko Botanical Garden) and Kharkiv (Bohodukhiv and Lebiazhe villages) regions, which ranges from 14.5 till 23.3 mg/g. In this case, vanillic acid (9,1 - 11,2 mg/g), rosmarinic acid (0,3 - 1,2 mg/g) and hyperoside (8,9 - 11, 6 mg/g) were the dominant compounds. In spite of this, the HPTLC showed that the higher terpenoids content in Lviv and Vinnitsa samples [2,3].

Conclusions. Although Kharkiv region (the steppe and forest-steppe zone) is more favourable for the accumulation of phenolic compounds, the Kyiv, Lviv, Vinnitsa regions (the forest-steppe zone) is more favourable for the accumulation of terpenoids. This dynamic is probably due to the differences of climatic conditions and chernozems composition.

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Analysis of O. A. Høeg's 'Planter og tradisjon' (Norway) for Possible Trends in New Herbal Medicinal Recipes for Skin Diseases and Cosmetics

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Background: When Ove Arbo Høeg (1898-1993) published “Planter og tradisjon” in 1974 he found that though some knowledge was lost, many traditions regarding the use of plants still lived on even after 200 years [1-2]. The analysis of archival sources can help to find possible trends in new herbal medicine recipes for skin diseases and for development of cosmetic products. In many countries, there is growing interest in local traditional knowledge, leading to the creation and scientific analysis of recipes [3].

Aim: The aim of this study was to analyze the ethnobotanical knowledge regarding skin diseases and cosmetics in archival source “Planter og tradisjon” in Norway (1925 to 1973). This archival source was chosen because it is a standard work based on a collection of ethnobotanical and biological knowledge. It was written by the father of ethnobotany in Norway. Additionally, the data will be compared to information in the available European Medicines Agency herbal monographs.

Method: The archival source was analyzed, and the medicinal plants indicated for the treatment of skin diseases and cosmetics were identified and compared with monographs presented in the European Medicines Agency assessment.

Results: The analysis of the archival data found that only 19 of the 71 herbal medicinal raw materials were described in the European Medicines Agency monographs, and the remaining 52 did not have the European Medicines Agency assessment. 9 out of the 19 raw materials described (12,67%) had indications for use corresponding to the European Medicines Agency recommendations.

Conclusions: In this study many of the plant species were used without European Medicines Agency approved medical indications for skin diseases. This archival material can be a great source of ideas for new herbal-based preparations for skin diseases and for the development of cosmetic products.

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Effect of Magnesium Aluminum Metasilicate on the Quality of Water-dispersible Tablets with Guarana Dry Extract

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Background: During the production of water-dispersible tablets with dry guarana extract, poor physical, chemical, and mechanical properties such as high hygroscopicity, stickiness, bulkiness and compressibility are observed [1]. To solve these problems, magnesium aluminum metasilicate can be used, which is characterized by good compressibility, it improves the technological properties of powders with plant extracts, the time of disintegration, and the hardness of tablets [2].

Aim: To produce guarana dry extract water-dispersible tablets using the multifunctional material magnesium aluminum metasilicate and to evaluate the quality of the tablets.

Methods: Appropriate concentrations of magnesium aluminum metasilicate were chosen. When studying the properties of the tablet mixture, flowability, angle of repose, tapped density, bulk density, compressibility index and Hausner ratio were determined. Quality tests of tablets were performed: uniformity of mass, friability of tablets, resistance to crushing of tablets and disintegration of tablets were determined.

Results: After adding different amounts of magnesium aluminum metasilicate to the mixtures, the properties of the powder improved. Based on the obtained results, it was decided to apply direct compression method to produce tablets. The optimal concentration of magnesium aluminum metasilicate to produce water-dispersible tablets with guarana dry extract is 30%. It was found that with this concentration of magnesium aluminum metasilicate, the tablets meet the requirements of the European Pharmacopoeia for mass uniformity, resistance to crushing – 32.6 N, friability – 99%, disintegration time – 01:06 minutes. The mass deviation of the manufactured tablets is within the permissible limits of ±7.5%, the resistance to crushing is between 30-40 newtons, the resistance to dilution is at least 99%, the disintegration time is up to 3 minutes.

Conclusion: The insertion of magnesium aluminum metasilicate into powder mixtures with dry guarana extract improved the technological properties of the powder mixtures, because of which high-quality water-dispersible tablets were produced.

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Biological Activity of Black Elderberry Flower's Extract

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Background: As the use of herbal remedies is on the rise in modern society, the search for new active substances and the study of their biological effects are important. Studies on the raw materials of black elderberry (*Sambucus nigra* L.) published in the scientific literature reveal anti-inflammatory, antiviral, antibacterial and antioxidant activities [1]. Extracts of elderflowers proven effective in reducing the level of intracellularly generated ROS in vitro therefore can be preventive for many diseases caused by ROS-mediated cell damage [2].

Aim(s): To investigate the biological effects of black elderberry extract on human respiratory tract cells.

Methods: Percolation and ultrasoud methods were used for the extraction. Total phenolic content was determined spectrofotometricaly. Assessment of cell viability was evaluated by fluorescence microscopy using human respiratory epithelial cells (HBEC-3).

Results: The extract diluted with water did not affected cell viability and increased cell regeneration about 20%. The extract diluted with water and polyethylene glycol (PEG) did not affected cell viability and increased cell regeneration about 25%. The amount of extract used in the studies was 10 - 5 - 1 µl, showed that increasing the amount of extract increases regeneration percentage. Cells exposed to the ethanolic extract alone showed an average reduction in viability of about 34%.

Conclusion: The extract of black elderflower blossoms produced with 50% ethanol by percolation showed the highest content of phenolic compounds ($p<0.05$). Extract diluted with water and PEG maintains the viability of respiratory tract cells. Extract diluted with water and PEG has a regenerative and protective effect on damaged airway cells by mimic the virus sequence.

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Enhancing Emulsion Stability: Mustard versus β-Cyclodextrin with Aqueous Red Clover Extract

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Background: emulsions are vital in many industries for delivering hydrophobic compounds. Maintaining stability, especially in oil-in-water systems, is crucial for product quality and prolonging shelf-life [1]. Despite extensive research on mustard and β-cyclodextrin as emulsifying agents, there's a gap in directly comparing their effectiveness in stabilising plant extract emulsions, especially red clover. Mustard extract serves as a natural emulsifier in traditional emulsions, whereas β-cyclodextrin can form Pickering emulsions, presenting distinct characteristics and potential applications [2],[3].

Aims: to investigate and compare the effectiveness of mustard and β-cyclodextrin as emulsifying agents for improving the stability of oil-in-water emulsions containing aqueous red clover extract

Methods: Out of the eight formulations tested, six remained stable at 1006g centrifugation (100% stability), while only four remained stable at 5478g, albeit with slight layering observed. Formulations I (utilising mustard extract) and II (utilising β-cyclodextrin) initially employed a 10% emulsifier and 60% red clover extract, demonstrating stability rates of 66.67% and 50%, respectively. Increasing the emulsifier to 15% and reducing the extract to 55% improved stability to 75.66% (for formulation III with mustard extract) and 70.15% (for formulation IV with β-cyclodextrin). Mustard proved to be more effective than β-cyclodextrin.

Additionally, the particle sizes differed between formulations III and IV. The formulation using mustard extract exhibited a Dx (90) of 0.744 μm, whereas the formulation using β-cyclodextrin had a Dx (90) of 0.981 μm. Consequently, emulsions formulated with mustard as the emulsifier contained smaller oil particles.

Conclusions: The most stable emulsion among all formulations was formulation III, which employed mustard extract as the emulsifier. Mustard extract exhibited superior effectiveness as an emulsifier for aqueous red clover compared to β-cyclodextrin.

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Phenolic Content and Antioxidant Activity in Honey of Various Floral Origin

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Background: Honey has been used since ancient times due to its sensory, nutritional, and therapeutic properties [1]. The antioxidant activity of honey is related to its chemical composition, mainly to phenolic compounds. [1,2]. Because the chemical composition and biological properties of honey is highly dependent on its botanical origin, the investigation of these characteristics are very important.

Aim: to determine the total phenolic content (TPC) and the antioxidant activity *in vitro* of honey samples (lime, buckwheat and forest honey), collected in Lithuania.

Methods: lime honey was colected in 2023 from the apiary, Kaunas district (54.9025° N, 23.8043° E), forest honey in Ignalina dictrict (55.4338° N, 26.3101° E) and buckwheat honey in Trakai district (54.6238° N, 25.1113° E).). 1 g honey was dissolved in 10 ml water or 70% ethanol. TPC was investigated by Folin-Ciocâlteu assay, antioxidant activity *in vitro* by ABTS and CUPRAC assays.

Results: The highest total phenolic content was evaluated in buckwheat honey (2.33±0.42 mg GRE/g and 2.70±0.02 mg GAE/g), in both, water and ethanol solutions, respectively, whereas in forest honey it was 0.48±0.01 mg GAE/g and 0.68± 0.32 mg GAE/g, respectively. Lime honey contained the lower total phenolic content (0.27±0.01 mg GAE/g and 0.59±0.18 mg GAE/g, $p<0.05$). The highest reducing activity *in vitro* using CUPRAC assay was determined in both, water and ethanol solutions from buckwheat honey 1.04±0.10 µmol TE/g and 0.67±0.01 µmol TE/g, respectively, vs 0.30±0.05 µmol TE/g and 0.72±0.20 µmol TE/g in forest honey. The highest antiradical activity *in vitro* by using ABTS assay was also determined in buckwheat honey.

Conclusion: our results showed that all investigated types of honey possess antioxidant (antiradical and reducing) activities, and its phytochemical composition, as well as antioxidant activity, varies among the honey of different sources. The highest reducing and antiradical activity *in vitro* and the highest total phenolic content contains buckwheat honey.

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Evaluation of Bioactive Compounds of Lavender Essential Oil by Chromatographic Methods

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Background: *Lavandula angustifolia* Mill. is widely known for its sedative, anxiolytic properties, and is used in aromatherapy or herbal medicine. The main components responsible for the calming and relaxing effect are linalool and linalyl acetate. In addition, these are the main markers of the quality of lavender oil [1].

Aim: comparative analysis of lavender essential oils according to monograph "Lavandulae aetheroleum" Eur. Ph 11.1.

Methods: Herb samples were prepared in Lithuania, France and Croatia. Chromatographic separation of terpenoids was conducted on the SHIMADZU GC-2010 system with FID. The HPTLC analysis was carried out using Si 60 F_{254} plates with toluene and ethyl acetate (95:5) as mobile phase; linalool, linalyl acetate and 1,8-cineole as a reference and anisaldehyde solution for detection.

Results: the combination of the two methods gave the following results: the highest intensity of 1,8-cineole spot was detected in *L. angustifolia* from France (6,686 mg/ml by GC-FID) and in *L. latifolia* (11,835 mg/ml) from Croatia; less in Lithuania (0,803 mg/ml). All samples contained linalool and linalyl acetate with intense violet zones. The most intensive spots of linalool (30,292 mg/ml) and linalyl acetate (16,887 mg/ml) were visible in *L. angustifolia* from France. The least intensive spot of linalyl acetate is visible at the place of *L. Latifolia* from Croatia (2,068 mg/ml).

Conclusion. The quantitative content of compounds depended on *Lavandula* species or varieties, place, and time of raw materials collection. By the HPTLC method, 1,8-cineole, linalyl acetate, and linalool were detected in all samples and their amounts correlated with the GC-FID data.

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Influence of the Ratio of Tween 80 to Span 80 on the Quality Parameters of Microemulsions with Sea Buckthorn Oil

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Background: Microemulsion (ME) is thermodynamically stable dispersion of oil and water, stabilized by an interfacial film of surfactants along with co-surfactants [1]. The dosage and type of surfactants used in ME directly influence the ME formation size and stability [2]. Microemulsions used as topical preparations possess beneficial characteristics such as enhanced rate and depth of moisturizing agents [3].

Sea buckthorn oil (SBO) is known to be effective in treating mucous-membrane-related disorders and has moisturizing and regenerative effects on nasal mucosa [4, 5].

Aim(s): Preparation of stable microemulsions with sea buckthorn oil using different ratios of tween 80 to span 80 as a mixture of surfactants and evaluation of their influence on physical properties of microemulsions.

Methods: MEs containing fixed amount of SBO (2 %) were prepared by magnetic stirring and homogenization: first ME was prepared with only tween 80, second, third and fourth MEs were prepared with tween 80 and span 80 in ratio 9:1, 8:2 and 7:3, accordingly. Microemulsions were characterized by particle size and polydispersity index measurement using dynamic light scattering method, pH and viscosity measurements, kinetic stability by centrifugation test and thermodynamic stability study by freeze-thaw and heating-cooling cycles.

Results: Only first three MEs were kinetically and thermodynamically stable with particle size of 11.74±0.12 nm (PDI = 0.123±0.012), 12.68±0.11 nm (PDI = 0.036±0.015) and 101.2±1.72 nm (PDI = 0.254±0.019) respectively. The pH ranged from 4.654±0.01 to 4.825±0.03. The viscosity increased from 566.4±3.2 to 687.2±2.9 mPa*s.

Conclusion: Addition and higher proportion of span 80 increased microemulsion particle size, pH and viscosity, while surfactant ratio of 7:3 did not result in formation of stable microemulsion at all. Tween 80 and span 80 in ratio 9:1 impacted only a small increase in particle size and a significant decrease in PDI compared to the microemulsion containing only tween 80.

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Preliminary Evaluation of Hard Gelatin Capsules Containing Alginate-hypromellose Microparticles with Posaconazole

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Background: Multicompartment drug formulations such as microparticles (MP) enable to enhance drugs bioavailability. As mucoadhesive polymers prolong retention time on the mucosa surface, sodium alginate (ALG) and hypromellose (HPMC) were utilized to design MP. Posaconazole (POS) is an antifungal drug with poor water solubility and viable bioavailability [1-4], therefore it was selected as a model substance.

Aim: Comparison of selected pharmaceutical properties of capsules containing MP with POS and capsules with physical mixtures of the same composition.

Methods: MP were obtained by the spray dryer Büchi-290 (Büchi, Switzerland). Erweka Dissolution Tester (Heusenstamm, Germany) was applied in the release assay. TA.XT Plus Texture Analyser (Godalming, UK) was utilized to evaluate mucoadhesiveness.

Results: ALG/HPMC MP with POS were prepared by dispersing POS in polymers solution containing ALG and HPMC in 1:3 (MP1) and 1:5 (MP2) ratios. Physical mixtures Mix1 and Mix2 were obtained in a mortar with the same polymer ratio (1:3 and 1:5, respectively). Then, MP and physical mixtures were placed in hard gelatin capsules. Results of release study in 0.1M HCl showed that microparticles MP1 possessed more extended POS release than mixture of powders Mix1, since approximately 80% of POS was released from MP1 after 24 hours, while from Mix1 – just after 45 minutes. The relase assay carried out in simulated vaginal fluid (SVF) showed only gentle differences between microparticles MP2 and powders mixtures Mix2. It might be related to the different solubility of ALG, since it is soluble in SVF, not in acidic medium. Microparticles (MP1, MP2) were characterized by stronger mucoadhesive properties comparing to powders mixtures (Mix1, Mix2) - higher values of detachment force (F_{max}) were noted.

Conclusion: MP provided prolonged POS release in the acidic medium, without substantial variance in SVF. Moreover, MP possesed stronger mucoadhesive properties than mixtures of powders.

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Spectrophotometric and Chromatographic Assessment of Polyphenol Content in *Rhododendron tomentosum* Extracts

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Introduction**.** Phenolic acids and flavonoids have recently attracted considerable attention due to their biological activity. *Rhododendron tomentosum* is known as an ethereal plant, in the glandular trichomes of which a large number of terpenoids are synthesized. In addition to terpenoids, the shoots of *Rh. tomentosum* also contain polyphenolic compounds [1].

Aim. The work aimed to develop a technique for identifying some phenolic acids and flavonoids in the shoots of *Rh. tomentosum* by HPTLC and their determination by spectrophotometry

Methods. The harvesting of raw materials of *Rh. tomentosum* was carried out in September 2022 on the territory of Rivne region of Ukraine. Extracts were prepared using different concentrations of hydroalcoholic mixture and purified water to determine the effect of ethanol concentration on the extraction of polyphenols. Thus, the extracts to be studied were prepared in the ratio of raw material to extractant 1:5. Chromatographic analysis was performed using CAMAG analytical system (Muttenz, Switzerland). The total polyphenol content and total flavonoid were estimated using UV-vis methods involving the Folin–Ciocalteu reagent and the complexation reaction with aluminum chloride, respectively.

Results. By the method of HPTLC in the system of solvents ethyl acetate: formic acid: water (15:1:1) the following substances have been separated and identified: rutin, hyperoside, quercetin, and chlorogenic acid in all the extracts obtained. The total polyphenol content expressed as gallic acid equivalents ranged from 45 to 55 mg GAE/g. A correlation analysis conducted between antioxidant activity and the polyphenolic substance content. Following the DPPH assay, regression analysis shows that phenolic compounds contribute to about 91% (r = 0.908, P < 0.05) of radical scavenging properties in the extract of *Rh. tomentosum*.

Conclusions. According to the results, it is advisable to use rutin, hyperoside, or quercetin as a standard substance to standardize the raw material of *Rh. tomentosum* shoots.

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Influence of Organic Solvents and Their Concentrations on Determination of Phenolics and Tannins in *Potentilla anserine* Leaves

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Background: Silverweed (Potentilla anserina, Rosaceae) possesses anti-inflammatory and astringent properties and is traditionally used for treating sore throats, diarrhea, and to stop bleeding. These therapeutic effects are attributed to pharmacologically valuable phenolic compounds and tannins that accumulate in silverweed (1–3). Therefore, to maximize the extraction of phenolic compounds and/or tannins from herbal raw materials, it is crucial to carefully select the appropriate solvent and determine its concentration for each species separately.

Aims: The work aimed to choose the right organic solvent and its concentration for optimal extraction of phenolic compounds and tannins from leaves of silverweed.

Methods: Silverweed leaves were collected at the butonisation stage in the Verkiai Regional Park (Vilnius) meadows and dried at room temperature in the dark. Extractions were performed using an ultrasonic bath and a centrifuge with different concentrations (100%, 70%, and 50%) of methanol, ethanol, and acetone. The spectrophotometric method and Folin-Ciocalteu reagent were applied to identify total phenolic and tannins (expressed in tannic acid equivalents) in the dry raw material extracted by different concentrations of the aforementioned solvents.

Results: The lowest amounts of total phenolics and tannins in *P. anserina* leaves were found after extraction with undiluted solvents, particularly with undiluted acetone: amounts of phenolics and tannins in leaves extracted with 100% acetone were 14–17 and 22–25 times lower, respectively, than those extracted with diluted acetone. The highest amounts of total phenolics and tannins were found in raw material after extraction with 70% (12.4±1.8% and 9.4±0.1%, respectively) and 50% (10.4±0.9% and 8.2±0.1%, respectively) acetone.

Conclusions: The results varied more with the dilution of the solvent than with the type of solvent. Therefore, in order to extract the highest possible quantities of phenols or tannins from silverweed's leaves, it is very important to consider the concentration of the organic solvent used.

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Comparative Amygdalin Contents in Different Parts of Apricot (*Armeniaca vulgaris*) "Shalakh".

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Background: The fatty acid composition of the Armenian apricot variety "Shalakh" has been studied previously [1]. To continue the research, it was decided to determine the content of the glycoside amygdalin. According to European Pharmacopoeia amygdalin content is the quality indicator of apricot seeds [2]. Amygdalin is a cyanogenic glycoside found in the seeds of Rosaceae species, such as apricot, peach, almonds, apples etc. Enzymatic degradation and hydrolysis of amygdalin produces hydrogen cyanide, which not only has anticancer activity, but also can be toxic. Many modern studies have confirmed that a small amount of hydrogen cyanide can help to relieve cough and asthma. [3,4]. So, it's important task to determine the possible toxicity in the raw materials.

Aim: Comparative assessment of the Amygdalin content in seeds, leaves and endocarp of Armenian Apricot (*Armeniaca vulgaris)* "Shalakh".

Materials and methods: Apricot raw materials were harvested in 2023 in the Tairov village of Armavir region (Armenia). The amygdalin content was determined by HPLC using Ph. Eur. 11.0[5] on Waters e2695 Alliance chromatograph coupled with a PDA detector. The gradient elution mode with pure water (A) and acetonitrile (B) was as follows: 0-3 min, 5% B; 3–13,5 min, 5-52% B; 13,5–15 min, 52-95% B; 15-20 min, 95% B. The flow rate was 1.200 mL/min, injection volume was 10 µL. The spectrum was recorded at 210 nm.

Results: Amygdalin content was determined in 96% ethanolic plant extracts by using a calibration curve with 11 different concentrations. The following compound content was found in the seeds, namely 23,41±0,03 - mg/100 g DW, in the leaves almost the same was 24,28±0,04 mg/100 g DW, the highest content (34,90±0,07 mg/100 DW) was in the endocarp.

Conclusion: The amygdalin content in Armenian Apricot raw material was determined. The highest content was detected in the endocarp.

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Development and SPF Evaluation of Creams Containing Blackcurrant Extract

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Background: Excessive amounts of UV radiaton from solar exposure has been associated with skin aging, sunburs and carcinogenesis. One of the main tools to protect the skin is to use sunscreen [1]. With the growing interest in natural cosmetics, there is a concurrent exploration by sunscreen developers into the utilization of plant-derived materials [2]. Anthocyanins have been found to have antioxidant and photoprotective properties, so it is beneficial to research anthocyanin-rich berries [3], such as blackcurrants [4], as possible SPF agents.

Aim(s): The objective of this study was to formulate a cream, integrating 5% blackcurrant extract and evaluate its Sun Protection Factor (SPF) in vitro.

Methods: In this study, creams were formulated with a lipophilic base comprising cannabis seed oil and Olivem-1000, combined with a hydrophilic base of water, glycerol, and phenoxiethanol. Blackcurrant extract was incorporated into the hydrophilic phase of the test cream to a concentration of 5%. Additionally, a 0.01% aqueous blackcurrant extract was produced. The Sun Protection Factor (SPF) of these formulations was determined using the Mansur method through in vitro UV spectroscopy. The results were analyzed using "MS Excel 2023".

Results: The SPF for the cream containing 5% blackcurrant extract was calculated to be 5,496, exhibiting an increase compared to the base cream, which yielded an SPF value of 3,397. Notably, the formulation containing a 0,01% concentration of aqueous blackcurrant extract demonstrated a slightly higher SPF value of 5,531.

Conclusion: The calculated SPF of blackcurrant extract supports its photoprotective potential as reported in literature. However, the 5% blackcurrant extract cream still showed rather low SPF, indicating a need for further adjustments in the formulation to fully unlock its photoprotective benefits.

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Optimization of Extraction Process for Phenolic Compounds Recovery from Walnut (*Juglans regia* L.) Septum

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Background: With the food industry annually growing, scientific studies seek to investigate the by-products of plants as they can be valuable sources of bioactive compounds. Nowadays, there is an increasing interest in the study of English walnut (*Juglans Regia*) septum. Collected data shows that walnut septum is rich in polyphenols.[1]

Aim(s): This study aimed to determine the optimal extraction conditions of the polyphenols, by combining several parameters, such as extraction method, solvent, and water percentage.

Methods: Walnuts were collected at Šilainiai, Kaunas in the autumn of 2022. The unshelled walnuts were cracked and the walnut septum was removed and ground before the extractions. Maceration (with and without mixing 6, 12, and 24 hours) and ultra-sound assisted extraction (10, 20, and 30 min) with different concentrations (100%, 70%, and 50%) of methanol, ethanol, and acetone were used for recovery of polyphenols. The spectrophotometric method and Folin-Ciocalteu reagent were applied to identify total phenolic compounds.

Results: After data analysis, it was found that the results varied depending on the dilution of the solvent, the type of solvent, and the extraction method. The lowest amounts of total phenolics were found after extraction with undiluted acetone, not depending on the extraction method, and varied 48.7-96.8±0.1mg GAE/g dw (gallic acid equivalents per dry weight of walnut septum). The highest amounts of total phenolics were found after extraction with diluted acetone (50%, 60%, 70%) applying maceration with mixing for 6 h and 12 h, 257.14-278.6±0.1mg GAE/g dw and 216.8-265.9±0.1mg GAE/g dw, respectively.

Conclusion: This study aimed to describe the optimum experimental conditions for extraction and was focused on obtaining high content in the polyphenols. It was concluded that maceration with mixing for 6 hours in 50% acetone should be applied for extraction of polyphenols.

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High Risk Potentially Inappropriate Medications in Polypharmacy Nursing Home Patient`s Medication Regimens

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Background: Medication use is the most common healthcare intervention. However, in the elderly, polypharmacy is often associated with inappropriate or suboptimal prescribing, leading to various adverse outcomes. The prevalence of potentially inappropriate medication (PIM) use in Europe is 22.6% among ambulatory elderly and 49.0% among those residing in nursing homes, varying across different studies and countries [1, 2].

Aim: To assess the presence of high-risk PIMs in the medication regimens of older nursing home patients in Estonia.

Methods: The study sample consisted of nursing home patients over 65 years old, using five or more medications, and enrolled in the automated dose dispensing (ADD) service. Analysis of PIM use was conducted using the EU(7)-PIM and EURO-FORTA integrated databases [3].

Results: Of 145 patients, 77.2% were female, and 75% over 80 years old. On average, each patient had 5.9 diagnoses, with the most common being circulatory system diseases and psychiatric and behavioral disorders. Patients were using 125 different medications, with cardiovascular and nervous system medications being the most common. Of all medications, 26 (20.8%) were classified as high-risk potentially inappropriate medications, with at least one such medication present in the regimen of 81 patients (55.9%). NSAIDs – etoricoxib, ketoprofen, naproxen – were more commonly used long-term for chronic pain, benzodiazepines – diazepam, lorazepam, clonazepam – for depression, sleep disorders, and anxiety, and carbamazepine for epilepsy.

Conclusion: To reduce the prevalence of PIMs in nursing home residents with polypharmacy, it is essential to regularly assess the condition of these patients and adjust treatment accordingly to maximize patient well-being. One approach could involve integrating the assessment of PIMs into the medication ADD service.

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Ethnopharmacological Study of Plant Phytoconstituents (Acteoside) in Treatment of Alzheimer's Disease

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Background: Alzheimer's disease is a progressive neurological disorder that primarily affects memory and cognitive function, mostly affecting the elderly population (1). Although there are currently no disease-modifying treatments for such neurological disorder, but there are a number of ways to reduce the risk for Alzheimer's through appropriate diagnosis and using of natural plants products (2).

Aim(s): The goal of this research study was to see how the main phytoconstituents (Acteoside) overcome Alzheimer's type dementia in rodents by activating the cholinergic system, anti-oxidant and protection of neuronal death in the hippocampus region of the brain.

Methods: Investigating the extraction method initially, followed by an *In-Vitro* and *In-Vivo* investigation in rodent models, and a phytoconstituents analysis using a variety of analytical techniques. Numerous criteria, including behavioral, biochemical, and histological examination, are examined during rodent modeling, using different groups. Subsequently, a standard group including marketed formulation was used to assess each group.

Results: The hot continuous percolation (Soxhlet) method is used in the preliminary evaluation to determine the percentage yield, which comes out to be 14.10%. Strong antioxidant properties are also shown by plant extract in the early stages.

Conclusion: The current study suggested that the plant extract in *In-Vivo* experiments to prevent related oxidative stress-mediated problems. Further studies are needed to explore the potential medicinal applications of this plant

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The Microscopic Study of *Rhus typhina* L. Leaves

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Background: Scientists are increasingly interested in polyphenolic components of plants with antimicrobial activity [1]. One of the ways to replenish natural sources of polyphenolic compounds is to use invasive species as a source of tannins, such as *R. typhina*, which has spread uncontrollably across Ukraine. Microscopic features of medicinal plant materials are important for the diagnosis of raw materials, especially in the identification of impurities.

Aim: To determine the microscopic characteristics of *R. typhina* leaves.

Methods: Microscopic studies were carried out by light microscopy method [2].

Results: The leaf of *R. typhina* is dorsoventral, hypostomate. The upper epidermis consists of thick-walled rhombic cells with simple straight pores, tightly adjacent to each other. Cells of the lower epidermis are rectangular-convex with numerous actinocytic stomata. Stomatal index 15.25±1.5 %. The surface of the leaf blade is covered with glandula head trichomes with a multicellular stalk and head with light brown contents inside the cells. The epidermis of rachis is represented by rectangular tightly closed cells with very strong pubescence by simple multicellular trichomes and rare glandula head trichomes with a multicellular stalk and head. There are rows of cells with druses in the epidermis of the rachis. The cross-section of the rachis consists of three main parts: the integumentary, the cortex, and the central cylinder. The integumentary part is covered by an epidermis with trichomes. The cortical part consists of 4-6 layers of lamellar collenchyma cells followed by 3-4 strips of chlorenchyma. The central cylinder is represented by collateral closed vascular fiber bundles arranged in an orderly circular pattern, with clearly visible bast fibers and a core in the center.

Conclusion: It has been established that the main diagnostic anatomical features of *R. typhina* leaves are the presence of druses, two types of trichomes: simple multicellular and cephalic and an actinocytic stomatal apparatus.

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The Feasibility of Using Avocado Seeds as an Additional Source of Polysaccharides and Phenolic Compounds in Fruit Processing

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Background: *Persea americana* L. has become quite popular in food and cosmetic industries in Ukraine, due to its unique composition of biologically active substances. According to the data of analytical and information platforms the supply of this fruit increased more than eightfold compared to the last year in Ukraine [1]. The seeds are simply disposed of during manufacturing. In our work, we propose the use of avocado seeds as an additional source of starch.

Aim: To establish macro- and micromorphological features and determine the quantitative starch content of seeds of three avocado varieties.

Methods: Microscopic studies were carried by light microscopy method [2]. The quantitative starch content was determined by the gravimetric method [3].

Results: There are three types of avocados in Ukraine: Mexican, Guatemalan and West Indian. The seeds of the three varieties are conical, smooth, light brown, membranous with a pronounced network of veins. The seeds sizes vary from 3.7±0.68 cm in the Mexican variety to 5.6±0.56 cm in the West Indian variety, the Guatemalan variety – 5.0±0.5 cm. The seeds make up from 10 to 23% of the fruit weight. The shape of the cotyledon cells of the Mexican variety is elongated-round, starch grains are simple eccentric or concentric. The West Indian has an elongated rectangular shape, densely filled with simple grains. In Guatemalan, the cells are rhombic with simple eccentric starch grains. The starch content ranges from 19.32±0.85% in the West Indian, 19.93±0.44% in the Mexican and 20.03±0.78% in the Guatemalan variety.

Conclusion: It was found that the seeds of three avocado varieties differ in size, shape and volume fraction of the total fruit mass, type of starch grains and shape of cotyledon cells. The content of starch in *P. americana* seeds was from 19.32 to 20.03%, which will allow its use as an alternative source of starch.

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Evaluation of Students‘ Opinion Regarding the Quality of the Pharmacy Study Program at the Lithuanian University of Health Sciences

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Background: Higher education institutions are considered as one of the best environments for students to improve their abilities, plan careers, and reveal their potential. Therefore, it is important that educational services are provided in appropriate quality [1]. An essential indicator of the performance of higher education institutions is the satisfaction of students with the quality of educational services. When students are satisfied with the quality of services provided, they are more likely to continue with their studies and recommend them to others [2].

Aim: To evaluate the students' opinion regarding the quality of the pharmacy study program at the Lithuanian University of Health Sciences.

Methods: Anonymous questionnaires were distributed to students of pharmacy program at Lithuanian University of Health Sciences. The study was conducted in November 2023. In total 206 correctly filled questionnaires were collected and used in analysis.

Results: Our study has revealed, that the majority (73.3%) of the respondents were satisfied with pharmacy studies and only 1.9% - not satisfied. One third (33.0%) of students did not notice the obvious shortcomings of pharmacy studies. However, 25.2 percent of participants named poor organization of studies as the main drawback. 47.1 percent of students thought that more to practice oriented classes would increase possibilities for employment after graduation. 72.3 percent of participants would recommend to their friends to study in the pharmacy study program.

Conclusion: Most of the students of the pharmacy study program were satisfied with the quality of studies and didn't notice serious shortcomings of the study program. Students' were in favor more practical trainings, which will increase their practical skills and possibilities for employment after graduation. The vast majority of respondents would recommend to study pharmacy for their friends.

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Study of Textural Parameters and Solubility of Dental Polymeric Films for the Treatment of Infectious and Inflammatory Diseases of the Oral Cavity

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Background: The rational medicinal form for the treatment of infectious and inflammatory diseases of the oral cavity is polymeric films, which are characterized by good adhesion and a prolonged effect.

Aim: To study the textural parameters and solubility of the developed dental polymeric films.

Methods: APIs – clove extract, lavender and grapefruit essential oils; film formers – sodium alginate, polyvinyl alcohol (PVA), sodium carboxymethyl cellulose (Na-CMC), hydroxyethyl cellulose (HEC), hydroxypropyl cellulose (HPC); plasticizers – glycerol and polyethylene oxide 400 (PEO-400); solvents – water purified, ethanol 96%. Combined films were prepared: No.1 – 3% HEC + 1% HPC; No.2 – 1.5% Na-CMC + 1% HPC; No.3 – 2% sodium alginate + 1% HPC; No.4 – 2% PVA + 1% HPC; No.5 – 3% HEC + 1% PVA; No.6 – 1.5% Na-CMC + 1% PVA; No.7 – 2% sodium alginate + 1% PVA; No.8 – 3% HPC + 1% PVA. The bursting strength, tensile and adhesive capacity of the films were investigated using a texture analyzer TA.XT.plus (Stable Micro Systems Ltd, UK). The solubility was studied by placing films in a solution of artificial saliva with a pH = 6.5 and a temperature of 37.0±1.0°C.

Results: The dissolution time of the films in comparison with uncombined samples has increased significantly: in combination with HPC – more than 4 times, with PVA – more than 2 times. Combined films based on HEC (No.1 and No.5) and sodium alginate (No.3 and No.7) had the highest values of bursting strength and tensile capacity. The best adhesive ability was demonstrated by the samples containing HPC as an additional film former – the adhesion changed in the following order: No.1 > No.2 > No.3 > No.4.

Conclusion: Based on the results, films with a combination of HEC and HPC with PEO-400 as a plasticizer (No.1) have the highest values of adhesion, bursting and tensile strength as well as the longest dissolution time.

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Quantitative Analysis of the Main Biologically Active Compounds and Antioxidant Activity of the Obtained Raspberry Shoot Extracts

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Background: According to literary sources, one of the reasons of the disease is free radicals [1, 2]. That is why, we observe a great interest to antioxidants, especially nature origin as synthetic antioxidants whose use must be limited have a high chance of side effects.

Aim: Determine the total content of phenolic compounds, flavonoids, catechins, hydroxycinnamic and organic acids, antioxidant activity of obtained 96%, 60% ethanolic and aqueous extracts

Methods: The extracts of raspberry shoots were obtained by the following way: 10.0 g of the grinded shoots was mixed with 200 mL of solvent. Extraction was carried out within 1 hour on water bath with a condenser, then repeated two times with a new portion of the solvent. After that the obtained extracts were filtrated and concentrated using rotary evaporator to 20 mL. The total content of phenolic compounds was measured by the Folin-Ciocaltau assay. The vanillin reagent assay was applied to find out the total catechins. The total flavonoids were determined using assay of complex formation with $AlCl_3$. The total hydroxycinnamic acids derivatives content was measured by assay of complex formation with $NaNO_2$-Na_2MoO_4. The total organic acids content was determined by acid-base titration. The level of antioxidant activity was evaluated by potentiometric method.

Results: The highest content of biologically active compounds and the level of antioxidant activity had the aqueous extract raspberry shoot extract.

Table 1. The total content of polyphenols, catechins, flavonoids, organic acids and the level of antioxidant activity of obtained raspberry shoot extract

Sample	Amount of polyphenols, mg/mL	Amount of catechin, mg/mL	Amount of flavonoid, mg/mL	Amount of hydroxycinnamic acids, mg/mL	Amount of organic acids, mg/mL	Antioxidant activity mmol-equiv./$m_{dry\ res.}$
96% extract	4.70±0.10	2.40±0.05	0.16±0.01	2.10±0.05	1.55±0.03	35.41±0.71
60% extract	18.76±0.38	13.9±0.28	0.90±0.04	3.71±0.07	2.26±0.05	109.04±2.18
aqueous extract	23.20±0.46	20.00±0.4	0.63±0.01	3.13±0.06	1.95±0.04	142.40±2.85

Conclusion: The aqueous extract obtained from red raspberry shoots will be further analyzed on the present other pharmacological effects.

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The Effect of Nutmeg Essential Oil Concentration on Physical Parameters of Microcapsules

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Background: The main problem is that essential oil is unstable and loses its effectiveness when exposed to external factors [1]. Microcapsules containing essential oils are more resilient to conditions like acidity, pH changes, high temperatures, and moisture because they have a protective outer shell around the labile substance [2,3].

Aim: The purpose of this study was to produce microcapsules by lyophilization method and to evaluate the effect of essential oil on the physical parameters of microcapsules.

Methods: Microcapsules were made by lyophilization method. The concentration of nutmeg essential oil was 0-25%. Physical parameters were evaluated: moisture, yield and powder properties (compressibility index and Hausner ratio).

Results: microcapsules containing 20% essential oil had the highest moisture (25.90±2.37%) and yield, the lowest moisture (13.10±2.67%) - without oil. After evaluating the properties of the powder, none of the microcapsules composition had good properties (passable or poor flow).

Conclusion: Substances of liquid aggregate state and oily consistency (essential oils) determine the physical parameters of microcapsules. In order to improve the flow of microcapsules, a new composition should be modeled by choosing other excipients.

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Compositional Modeling, Screening, Physical Properties and Biopharmaceutical Evaluation of Cellulose Hydrogels with Propolis Phenolic Compounds

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Background: propolis, a natural bee product rich in flavonoids and phenolic compounds, has diverse biological properties, including antioxidative effects [1]. Formulating an appropriate substrate is vital for semi-solid dosage forms. Hydrogel composition plays a key role in formulation stability and phenolic compound release kinetics [2, 3].

Aim: to design and select cellulose hydrogels containing propolis phenolic compounds, evaluate their physical properties, and conduct biopharmaceutical evaluations.

Methods: experimental hydrogel composition was modeled using a central compositional model. Cellulose hydrogels were prepared with an aqueous propolis extract. Quality assessment included temperature and thixotropy tests, and determination of physical and mechanical properties (pH via pH meter, strength via texture analyzer). Total phenolic compound content and release rate were evaluated using an in vitro model, with concentration determined via spectrophotometric method and coumaric acid calibration curve.

Results: the study identified the content of hydroxyethyl cellulose (HEC) as the primary factor influencing hydrogel properties. The hydrogels exhibited stable rheological properties, maintaining gel texture within the temperature range of 0-40 °C. pH values of simulated cellulose hydrogels with aqueous propolis extract ranged from 4.35 to 4.68. In vitro testing revealed that hydrogels with lower viscosity exhibited higher phenolic compound release (43.57%), while those with higher viscosity showed lower release (24.32%). All hydrogels released sufficient phenolic compounds to elicit biological effects.

Conclusion: the central compositional model successfully generated statistically significant models for selected parameters, enabling prediction of optimal hydrogel composition. The experimental hydrogels met quality parameters and demonstrated suitability for propolis phenolic compound release.

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In vitro Release of Ciclopirox Olamine from Different Formulations of Oil in Water Emulsions with Oat Gel

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Background: Oil-in-water emulsions rely on critical factors like emulsifier composition and quantity, viscosity modifiers and other additives for emulsion stability and efficacy of active substances. [1] Oat gel renowned for its skin-enhancing properties, serves as a multifaceted component in emulsion dispersion, offering stabilization, emulsification, and textural augmentation. [2] Oat-fortified emulsions efficiently alleviate dermatological symptoms. [3] Ciclopirox olamine, a versatile topical agent, effectively treats fungal skin conditions. [4] *In vitro* release studies are crucial for evaluating its performance in emulsions.

The aim: to determine the *in vitro* release profiles in ciclopirox olamine across various oil in water emulsion formulations with oat gel.

Methods: The *in vitro* study was performed using flow-through cells. Quantitative analysis of released ciclopirox olamine was conducted using ultra-high-performance liquid chromatography. Conducted over 6 hours at 32 ± 0.5 °C, simulating skin surface temperature with cellulose diffusion membranes. Four emulsion formulations with varying emulsifier (10% or 5%) and cetyl alcohol (0% or 5%) content were tested. All other components, including ciclopirox olamine concentration (1%), oat gel (5%), xantan gum (0,3%) and propylene glycol (5%), remained consistent across formulations.

Results: After 6 hours, ciclopirox olamine flux varied (0.116 mg/cm² to 0.151 mg/cm²) across emulsion formulations. The highest flux (0.151 mg/cm²) occurred in 0% cetyl alcohol and 5% emulsifiers emulsion, while the lowest, comparable fluxes were in emulsions with 5% cetyl alcohol and 5% emulsifiers (0.116 mg/cm²), 5% cetyl alcohol and 10% emulsifiers (0.118 mg/cm²). Statistical test shows no significant differences ($p=0.602$, when the level of statistical significance is $p < 0.05$).

Conclusion: While there was no statistical distinction in cyclopirox release among various emulsion formulations, subtle differences were noted. Emulsions with reduced emulsifier and cetyl alcohol content exhibited enhanced in vitro release of cyclopirox olamine, whereas those with elevated emulsifier and cetyl alcohol content demonstrated marginally lower release.

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Seasonal Variation of Phenolic Compounds in Iris Species

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Background. The place and time of herbal raw material (HRM) collection play an important role in the efficacy of herbal medicines. Plants should be harvested when the bioactive compounds are at their peak. *Iris* plants are a rich source of different secondary metabolites with antitumour, anticholinesterase, antimicrobial and immunomodulatory properties. It is therefore important for the pharmaceutical industry to determine the optimum time for harvesting HRM.

Aim: To assess the influence of harvest location and season on the chemical profile of phenolic compounds in Iris raw material.

Materials and methods. Leaves and rhizomes of *Iris pseudacorus* (6 localities) and *Iris* ×*germanica* (3 localities) were collected from wild or naturalised populations in Lithuania, Latvia and Ukraine in September 2017 and June 2018. Chromatographic separation of phenolic compounds was conducted in the Shimadzu Nexera X2 LC-30AD HPLC system using ACE C18 column (1). The identification of the compounds was based on the UV/MS spectral data.

Results. Mangiferin, tectoridin, 6,7-dihydroxyisoflavone, irigenin, chlorogenic acid and caffeic acid were identified in most *Iris* samples regardless of the season and plant part. Apigenin-7-glucoside, 7-hydroxyisoflavone, isoquercetrin and astragalin were not detected in samples of *Iris* leaves harvested in autumn, and the presence of robinin was not detected in *Iris* leaves harvested in summer. The content of xanthones, flavones and phenolic acids was significantly higher in summer than in autumn in the leaves of analysed *Iris* species. The rhizomes contained significantly more phenolic acids in summer, while the content of other substances in rhizomes was not significantly different in summer and autumn.

Conclusions. The analysis revealed that the content of polyphenolics in leaves and rhizomes was higher in summer than in autumn. This is probably due to the intensity of sunlight, as one of the physiological functions of polyphenolics is to protect plants from ultraviolet radiation.

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New Data about Chemical Composition of *Cynanchum acutum* L.

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Background: *Cynanchum acutum (L.)* is a plant species belonging to Cyanchum genus. This genus comprises of about 200 species in *Asclepiadaceae* family and is distributed worldwide. *C. acutum* is quite poisonous with few medical applications. The alcohol extract of aerial parts of *C. acutum* was reported to have many biological and pharmacological effects (1).

Aim: The goal of the research is to study the chemical content of the underground parts of *Cynanchum acutum* in order to determine the possibility of their use in medicine.

Methods: The roots of *C. acutum* (0.500 kg) were powdered and extracted three times with MeOH at room temperature. The collected extracts were dried under reduced pressure, and the concentrate was partitioned between $CHCl_3$ and H_2O. A part of the aqueous extract was subjected to Diaion HP-20 column chromatography and eluted with a gradient system of H_2O-MeOH 10:0 to 0:10 to yield one fraction of 80% MeOH. The part of 80% MeOH fraction was separated on Sephadex LH-20, eluted with MeOH; enriched fractions were then separated by CC (SiO2), eluted with $CHCl_3$/MeOH/H_2O 40:9:1

Results: HPLC over a SUPELCOSIL LC-18 column (250 × 10 mm, 5 µm) isolated three pure cardenolide glycosides. The complete chemical structures were determined using one- and two-dimensional nuclear magnetic resonance spectroscopy (1H, HSQC, HMBC, COSY) and mass spectrometry. These compounds are the known substances: lanatoside A, lanatoside C (2), and corchorusoside C (3).

Conclusion: Three cardenolide glycosides lanatoside A, lanatoside C, and corchorusoside C, were isolated from roots of *Cynanchum acutum.* Cardenolide glycosides, the new class observed for the genus cynanchum are definitely interesting.

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Preliminary Evaluation of Orodispersible Minitablets with Hydrocortisone in Pediatric Doses

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Background: A novel alternative to conventional tablets intended to be administered to younger children are minitablets enabling individualized dosage adjustment. For patients who have swallowing difficulties, orodispersible minitablets (ODMTs) are particularly recommended (1,2). Hydrocortisone (HT) was selected as the model drug, since it is widely utilized in pediatric population (3).

Aim: The purpose of this study was to develope 2 mm ODMTs with HT in pediatric doses (0.5 mg and 1 mg) with disintegration time below 30 seconds (4).

Methods: To formulate ODMTs, multifunctional co-processed mixture – Prosolv® ODT (JRS Pharma, USA) was used. As obtaining ODMTs with HT by direct compression was impossible, HT was granulated with hypromellose (Pharmacoat® 605, Shin-Etsu Chemical Co., Ltd., Tokyo, Japan) in 1:1 ratio. ODMTs were prepared by using traditional tablet press (Type XP1, Korsch, Berlin, Germany) equipped with 2-mm punches. The properties of formulated ODMTs were assessed according to the European Pharmacopoeia 11.0 (5).

Results: ODMTs possessed smooth surface, uniform mass, thickness and HT content. They were characterized by satisfying mechanical properties (hardness, friability), as well as desired disintegration time.

Conclusion: The technological difficulty while preparing orodisperible tablets constitutes simultaneous maintenance of a short disintegration time and adequate mechanical parameters. The use of Prosolv®ODT and HT in granules form enabled to obtain ODMTs with adequate properties.

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The Technology and Evaluation of Bigel with Rose Hydrolat and Sesame Oil

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Background: Rose hydrolat has an anti – inflammatory effect on the skin and sesame oil is known for its moisturizing, nourishing properties for dry skin. Bigel is a semisolid pharmaceutical form, consisted of oily and aqueous phase, which provides the hydration of the stratum corneum, cooling, non – sticky feeling on the skin, etc. [1, 2]. Rose hydrolat and sesame oil enables bigel to be used for dry, irritated skin.

Aim: To make a bigel with rose hydrolat and sesame oil and evaluate its quality.

Methods: APIs – rose hydrolat, sesame oil; plasticizer – glycerol; gelling agents – hydroxyethylcellulose (HEC), Carbopol Ultrez 21, sorbitan monostearate, sorbitan monopalmitate; antioxidant – vitamin E; preservative – phenoxyethanol. 12 bigel samples were made. The main differences between the samples were the ratio of hydrogel and organogel (9:1; 8:2; 7:3) and different gelling agents. Hydrogels were made using Carbopol Ultrez 21 and HEC, in organogels were used sorbitan monostearate and sorbitan monopalmitate. The stability, pH, viscosity and textural properties of the samples were studied.

Results: Bigels with the ratio of 7:3 had a higher viscosity compared to bigels with a ratio of 9:1 and 8:2. The pH values of all the samples were within the limits suitable for use on the skin (4.1-7.4), but the bigels with Carbopol Ultrez 21 had a lower pH value compared to HEC bigels. Centrifugation and freeze – thaw cycling tests showed that bigels with Carbopol Ultrez 21 and sorbitan monopalmitate (ratio 7:3) also bigels with Carbopol Ultrez 21 and sorbitan monostearate (ratios 8:2 and 7:3) were unstable. The most optimal texture properties were exhibited by bigels with HEC and sorbitan monostearate in ratios of 9:1, 8:2 and 7:3.

Conclusion: Bigels with HEC and sorbitan monostearate showed the highest stability, the best textural properties (i.e. hardness, consistency, stickiness and viscosity index) and pH values.

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Iron Deficiency in Athletes - the Role of the Nutritionist, Pharmacist and Physician

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Background: Intense physical activity may contribute to the development of iron deficiency anaemia (IDA) [1] resulting in reduced physical performance [2]. The existing research in this area on young football players is limited [3-4].

Aim(s): The aim of this study was to assess the risk of IDA among young football players in comparison with athletes in other sports, and defining the role of the nutritionist, pharmacist and physician in preventing or treatment of IDA.

Methods: The study group consisted of 36 young (13-17 years) athletes from the Football Academy. Dietary iron (Fe) intake was assessed based on 24-hour dietary interviews. In the blood, haemoglobin (HGB), red blood cell count (RBC) and haematocrit (HCT) were determined. Subjects who had decreased at least 2 basic blood count parameters were classified as predisposed to develop IDA.

Results: It was shown that one in three young football players was predisposed to IDA. It was found that more predisposed compared to non-disposed individuals had longer workouts and exercised more often. It was noted that 36% of subjects supplemented their diets with Fe supplements; furthermore, their dietary Fe intake (16mg/day) was significantly ($p<0.02$) higher than that of non-supplementers (11.9mg/day). In preventing or treating IDA, the role of the physician monitoring the patient's condition and proposing appropriate therapy in cooperation with a nutritionist (nutrition modification) and a pharmacist (selection of the most bioavailable chemical form of preparations) is crucial.

Conclusion: Young football players are at risk of developing IDA. Collaboration between nutritionists, pharmacists and physicians is necessary in the effective care of young athletes.

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Risk Assessment for Analytical Procedure Variability Sources by Insignificance Principle

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Introduction: Scoring and ranking of identified variability sources are effective tools for risk assessment by the AQbD concept. These processes often rely on expert opinion, leading to variability in risk severity. Utilizing the principle of insignificance, the concept of measurement uncertainty serves as a tool for the qualitative evaluation of how source variability affects reportable results.

Aim: The aim is to set sound criteria to evaluate the severity of variability sources' influence based on the insignificance principle and metrological approaches of the State Pharmacopoeia of Ukraine (SPhU).

Methods: Statistical methods.

Results: The SPhU defines the Test-to-Uncertainty Ratio (TUR) value of 1/0.32 as negligible for a 95% reliability level, suggesting TUR as a means for an objective severity assessment of the impact of identified variability sources (expressed as expanded uncertainty U_i) on the target uncertainty (U^{tg}) within specified ranges, which can be classified from insignificant to unacceptable severity levels, providing a structured approach to managing variability risks: *1. Insignificant Severity (Low): If* $U_i \leq 0.32 \times U^{tg}$, the impact is minor and only needs reporting; *2. Moderate Severity (Medium):* For $0.32 \times U^{tg} < U_i \leq (1\text{-}0.32) \times U^{tg}$, the impact is notable but manageable. Control measures depend on risk assessment probability; mitigation might not be required; *3. Significant Severity (High):* When $(1 - 0.32) \times U^{tg} < U_i \leq U^{tg}$, the impact is critical, requiring control measures and efforts to mitigate; *4. Unacceptable Severity:* If $U_i > U^{tg}$, the impact exceeds acceptable levels, necessitating urgent mitigation. This methodology was validated through practical application in the validation of analytical procedures for desloratadine tablets and the verification process for Ibuprofen tablets.

Conclusion: In conclusion, the study introduces scientifically grounded criteria for evaluating the severity of the influence of identified variability sources, offering a robust framework for risk assessment in quality management processes.

Chemical Composition of *Camellia sinensis* (L.) Kuntze Extract

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Background: the chemical composition of green tea (*Camellia sinensis* (L.) Kuntze) consists of phenolic compounds (30% dry weight in leaves), 3 – 4% of alkaloids known as methylxanthines such as caffeine, theobromine and theophylline, proteins (15-20% dry weight in leaves), and carbohydrates (5-7% dry weight in leaves). The main component of green tea is phenolic compounds, which are presented by flavonols, flavandiols, flavonone, and phenolic acids. Due to the wide variety of phenolic compounds, green tea possesses different pharmacological activities such as antioxidant, anti-inflammatory, antiviral, anti-bacterial, anti-tumor, and anxiolytic activity. Many scientific researches have found that green tea catechins possess a significant antioxidant activity [1].

Aim: To determine the qualitative and quantitative composition of *C. sinensis* extract.

Methods: For extraction, dried and powdered *C. sinensis* leaves were used. After ultrasound-assisted extraction (the sample/solvent ratio was 1:10), the obtained extract was lyophilized using a Freeze Dryer (Telstar LuoQuest, Spain). Dry *C. sinensis* extract has been analysed using HPLC-PDA (Waters e2695 Alliance system, Walters, Milford, MA, USA) system (in samples 1.1 mg/ml with the solvent - water).

Results: HPLC-PDA analysis has shown that dry *C. sinensis* extract (1:10) contains (mg/g dry weight): 19,5962 ± 0,61 SD mg/g gallic acid, 217,5384 ± 5,65 SD mg/g epigallocatechin (EGC), 292,7654 ± 7,92 SD mg/g epigallocatechin gallate (EGCG), 111,3464 ± 2,89 SD mg/g epicatechin gallate (ECG) and 431,9150 ± 9,51 SD mg/g caffeine.

Conclusion: The obtained dry extract of C. sinensis was distinguished by the phytochemical marker caffeine, which accounted for 40,247% of the total identified compounds.

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Naturally Occuring Flavonols, Tamarixetin and Isorhamnetin, Exert Vasodilatory Effects in Two Different *Ex Vivo* Experimental Models

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Background: The flavonoid-rich diet can be associated with various positive health effects including the cardiovascular ones. So far, the knowledge of the active compounds is limited.

Aim: In this study, 21 compounds from hawthorn including several flavonoid metabolites were screened on two *ex vivo* models of vascular beds – porcine coronary artery or rat thoracic aorta. Two most active compounds were selected for subsequent *ex vivo* mechanistic studies.

Methods: The isolated tissue bath system (Krebs solution, 37°C, carbogen oxygenation, isometric measurement of tissue dilation/contraction) with isolated segments of precontracted vessels (KCl 40 mM or norepinephrine 10 µM) were used for cumulative application of tested substance (0.1-100 µM) and the vasoactivity was compared to the effects of nitroprusside sodium (100 µM). Mechanistic studies were performed using endothelium intact or denuded vessel rings and specific activators/inhibitors.

Results: Isorhamnetin and tamarixetin exerted the highest vasodilatory activity in both experimental models (dose-dependent effects with EC_{50}=47 and 48 µM on coronary artery and 16 and 23 µM on rat aorta, respectively). On porcine coronary artery, the vasodilatory effect was endothelium-independent and the direct effect on the smooth muscle was mediated by L-type of Ca^{2+} channels. No effects on K^+ channels or on intracellular protein kinase A or G pathways were observed. In accordance, the endothelium-independent action was also shown on rat aorta.

Conclusions: Two natural flavonols, tamarixetin and isorhamnetin, induce vasodilation *ex vivo* which is mediated by L-type of Ca^{2+} channels.

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In Silico Study of the Metabolic Pathways of a New Promising Anticonvulsant Epimidine

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Background: Epilepsy remains one of the most common neurological diseases in the world – according to the WHO [1]. Despite a relatively wide range of antiepileptic drugs only 65-70% of patients achieve satisfactory seizure control [2]. Scientists at the National University of Pharmacy have developed a new effective anticonvulsant agent – Epimidine, with a powerful spectrum of activity, as well as a favourable profile of concomitant pharmacological properties and low toxicity [3]. In order to reduce the risk of withdrawal of a drug candidate compound at the clinical trial stage due to unfavourable metabolic characteristics, it is possible to predict the directions of biotransformation of a molecule using *in silico* methods. The aim of the presented research is in silico prediction of possible biotransformation pathways of Epimidin – 1-(4-methoxyphenyl)-5-(2-[4-(4-methoxyphenyl)piperazin-1-yl]-2-oxoethyl)-pyrazolo[3,4-d]pyrimidin-4-one.

Methods: BioviaDraw 2021; XenoSite was used for prediction of the of metabolism [4].

Results. According to the results of the prediction, the following transformations are most likely to occur in the first phase of metabolism: unstable oxygenation of methoxy groups at the 4-position of phenyl radicals by O-dealkylation reaction with formation of O-dealkylated derivative – 1-(4-hydroxyphenyl)-5-[2-[4-(4-hydroxyphenyl)piperazin-1-yl]-2-oxo-ethyl]pyrazolo[3,4-d]pyrimidin-4-one; high probability of formation of stable oxidation - aliphatic hydroxylation at CH_2 by groups of the piperazine cycle, with a higher probability of formation of 3- or 5-hydroxy-4-(4-methoxyphenyl)piperazin-1-yl]-2-oxo-ethyl]-1-(4-methoxyphenyl)pyrazolo[3,4-d]pyrimidin-4-one; high probability of hydrolysis of the cycloamide group with the formation of two products - 2-[1-(4-methoxyphenyl)-4-oxo-pyrazolo[3,4-d]pyrimidin-5-yl]acetic acid and 1-(4-methoxyphenyl)piperazine; it is also possible to form glucuronide at position 1 of the pyrimidine cycle with the participation of Uridine diphosphate glucuronosyltransferases (UGTs) as a catalyst. The low probability of formation of epoxides, which are common reactive metabolites and often cause drug toxicity, was determined.

Conclusions: The probability of Epimidine metabolism by O-dealkylation, hydrolysis and oxidative hydroxylation, as well as the low probability of toxic metabolites formation were determined.

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Analysis of Quantitative Content of Phenolic Compounds in Green Tea Leaf by HPLC Method

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Background: Today, tea is used as a beverage and as an ingredient in cosmetics because of its antiaging properties. There are different types of tea, for example, white, green, oolong, black and Pu-erh tea and all of them are being produced from *Camellia sinensis* [1,2].

Aim: Determination flavonoid and phenolic acids content in green tea leaves by HPLC method.

Methods. Green tea leaves used for the analysis were collected in Anhui Province, China. The extract for the HPLC analysis was obtained by the maceration method with 60 % ethanol twice in the rawmaterial / extractant ratio of 1 : 20. The analysis of the extract from green tea leaves was performed by high performance liquid chromatography using a ProminenceLC-20 Shimadzu chromatographic system (Japan) with a SPD-20AV spectrophotometric detector, an AgilentTechnologies Microsorb-MV-150 column (reversed phase, C18 modified silica gel, length – 150 mm, diameter –4.6 mm, particles size – 5 μm). Substances in the extract were identified by comparing the retention time and the spectral characteristics of the test substances with the same characteristics of the reference standards.

Results. Using high performance liquid chromatography 9 flavonoids and 4 phenolic acids were identified. Among flavonoid aglycones quantitatively dominated by quercetin (0.35 %), in the case of flavonoid glycosides, it was luteolin-6-C-glycoside (1.30 %) and among phenolic acids, it was gallic acid (5.21 %).

Conclusion. The qualitative composition, quantitative content of flavonoids and phenolic acids in the green tea leaves were determined by high-performance liquid chromatography. According to HPLC, the content of flavonoids in green tea leaves was higher than the content of phenolic acids.

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Development of Cultivation Technologies of *Cannabis sativa* L. and Their Influence for the Quality and Quantity of Biological Productivity

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Background: When considering the application of *Cannabis sativa* L. in various fields (medicine, food industry, phytopathology, agriculture), innovative cultivation technologies of this plant are being developed, on which the quality of the medicinal plant raw material depends.

Aim(s): To assess *Cannabis sativa* L. seed sowing norm and cultivation technologies influence for plant the ground part.

Methods: A stationary field experiment was carried out in the Plunge district in the village of Varkaliai. *Cannabis sativa* L. of the family *Cannabaceae* Martinov was grown in a field experiment. The experiment was carried out in the soil that is classified as sandy loam and sandy loam silty loam areas of the Western Samogitians plain and the Western Samogitians plateau district (Lietuvos dirvožemiai, 2001). The selected seed hemp variety was ′FUTURA 75′. The applied rate of the seed was 5 kg ha^{-1}, 25 kg ha^{-1}, 16 kg ha^{-1}, 69.12 kg ha^{-1}. The experiment was performed in 3 repetitions. The initial size of the fields was 20 m^2 (10 x 2 m), and the accounting - 15 m^2 (10 x 1.5 m). The yield of the green above-ground biomass of the sowing hemp crop was determined, and the biologically active compound of the above-ground part of the plant - cannabidiol (CBD), was determined quantitatively by the gas chromatography method (Kubilienė et. al., 2020; Odieka et. al., 2022). The experimental research data were evaluated using mathematical statistical methods (SPSS Inc., 2000, Raudonius, 2017).

Results: While growing *Cannabis sativa* L. in experimental fields and applying different sowing rates, it was found that the size of the sowing rate and ecological conditions affect the growth and development of the plant and elements of the above-ground crop structure.

Conclusion: While growing *Cannabis sativa* L. in experimental fields, the highest productivity of the above-ground part of the plant (flowers, stems and leaves) is when the seeding rate is the highest (69.12 kg ha^{-1}) and the highest amount of cannabidiol (CBD) (4.03) - when the seed sowing rate is the lowest (5.00 kg ha^{-1}). Cultivation of *Cannabis sativa* L. in the Republic of Lithuania legalized in 2014 and their studies have a theoretical and practical significance.

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Iontophoretic Enhancement on Transungual Delivery of Amorolfine from Hydrophilic Nail Lacquers

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Background: Transungual drug absorption is severely constrained by the nail's composition and architecture [1]. For the treatment of fungal nail diseases, topical therapy is recommended. By removing the systemic therapy's side effects, the topical medication improves patient compliance and reduces treatment expenses [2]. Nevertheless, because transungual delivery is so challenging, topical efficacy may be increased by various penetration enhancement techniques [3].

Aim: To investigate iontophoresis influence on transungual delivery of amorolfine from hydrophilic nail lacquers.

Methods: Hydrophilic nail lacquer formulations were evaluated as potential amorolfine delivery systems. Human nail clippings of a 25-year-old male with an average thickness of 0.638 mm were used alongside cotton balls that acted as nail beds. Iontophoresis was used as a physical enhancer to evaluate its influence on transungual delivery of amorolfine *ex vivo,* on the maximum power (25 W) setting and two different time sets of 5 and 10 minutes. UPLC was used for quantitative analysis of penetrated antifungal agent.

Results: Acquired results showed the difference in accumulation of amorolfine in nail clippings and penetration through nail clippings between two different samples of nail lacquers with iontophoresis enhancement and without enhancement. Non-enhanced samples in both nail lacquer formulations showed accumulation of amorolfine in nail clippings ranging from 3.3% up to 4.1% and from 0.7% up to 2.3% of amorolfine penetrated through nails, while samples that iontophoresis as enhancement showed a significant increase in accumulation of amorolfine in both nails' clippings and acceptor media. Nails that underwent iontophoresis enhancement for 5 and 10 mins for both lacquer formulations showed accumulation of amorolfine in nail clippings ranging from 6.7% up to 17.8%, and 12.2%- 24.2% penetrated through nails.

Conclusions: It was determined, that iontophoresis could influence transungual penetration of amorolfine, depending on the delivery system and application time.

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Optimization of MMF Dosing in the Kidney Patients

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Background.Mycophenolate mofetil (MMF) is one of the standard therapy immunosuppressant after kidney transplantation. Optimization of the efficacy in MMF treatment to achieve better results requires a complete understanding of its pharmacokinetics and dosing techniques. Simcyp simulations with clinical data allow us to determine potential areas for enhancement in MMF therapy, in order to improve effectiveness with minimal risk involved.

Aim: to optimize MMF treatment approaches and increase therapeutic outcomes.

Methods: Study included 29 kidney recipients receiving MMF 2000 mg/day. Blood samples were taken 3 times/day and at three different periods: within 48 hours after treatment initiation (1st period), after 15 days (2nd period) and 60 days (3rd period) after transplantation. MPA level was determined by HPLC-UV/DAD. Concentration analysis was made by the Simcyp simulator. The therapeutic range is taken from 1-4mg/L.

Results: In the 1st period patients' MPA levels ranged 1.2-12.5 mg/L; and 41% of these patients' MPA levels were within the therapeutic range (1-4 mg/L) vs 2nd period where MPA levels ranged 1.2-17.5 mg/L and only 8% of patients' MPA levels were within the therapeutic range; vs 3rd period where patients' MPA levels ranged 1.0-33.9 mg/L and only 5% of patients' MPA levels were within the therapeutic range. The highest MPA peak concentration (33.9 mg/L) was observed between third period patients.

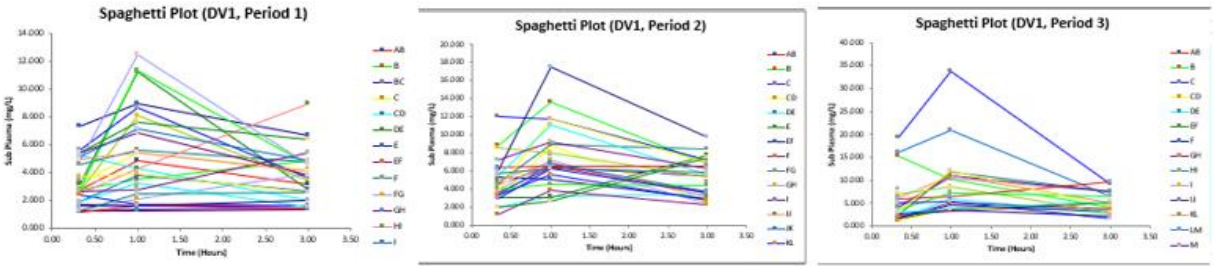

Fig 1. Plasma levels in patients receiving 2g/day of MPA.

Conclusion: Data shows that in the long term MPA level in plasma is increasing requiring dose adjustment to diminish the potential risk of adverse reactions.

Determination of the Prospects of New 8-thia/oxa-1,3-diazaspiro[4.5]decane-2,4-dione Derivatives as Acetylcholinesterase Inhibitors

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Background: The spectrum of cognitive impairment is very wide and ranges from normal cognitive decline with age to diseases of the central nervous system, including Alzheimer's disease, Parkinson's disease and others [1]. The most important trajectory of cognitive impairment is the cholinergic hypothesis, which postulates that cognitive deterioration is associated with a decrease in the amount of the neurotransmitter acetylcholine [2]. Today the cholinesterase inhibitors (AChEIs) donepezil, galantamine and rivastigmine are prescribed for the treatment of cognitive disorders, in particular, Alzheimer's disease [3]. The search for new AChEIs benefits from well-established knowledge of the molecular interactions of selective AChEIs, such as donepezil and related dual binding site inhibitors [4]. The high level of diseases with neurological deficits requires the search for effective treatment strategies and the development of new drugs to correct these conditions. The aim of the study was to predict the acetylcholinesterase inhibitory activity of new 1-aryl/heteryl-substituted derivatives of 3-(5-oxopyrrolidin-3-yl)methyl)-8-oxa-1,3-diazaspiro[4.5]decane-2,4-dione.

Methods: The following programs were used BioviaDraw 2017R2, Discovery studio Visualizer 2021, VMD1.9.3, AutoDock Tool and Autodock Vina. Crystallographic data for AChE (PDB ID 5NAU) were obtained from the Protein Data Bank (http://www.rcsb.org/pdb).

Results: Based on the hydride-pharmacophore concept, 3-aryl/heteryl-substituted derivatives of (5-oxopyrrolidin-3-yl)methyl-8-thia/oxa-1,3-diazaspiro[4.5]decane-2,4-dione were designed as possible agents for the correction of cognitive impairment. To evaluate the prospects of studying experimental ligands for acetylcholinesterase inhibitory activity, molecular docking into the active site of inhibitor of the AChE isolated from *Tetronarce californica* was performed. Donepezil was used as a reference ligand, and the docking methodology was validated using the native ligand (2E)-2-[(1-benzyl-4-piperidyl)methylene]-5-methoxy-indan-1-one as a promising simplified Donepezil analogue. According to the results obtained high affinity was predicted for the studied ligands: the binding energy ranged from -9.2 to -10.8 kcal/mol, compared to 11.0 kcal/mol for Donepezil.

Conclusions: The docking studies for the readily synthetically available 3-aryl/heteryl substituted derivatives (5-oxopyrrolidin-3-yl)methyl-8-thia/oxa-1,3-diazaspiro[4.5]decane-2,4-dione showed the expediency of their study as the novel class of potent AChEIs. The 7 designed compounds with the lowest binding energy values and fixation in the active site by amino acid residues of the active site (Tyr121, Tyr334, Trp84, Trp279) were selected for further in vitro and in vivo studies.

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Total Phenolic Compounds in Samples of Edible Honeysuckle Berry Cultivars from Different Lithuanian Places.

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Background: Honeysuckle berries belong to the genus *Lonicera*, family *Caprifoliaceae* [1]. Studies have shown that honeysuckle berries accumulate beneficial bioactive compounds, especially phenolic compounds, mainly anthocyanins, chlorogenic acid, quercetin and iridoids. The compounds in the fruit of *L. Caerulea* have antimicrobial, antidiabetic, anticancer, anti-inflammatory, neurological and cardioprotective effects [2].

Aim: The aim of this study was to determine the total phenolic compounds of edible honeysuckle berries growing in Lithuania.

Methods: Extracts of frozen edible honeysuckle berries are prepared by crushing 1 g of the plant material, adding 70% methanol up to the 9 ml mark and placing in an ultrasonic bath for 30 minutes. The resulting extract is filled with 70 % methanol to the 10 ml mark. Centrifuge for 5 min. The total phenolic compounds in the honeysuckle extract were determined spectrophotometrically using Folin-Ciocalteu reagent.

Results: The highest content of total phenolic compounds was found in the cultivar "Zojka" - 14,35 ± 0,26 mg/g (grown in Alytus) and 13,69 ± 0,25 mg/g (grown in Klaipėda). Slightly lower levels were found in the variety 'Zojka' - 11,15 ± 0,20 mg/g (grown in Klaipėda). The lowest total phenolic compounds were found in the cultivar 'Honey bee' - 7,12 ± 0,13 mg/g (grown in Alytus) and in the cultivar 'Honey bee' - 7,12 ± 0,13 mg/g (grown in Vilnius). These results are statistically significantly different from those of 'Honey bee' (grown in Klaipėda) ($p<0,05$).

Conclusions: The results showed that the place of cultivation influences the accumulation of phenolic compounds in edible honeysuckle berries. The variation in phenolic compounds between cultivars was related to growing and climatic conditions.

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Investigation of Triterpenoids from Rue Herb as an Important Aspect of Pharmacological Effects Exploration

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Background. *Ruta graveolens* is natural growth in rocky, sunlit areas such as the Crimean Peninsula (Ukraine). Plant is cultivated in southwestern Ukraine. It has a rich chemical composition [1]. The plant is popular in folk medicine and homeopathy in Ukraine and other countries but it is not official and is not included in the State Pharmacopoeia of Ukraine [2]. It has anti-inflammatory, healing, anti-inflammatory, antispasmodic, anthelmintic, antifungal, anti-diarrheal and anti-ulcer effects [3]. Ruta has not been studied enough, so it is of great interest for research into its composition, including triterpenoids, and confirmation of its effects.

Aim: The aim is quality and quantitate analysis triterpenoids in *Ruta* herb.

Materials and methods: *Ruta graveolens* L. was collected in the Botanical Garden of the Ivan Franko National University of Lviv, Lviv city, Ukraine, July 2022. For triterpenoids analysis, chromatographic separation using a Waters e2695 Alliance HPLC system in combination with a 2998 PDA detector (Waters, Milford, MA, USA) was used. A gradient elution mode was used, which included acetonitrile and water (89:11, v/v) as the mobile phase. The spectrum was recorded at 205 nm. Quantification was done by external standard method.

Results. The total triterpenoids content was 77.38 mg/g in *Ruta* herb sample. There are five triterpenoids were identified, such as oleonolic acid (0.038 ± 0.001 mg/g), ursolic acid (0.243 ± 0.004 mg/g), maslinic acid (1.696 ± 0.029 mg/g), corosolic acid (0.456 ± 0.008 mg/g), betulin (74.947 ±1.317 mg/g). The largest amount of pentacyclic triterpenoid betulin may contribute to the presence of choleretic properties, stimulates the outflow of bile and counteracts stagnation, hepatoprotective, anti-inflammatory, antioxidant activity in the raw material.

Conclusions. *Ruta graveolens* L. is a source of triterpenoids. Determined compounds have broad pharmacological activity from antioxidant to anticancer. Therefore, further analysis of the biological activity of rue herb is relevant.

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Glutamate Receptors for In Silico Evaluation of Antiparkinsonian Activity of New Compounds

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Background: Neurodegenerative diseases are debilitating conditions that lead to progressive deterioration or death of nerve cells [1], causing cognitive dysfunction, dementia, and slow down motor function in various parts of the brain [2]. It is now evident glutamatergic signalling in brain plays the central role in its functioning, as well as in the modulation of neurodegenerative pathologies, including Parkinson's disease [3]. Modulation of glutamate receptors (GluRs) has been shown to improve the motor symptoms of Parkinson's disease, increase the effectiveness of antiparkinsonian dopaminergic agents and protect substantia nigra neurons. The search for new ligands-modulators of glutamate receptors is a priority for the development of new drugs.

Aim: The aim of the study is to review the available crystallised glutamate receptors in conformation with promising antiparkinsonian ligands and validate docking methodologies for their further use for *in silico* studies.

Methods: The following programs were used Discovery studio Visualizer 2021, AutoDock Tool1.5.6rc3, Autodock Vina. Crystallographic data for all glutamate receptors were obtained from the Protein Data Bank.

Results: The results of the study are presented below:

Receptor	PDBID/ Expression System	Native ligand / Finding an active site	Binding energy kkal/mol	Amino acid residues of the active site GluR
NMDA	3QEL/ Trichoplusia ni	Ifenprodil –NAM, ATD	-11.2	Glu236, Leu135, Phe114, Phe176,Ala107, Leu135, Pro78, Ile111, Pro177
	5UOW/ Homo sapiens	Dizocilpine – NAM, TMD	-8.0	Leu630, Leu649,Leu636, Ala643, Ala 631
AMPA	6FQH/ Escherichia coli	NBQX – NAM, LBD	-8.2	Tyr61, Tyr220, Thr91, Thr 174, Glu193, Pro89, Arg96
	5L1G/ Homo sapiens	Talampanel, LBD	-10.2	Asn791, Ser615, Ser790, Asp519, Phe623, Leu620, Leu624, Leu787, Pro520
mGluR1/ 5	4OO9/ Homo sapiens	Mavoglurant, NAM, TMD	-9.0	Asn747, Ser805, Ser809, Val740, Ser654, Pro65, Ala813, Ile625, Ile651, Val740, Pro743, Leu744, Tyr659, Trp785, Phe788, Pro655, Ala810
	6FFH/ Homo sapiens	Fenobam –NAM, TMD	-8.7	Trp785, Val806, Ser809 Ser658, Gly624, Tyr659, Ala810
mGlu 2/3	4XAQ/ Homo sapiens	LY379268 – agonist, ATD	-7.9	Ala166, Asp295, Thr168, Ser145, Lys377, Arg61, Ser143, Tyr 216, Tyr 144, Glu273
mGluR4, 6,7,8	8JD5/ Homo sapiens	ADX88178 – PAM mGluR4	-11.2	Leu774, Ala775, Ala800, Ile804, Leu777, Pro778, Leu828, Pro778, Val824, Leu590, Pro591, Val824

NAM – negative allosteric modulator; PAM – positive allosteric modulator; ATD – amino-terminal domain; TMD – ransmembrane domain, LBD – ligand-binding domain.

Conclusions: The available crystallographic structures of glutamate receptors in conformations with NAM and PAM, which are promising as antiparkinsonian agents, were selected; docking methodologies for native ligands were validated, and parameters for future in silico studies of the glutamatergic effect of new ligands were determined.

Funding: The research was funded by the Ministry of Health Care of Ukraine at the expense of the State Budget on the topic “Molecular modeling and synthesis of innovative pyrimidine derivatives as promising agents for the treatment of neurodegenerative diseases”, 2024-2026.

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Comparative Chromatographic Analysis of Polyphenols in the *Artemisia argyi* H. Lév. & Vaniot and *Artemisia ludoviciana* Nutt. Herbs

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Introduction: The Wormwood (*Artemisia* L.) genus comprises several hundred species of aromatic plants which are common on almost all continents, mainly in temperate and subtropical climates. *A. absinthium* L., *A. annua* L. and *A. vulgaris* L. are the most famous among them due to their medicinal properties (1). Some *Artemisia* species are of great scientific interest because their phytochemical profiles are poorly studied (2).

Aim: The aim of this study was the comparative chromatographic analysis of polyphenols in the *A. argyi* H. Lév. & Vaniot and A. *ludoviciana* Nutt. raw material under their cultivation in Ukraine.

Materials and methods: The aerial parts of plants were harvested in the flowering stage from the experimental plots in M.M. Gryshko National Botanical Garden (Kyiv, Ukraine). The shoots of plants were cut into 10–15 cm long segments and dried at the temperature of 25–35°C. The chromatographic profiles of flavonoids and phenolic acids were determined by high-performance liquid chromatography (HPLC) using an Agilent Technologies 1200 chromatograph. A sample of raw material (0.30 g) was extracted in 10 mL of 80% methanol in an ultrasonic bath during 2 h.

Results: The HPLC study revealed that among the flavonoids, the predominant components in the *A. argyi* herb were naringin (26378.24 μg/g) followed by fisetin (13025.20 μg/g), kaempferol-3-*O*-glycoside (3570.80 μg/g) and baicalein (737.40 μg/g). The major flavonoid components of *A. ludoviciana* were naringin (21924.25 μg/g), fisetin (13025.20 μg/g), kaempferol-3-*O*-glycoside (5118.97 μg/g) and rutin (1295.26 μg/g). As for the contents of hydroxycinnamic acids in the *A. argyi* herb, it decreased in such a direction: chlorogenic (13370.38 μg/g) > rosmarinic (12009.54 μg/g) > *p*-coumaric (818.63 54 μg/g) > cinnamic (628.68 μg/g). The following hydroxycinnamic acids prevailed in the raw material of *A. ludoviciana*: chlorogenic (14502.99 μg/g) > rosmarinic (3326.23 μg/g) > *trans*-ferulic (323.81 μg/g) > syringic (223.48 μg/g). Thus, despite the similar qualitative compositions of the major polyphenolic compounds in the studied raw materials, their contents differed significantly. It should be noted that the revealed predominant flavonoids and hydroxycinnamic acids possess a well-defined therapeutic potential (3,4).

Conclusion: The obtained results could be considered for further study of the pharmacological properties of *A. argyi* and *A. ludoviciana*.

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Development of a Transdermal Delivery System of Captopril

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Background: hypertension is the main cause of cardiovascular diseases and poses a threat to life. Today, every third adult in the world suffers from hypertension [1].

One of the leading places in the treatment of hypertensive conditions is occupied by inhibitors of angiotensin-converting enzyme, in particular captopril. When taken orally, the drug is quickly and almost completely (at least 75%) absorbed in the gastrointestinal tract. However, in the presence of food, bioavailability decreases by 30-40%. The duration of the antihypertensive effect is dose-dependent and reaches optimal values within several weeks [2].

The development of transdermal forms of delivery of captopril, which ensure the duration of action and allow to increase bioavailability, minimize the disadvantages of parenteral administration, reduce dosage, reduce the cost of treatment and promote patient compliance, is relevant.

Aim(s): to establish approaches of development of captopril transdermal form based on previous *in vitro* membrane permeability studies.

Methods: studies of captopril permeability *in vitro* were carried out by the method of dialysis through a semipermeable membrane using a two-chamber diffusion Valia-Chien cell.

Results: qualitative and quantitative characteristics of captopril permeability through a semipermeable membrane *in vitro* were determined. Based on the analysis of the experimental values of the API content in the dialysate sample X_i and the gradient of the specific flow per unit time ΔQ_t, it was noted that the process in the model conditions corresponds to zero-order kinetics and is characterized by a uniform speed. The high value of the correlation coefficient $r = 0.999$ for the obtained kinetic equations confirms the linear dependence of the passage of the drug through the membrane on time.

Conclusion: studies of captopril permeability *in vitro* make it possible to positively evaluate the acceptability of this API for use in transdermal form and to create a transdermal therapeutic system of antihypertensive action.

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The Relevance of Microemulsion Development for the Complex Therapy of Non-specific Ulcerative Colitis

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Background. Recently, there has been a worldwide increase in the incidence of chronic inflammatory bowel disease (IBD), which includes non-specific ulcerative colitis (UC) and Crohn's disease (CD). High incidence rates of IBD are noted in Europe (24.3 per 100,000), Canada and the United States of America (20.2 per 100,000). The incidence of IBD in general is twice as high in Western Europe as in Eastern Europe [1, 2].

The pathogenesis of IBD remains unclear. Although most of its components are known, there are still problems regarding the etiology of these diseases. Symptomatic therapy remains a priority in the treatment of IBD.

Aim. Therefore, we decided to develop an emulsion based on raw materials of plant origin for use in the symptomatic therapy of UC with the aim of eliminating functional intestinal disorders.

Methods. The objects of our research were samples of emulsions, which included active pharmaceutical ingredients: essential oils of common fennel and common caraway; auxiliary substances: purified water, vegetable oils, emulsifiers: polyethylene glycol 40 hydrogenated castor oil, polysorbate 80, polyethylene glycol 100 stearate, flavouring agents, viscosity regulators: acacia gum, guar gum, xanthan gum. We conducted studies of emulsion stability, viscosity, pH, particle size, and taste tests.

Results. As a result of the conducted research, an oil-in-water type microemulsion was obtained (particle size less than 200 nm), the composition of which includes about 100 % natural substances: essential oils of common fennel and caraway, refined sesame oil, soy lecithin, apple pectin, food flavouring additive "Tarkhun" (0.01 %) and purified water. The emulsion has optimal viscosity (350 ± 27,2 mPa·s) for convenient dosing and application, pleasant taste, almost neutral pH (6,5±0,1), stability.

Conclusion. With the help of our research, we managed to achieve our goal. The next stage of research is to study the release of APIs from the emulsion.

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Synthesis of Xylometazoline Suitable for Lipophilic Dosage Forms

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Background. Xylometazoline hydrochloride has been used in the EU in the treatment of nasal congestion caused by rhinitis/sinusitis since 1959 (1). One of its side effects is dryness of the nasal mucosa. However, it can be used in combination with essential oils to eliminate nasal dryness.

Xylometazoline hydrochloride is hydrophilic and practically insoluble in non-polar solvents However, xylometazoline base is a lipophilic molecule, which makes it possible to create a formulation with essential oils.

Aim: method of obtaining xylometazoline base for further development of formulations in combination with essential oils.

Methods: xylometazoline hydrochloride, which is commercially available, and aqueous sodium hydroxide solution were used to prepare xylometazoline base.

Results: xylometazoline base was obtained with a yield of about 89% of the theoretical yield. The chlorides content was less than 200 ppm, which indicates the completion of the neutralization reaction. The solubility of the obtained base in water was studied. The analysis showed that the obtained product is practically insoluble in water, which indicates the formation of a lipophilic xylometazoline form after removal of the chloride ion. The optimal time mode for drying the free base was selected, which does not lead to degradation of the product and the formation of impurities. The drying temperature was 25–30 °C. Analysis of the substance by liquid chromatography showed the absence of related substances at the limit of detection (less than 0.005%).

Thus, a method for obtaining a lipophilic form of xylometazoline, suitable for use in formulations in combination with essential oils, was developed.

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Influence of Solid Dispersions of Posaconazole on Mechanical Properties of Hydrogels

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Background: Effective therapy of skin diseases is affected by appropriately selected active substance and by the adequate dosage form. In order to achieve intended effect, satisfactory drug release has to be provided. One of the most important methods of increasing drug solubility is formulating solid dispersions (SD) [1,2].

Aim: The purpose of this study was to evaluate the effect of SD of poorly water soluble posaconazole [3], obtained by using a ball mill MM 400 (Retsch), on mechanical properties of hydrogels.

Methods: The mechanical properties (cohesiveness, hardness and consistency) were examined by TA.XT texture analyzer. The viscosity and thixotropy were tested using a cone-plate rotational rheometer (Brookfield).

Results: As the hydrogel base, a mixture of hydroxyethylcellulose (1%) and polyvinylpyrrolidone (1%) was used. Hydrogels contained SD of posaconazole with polyvinylpyrrolidone in 4:1; 2:1 and 1:1 mass ratio. As controls, hydrogel without drug and hydrogels with physical mixtures of POS with polyvinylpyrrolidone were used. The addition of SD in 4:1 mass ratio resulted in an increase in mechanical parameters, while SD in 2:1 and 1:1 ratios lowered the mechanical characteristics. The presence of SD in 4:1 ratio in the hydrogel increased its viscosity. Interestingly, SD did not affect thixotropic parameters of hydrogels.

Conclusion: The presence of SD in 2:1 ratio resulted in the slightest change in the mechanical properties and did no influence on the viscosity of hydrogel. The largest changes in the mechanical characteristics and viscosity was caused by SD in 4:1 ratio.

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Optimization of Spray-Drying Parameters for Enhanced Microencapsulation of Phenolic Compounds in *Citrus x paradisi* L. Peels: A Study on Yield, Moisture, and Solubility

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Introduction: This study delves into the spray-drying technique (1) crucial for pharmaceutical and food industry applications to explore effective methods for encapsulating bioactive compounds from *Citrus x paradisi* L. (grapefruit) peels (2). The focus is improving grapefruit peel phenolics' stability, solubility, and controlled release.

Aim: The study aims to optimize the spray-drying process for encapsulating grapefruit peel extracts, assess the technique's efficiency, and determine the best conditions and wall materials.

Methods: The extracts were prepared based on methodologies established in previous studies (3). Spray drying was employed using various wall materials such as maltodextrin, skim milk, β-cyclodextrin, chitosan, and carboxymethylcellulose. Parameters included inlet temperatures ranging from 90°C to 170°C, outlet temperatures from 25°C to 116°C, a consistent flow rate of 30 mL/min, and air pressure at 8 bars. The resulting microcapsules were analyzed for yield, moisture content, solubility, and other critical physicochemical properties.

Results: The spray-drying process demonstrated varied yields and moisture content across different conditions. Specifically, yields ranged from 48.1% (at 90°C inlet and 25°C outlet temperatures) to 52.95% (at 160°C inlet and 80°C outlet temperatures). Moisture content varied from 7.6% to a lower 5.31% under different drying conditions. Notably, the highest yield of 52.95% ± 2.64% and the lowest moisture content of 5.97% ± 0.298% were achieved at an inlet temperature of 160°C and outlet temperature of 80°C. The solubility of the microcapsules also varied significantly, with the highest solubility observed at 67.05% ± 3.35% in formulations containing 19% maltodextrin, 0.2% chitosan, and 0.8% carboxymethylcellulose.

Conclusion: This research study explains the potential of spray drying in encapsulating bioactive compounds from grapefruit peels, emphasizing the importance of process parameters and wall material selection. The results offer crucial insights into achieving optimal yield, moisture content, and solubility, providing a foundation for further investigation and application in the pharmaceutical industry.

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Phytochemical Analysis of Bee Pollen in Impact of Different Storage Conditions and Duration

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Background: Bioactive compounds found in bee pollen (BP) are essential for human health. Since the therapeutic effects depend on the quality of BP, preparation and storage conditions of BP are of great importance, as it may affect amount of bioactive compounds [1,2].

Aim: To evaluate the influence of storage conditions and duration on amino acids (AA) amount, total phenolic content (TPC) and antioxidant activity *in vitro* of BP.

Methods: BP were collected from the apiary, Pasvalio district (55.9598°N, 24.3422°E). Samples were dried or fresh-frozen (at -20°C or -80°C). TPC was investigated by Folin-Ciocâlteu method, antioxidant activity was determined by ABTS method, qualitative and quantitative analysis of AA was evaluated by UHPLC-MS/MS method. Tests were carried out every 3 months (total duration – 15 months).

Results: TPC in the start point was in a range of 23.61±0.36mg GAE/g to 24.52±0.66mg GAE/g. Antioxidant activity was in a range of 76.52 ± 9.76µmol TE/g to 79.08 ± 0.12µmol TE/g. TPC and antioxidant activity were not affected up to 6 months of storage in dried and up to 9 months in frozen BP, but further decreased with storage time. After 15 months TPC in frozen (at -20°C and -80°C) BP decreased by 1.5 and in dried BP by 2.5 times and the antioxidant activity was decreased by 65% in dried BP, frozen samples were much less affected. After UHPLC-MS/MS analysis, 17 AA were detected. All of AA, except for Cysteine, were well preserved for 6 months in both, dried and frozen samples. Both fresh-frozen and dried BP contained high amounts of Proline, Glutamic acid, Aspartic acid, Phenylalanine and Serine after 15 months of storage.

Conclusion: The obtained results demonstrate that total phenolic content and antioxidant activity were not affected up to 6 months of storage in dried and up to 9 months in frozen bee pollen, but later decreased with storage time. Quantitative composition of amino acids amount variates depending on storage conditions and duration.

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Investigation of the Chemical Composition of Phenolic Compounds in Saskatoon *(Amelanchier alnifolia Nutt.)* Berries

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Background: *Amelanchier alnifolia Nutt.* belongs to the *Rosaceae* family, the fruit of which is a berry, and has antioxidant, anti-inflammatory, antitumour, antidiabetic effects [1]. This plant has positive effects on human health, so it is appropriate to analyse the composition of phenolic compounds in the berries of saskatoon trees growing in Lithuania.

Aims: to determine and compare the quantitative and qualitative composition of phenolic compounds in the berries of different varieties of saskatoon grown in Lithuania.

Methods: the total phenolic compounds in the plant extracts were determined by spectrophotometric Folin-Ciocalteu method. Qualitative and quantitative analysis of phenolic compounds was carried out by high pressure liquid chromatography. An ACE C18 chromatographic column (250 mm × 4,6 mm) with a sorbent particle size of 5 µm was used for separation.

Results: the total average phenolic compound content of dried saskatoon berry samples is 78,30 ± 26,61 mg/g and 75,76 ± 40,28 mg/g in the frozen samples. Qualitatively assessed phenolic compounds: neochlorogenic acid, chlorogenic acid, rutin, hyperoside and isoquercetin.

Conclusions: the highest levels of phenolic compounds in dried saskatoon berries were found in 'Thiessen' (J) (111,20 ± 7,78 mg/g) and the lowest in 'Honeywood' (K) (24,03 ± 0,05 mg/g) varieties. The highest levels of phenolic compounds in frozen berries were found in 'Thiessen' (J) (127,51 ± 5,25 mg/g) and the lowest in 'Martin' (J) (11,19 ± 1,32 mg/g) varietes. The qualitative composition of the saskatoon berry samples revealed 5 phenolic compounds.

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Use of High-Risk Potentially Inappropriate Medications in Older Patients on Polypharmacotherapy in Estonia

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Background: In the older population, multimorbidity and polypharmacotherapy are increasingly accompanied by various risks, e.g., potentially inappropriate medications (PIM).

Aim: To investigate the use of PIMs in older polypharmacy patients, emphasizing the identification of high-risk PIMs, self-reported adverse events experienced, potential adverse drug reactions (ADR) and interactions, frequency of hospitalizations, and GP visits.

Methods: Out of 310 older (65+) participants in the Horizon 2020 „EuroAgeism" FIP7 project, 107 patients with polypharmacy (5+ medications) and at least one PIM according to an integrated PIM-tool based on the EU(7)-PIM and EURO-FORTA integrated lists [1] were involved into the present study. For potential ADRs and interactions, INXBase and RISKBase [2] were employed.

Results: Patients on polypharmacotherapy (69% female) used 859 medications (8.0 per patient), of those, 176 (1.6 per patient) were high-risk PIMs. NSAIDs (49%), benzodiazepines (16%), and acetylsalicylic acid (12%) were the most common high-risk PIMs. RISKBase analysis demonstrated that half of the patients (n=54) may have had ADRs due to PIMs, bleeding risk being the most frequent. INXBase identified an increased potential risk of interactions for 69% of the study participants. Polypharmacotherapy patients experienced orthostasis, hypotension, arrhythmias, and hypoglycemia more frequently compared to non-polypharmacotherapy patients; they also had more visits to GPs ($p<0.01$) but were not hospitalized more often.

Conclusion: The study results indicate a continued need to pay more attention to the use of PIMs in the older population and to adopt more accessible databases and assessment tools.

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The Effect of Vacuuming on the Essential Oil Content of Medicinal Raw Material from Lemon Thyme (*Thymus* × *citriodorus*)

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Background: To maintain the quality of dried medicinal raw material as long as possible, it is very important to determine optimal storage conditions. This is especially relevant for raw materials containing pharmacologically valuable essential oils, including lemon thyme (*Thymus* × *citriodorus*, Lamiaceae), which is a commercially important essential oil-bearing medicinal plant used in the pharmaceutical industry due to antiseptic, antibacterial, antifungal, and anti-acne activity, as well as in the treatment of asthma, and respiratory diseases (1-3).

Aims: The work aimed to determine changes in amounts of essential oils in the vacuumed and non-vacuum-dried raw material of lemon thyme.

Methods: Lemon thyme was collected in the full bloom phase, was dried at room temperature, ground, and divided into two parts; one part was vacuum packed in portions of 30 g each and the other part was non-vacuumed. Thus, prepared raw materials were stored at room temperature. Then, seven times every four weeks, essential oils were hydro distilled from vacuumed and non-vacuumed raw material samples using a Clevenger type apparatus. Their amounts were determined in the dry raw material.

Results: The mean amount of essential oil in vacuumed and non-vacuumed raw material of lemon thyme was 0.70±0.08% and 0.78±0.03%, respectively. Although statistically significant differences were not identified, the results showed that the essential oil content in the time gradient decreased in both vacuumed and non-vacuumed raw materials. Throughout the study, amounts of essential oil in non-vacuumed raw materials of lemon thyme were 0.01–0.19% higher than in vacuumed raw materials, except after one and three months of storage, when the essential oil content was higher in the vacuumed raw material.

Conclusions: The vacuum storage of dried and ground raw material of lemon thyme did not reduce the loss of essential oil content in a time gradient.

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Bioactive Compounds in *Epilobium angustifolium* in Relation to Phenological Stage

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Background. *Epilobium angustifolium* (Onagraceae) is a perennial herb widely used in folk medicine for its anti-inflammatory, sedative and antioxidant properties. The herb contains several important bioactive compounds such as polyphenolic compounds, polysaccharides and amino acids. Therefore, it is necessary to study the dynamics of accumulation of bioactive compounds in different phenological phases, as their content varies significantly at different stages.

Aim: To assess the changes in amino acid content in the aerial parts (flowers and leaves) of *E. angustifolium* during three phenological phases (early-, mass-, late flowering).

Materials and methods: *E. angustifolium* samples were collected in Western Ukraine, Transcarpathian region, Carpathian Mountains, Chornohirsky Massif (altitude 1800 m above sea level; 48.047151°N, 24.631051°E) in 2019 (1). GC-MS analysis of amino acids derivatisation procedure was performed according to (2) on SHIMADZU GC-MS-QP2010 chromatography system and Rxi-5 ms capillary column (Restek Corporation; 30 m, 0.25 mm outer diameter, 0.25 µm). The NIST14 and WRT10 libraries and a mixture of standards were used for amino acid identification.

Results. Using the 15 amino acid standards, 11 amino acids were found in the samples analysed, while glycine, methionine, lysine, histidine were not found in more than one sample. This is consistent with our previous data (3), which confirmed that these amino acids are not formed in *E. angustifolium* raw materials, irrespective of the place of growth and the time of harvest. The amino acid content starts to increase in the early flowering phase (41.41 ~ 108.31 µg/g), reaches a maximum in the mass flowering phase (134.89 ~ 190.89 µg/g) and then decreases in the late flowering phase (17.94 ~ 28.80 µg/g).

Conclusions. The results suggest that the optimal time to harvest the plant as a source of amino acids is during the mass flowering period, from July to August.

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Modelling the Composition of *Sorbus aucuparia L.* Oil Extracts and Analysis of Their Phytochemical Profiles

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Background: *In vitro* evaluation of *Sorbus aucuparia L.* fruit extracts revealed significant inhibitory effects on both gram-positive and gram-negative bacteria, surpassing those of extracts from other fruits [1]. These extracts contain carotenoids such as α- and β-carotene, cryptoxanthin, phytofluene, zeaxanthin, and lutein [2], that enhance skin's innate resistance against UVB-induced erythema, reduce photocarcinogenesis, and prevent aging-related collagen I degradation in the dermis [3].

Aim: Preparation of *S. aucuparia* fruit extracts and evaluation of qualitative and quantitative composition of carotenoids.

Methods: The freeze-dried samples of rowanberries were extracted by comparing mineral oil and almond oil as extractants in a ratio of 1:5. The research compared extraction methods, encompassing a 3-minute microwave-mediated extraction at 800 W, a 10-minute ultrasonic bath method, and a 24-hour extraction utilizing a magnetic stirrer. Total carotenoid content was quantified using a spectrophotometric method at 450 nm.

Results:

Table 1. The carotenoid concentration in *S. aucuparia* extracts under varying extraction conditions

Extraction methods	Extractants	Processing time	Concentration (μg/g)
UAE	Almond oil	10 min	26,268
UAE	Mineral oil	10 min	27,794
MAE	Almond oil	3 min*	28,245
MAE	Mineral oil	3 min*	50,136
Magnetic stirrer	Almond oil	24 hr	**96,196**
Magnetic stirrer	Mineral oil	24 hr	66,219

* - microwave extraction: 3 minutes with 1-minute cooling intervals.

The obtained results in Table 1 demonstrate that the isolation of carotenoids was most successfully accomplished by magnetic stirring extraction with almond oil.

Conclusion: The optimal extraction parameters, determined through a 24-hour magnetic stirrer extraction method utilizing almond oil, resulting in the highest concentration of carotenoids (96,196 μg/g), will be employed in subsequent researches aimed at formulating emulgels.

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Study on *Rhododendron tomentosum* Harmaja Leaf Extraction Efficiency Targeted Towards Phenolic-origin Phytochemical Yield and Antioxidant Activity

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Background: *Rhododendron tomentosum* (Ericaceae) is an evergreen shrub known to have a wide range of phytochemical constituents, such as flavonoids, phenolic acids, terpenoids which shows numerous biological effects including antioxidant, anti-inflammatory, antimicrobial, hypoglycemic etc. [1,2]. Although *R. tomentosum* has promising potential in various fields, further research is needed to fully explore it. The initial stage of *R. tomentosum* extraction studies involves the critical selection of solvents to reveal the full effectiveness of phytochemical analysis.

Aim: Evaluate the influence of extrahent on the extraction yield of phenolic compounds.

Methods: *Rhododendron tomentosum* extracts were prepared using 0,1 g of dried raw material and 10 ml of water, 96%, 70%, 50% and 30% of ethanol, 100% and 70 % of methanol, 100%, 80%, 70% and 50% acetone mixtures with water. Samples were extracted using ultrasonic bath at 25°C for 15 min. The total amount of phenolics was determined by Folin-Ciocalteu assay, with concentration expressed in gallic acid equivalents (GAE mg/g). The antioxidant activity was evaluated using ABTS radical scavenging assay, with results expressed as µmol/g Trolox equivalents (TE). ANOVA was applied to identify the significant differences.

Results: The values obtained for the study of the extraction conditions were statistically significant. The total amount of phenolics in *R. tomentosum* extract varied from 16.39 (SD=2.27) GAE mg/g to 76,565 (SD=3.58) GAE mg/g. The greatest amount ($p<0.05$) was determined in extraction with 70% Acetone mixture with water. ABTS radical scavenging assay values varied from 109,56 (SD=2.58) µmol/g TE to 755,22 (SD=6.99) µmol/g TE. The highest antioxidant activity value of 755,22 (SD=6.99) µmol/g TE was in the sample with 70% methanol mixture with water.

Conclusion: The study reveals that 70% methanol and 70% acetone solvents yield the highest extraction efficiency for *Rhododendron tomentosum* phenolic-origin phytochemicals.

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Investigation of Preanalytical Pecuilarities of Chlorogenic Acid Solutions with Polymer Excipients

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Background: Chlorogenic acid, a potent antioxidant phenolic acid, is abundant in coffee, fruits, vegetables, and various medicinal plants [1]. Formulating pharmaceutical compositions with chitosan polymers frequently involves interactions with the active ingredient, presenting challenges in analyzing complex polymer samples [2]. Preanalytical peculiarities can clarify these interactions during sample preparation, reducing the potential for alterations in results [3].

Aim: Determine the change in chlorogenic acid concentration under the influence of polymeric excipients.

Methods: 200 µg/mL alginate, α-cyclodextrin, chitosan, Carbopol® Ultrez 21 solutions in water and 20 µg/mL chlorogenic acid in 97% (v/v) ethanol were prepared. 90 µL of the polymer solution was mixed with 10 µL of the phenolic acid solution. After a 30-minute period, the solutions were centrifuged at 8500 rpm for 12 minutes at 3°C and analyzed using UPLC method.

Results: Based on the results obtained, a decrease in the concentration of samples containing chlorogenic acid compared to the control solution was determined. The samples with chitosan and α-cyclodextrin exhibited the greatest concentration reductions of 9.25±2.97% and 7.56±8.94%, respectively, compared to the control solution. In samples with alginate, concentration reductions were 5.42±7.37%. The minimum change in chlorogenic acid concentration was 3.73±10.07% in the solution containing Carbopol® Ultrez 21.

Conclusions: It was determined that in solutions with chitosan, the concentration of chlorogenic acid decreased significantly. Although there is insufficient data to determine a significant concentration decrease in solutions with cyclodextrin and alginate, due to the decrease in the concentration by more than 5 percent, it must be acknowledged that the change is significant from a pharmaceutical standpoint.

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Chewable Gel Tablets with Honey: a Comparison of Quality Parameters

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Background: Chewable gel tablets are contemporary pharmaceutical form. These gel tablets contain of gelling agents, water and sugar as a main ingredients [1,2]. Their main disadvantage is its high sugar content, which is detrimental to the health of humans [3]. Replacing sugar with honey is a healthier alternative. As a result, we decided to make chewable gel tablets containing honey, insert their structure-improving substances, and examine their effect on gel tablet quality.

Aim: The aim of this study was to evaluate the dependence of the springiness and hardness honey chewable gel tablets on the amount of glycerol.

Methods: Three series (G1, G2, G3) of chewable gel tablets with different glycerol amount (0%-15%) were prepared by using silicones forms. After preparation of chewable gel tablets, texture properties such as springiness and hardness were evaluated by texture analyzer TA.XT.plus. Measuring were repeated 3 times and an average with a standard deviation was presented. Chewable gel tablets base was made from gelatin (8,5%), water and glycerol. The amount of base was melted and honey was added. A citric acid solution (2%) as a preservative was added.

Results: Chewable gel tablets' springiness and hardness after preparation were 55,85±1,15-70,15±3,17 g and 830,31±8,28-697,22±25,45 g, respectively. Tablets with the least glycerol amount had the biggest value of hardness and the smallest value of springiness, while those with the most glycerol amount were the softest and the most elastic.

Conclusions: After evaluating the texture analyzer data, gel tablets with the most amount of glycerol had the best results on their texture quality after preparation. A further study will evaluate the effect of storage conditions on the mechanical properties of gel tablets.

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Qualitative Research: Patient Attitudes Towards Self-medication Practices, Expectations, and Pharmacist Consultation Experiences in Pain Management

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Background: Self-medication is widely practiced, with people of all ages and backgrounds opting for this approach. This approach is often the result of pharmacists' involvement. Pharmacists play a key role in guiding individuals to informed self-medication decisions, providing expertise to ensure responsible and effective choices. Pain, being the most critical area in self-medication, underscores the significance of informed decisions, making guidance crucial in addressing and managing individuals' healthcare needs.

Aim: This research explores and analyzes patient attitudes towards self-medication practices, their expectations related to pain management, and their experiences with pharmacist consultations.

Methods: The research utilized a qualitative thematic analysis approach. Interviews were conducted with a total of 7 patients. A total of 5 different self-medication topics were analyzed. These topics include pain, cold, dermatology, digestive system, and well-being. Every topic had 4 general questions related to diagnosing the problem, self-medication practices, expectations for pharmacist and consultation experiences.

Results: Patients employ diverse self-help methods, including pain medication, teas, liquids, food supplements, a healthy diet, adequate sleep, exercise, pain ointments, walking, traveling, rest, and pain gels. Patients anticipate pharmacists to provide optimal value in terms of medication selection, advice, information on usage, and problem-solving guidance. Desirable consultations involve pharmacists delving into the issue, specifying drug usage, suggesting beneficial measures, and expressing genuine interest in patient's well-being. Conversely, patients characterize unfavorable consultations as instances where pharmacists fail to delve into the patient's expressed concerns.

Conclusion: Patients elucidate diverse self-medication approaches varying from pain medication, to resting. They articulate distinct expectations, mostly expecting an explanation of potential pain source and recommendation to its management and assess consultation experience as either satisfactory or deficient based on the pharmacists' communicative and informative practices.