DANYLO HALYTSY LVIV NATIONAL MEDICAL UNIVERSITY

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CONTENTS

MISSION STATEMENT

"Annals of Pharmaceutical Faculty" is a collection of summaries of master projects and abstracts of PhD-students. Annals are published every year and represent an overview of the student's scientific interests. Preparing of master project is a unique opportunity for students to work on part of a current research project guided by a faculty member.

It is a powerful learning tool that helps students gain a better understanding of the research topic and the research methods. It also encourages students to present the obtained results at various scientific conferences. This approach is a good example of learning through investigation.

We are proud of our students' achievements who even under the hard conditions of the russian-Ukrainian war continue their studies and scientific activity.

The faculty staff and students support and are thankful to all people of goodwill currently struggling for liberty and justice in Ukraine.

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PhD STUDENTS ABSTRACTS

(APRIL 2023)

ANALGESIC AND ANTIINFLAMMATORY ACTIVITY OF NEW 5H-[1,2,4] TRIAZOLO[3,4-*b*] [1,3,4]THIADIAZINE DERIVATIVES

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Keywords: antinociceptive activity, antiexudative activity, 5*H*-[1,2,4]triazolo[3,4-*b*][1,3,4]thiadiazine derivatives.

Introduction. The search for new analgesic and anti-inflammatory drugs that are superior in effectiveness and/or safety to existing analogues is important and relevant. In this aspect, nitrogenous heterocycles are promising, particularly those containing triazole and thiadiazine fragments. Therefore, the search and development of active chemical compounds with antinociceptive and antiexudative activity among new derivatives of 5H-[1,2,4] triazolo[3,4-*b*][1,3,4]thiadiazine will allow in the future to create more effective and safe medicinal products with the specified effect.

Materials and methods. The study of 23 new derivatives of 5*H*-[1,2,4] triazolo[3,4-*b*][1,3,4]thiadiazine was carried out on white non-linear mice weighing 18-22 g. Analgesic and anti-inflammatory activity was studied on the models: "hot plate", acetic acid "convulsions" (antinociceptive effect) and carrageenan edema (anti-exudative effect) with a single intragastric administration at a dose of 25 mg/kg. Ketorolac at a dose of 25 mg/kg ("hot plate", acetic acid "cramps") and diclofenac sodium at a dose of 25 mg/kg (carrageenan edema) were used as a comparison drug.

Results and discussion: The studied compounds showed the presence of reliable antinociceptive and antiexudative effects. The antinociceptive activity of the series is associated with the modification of the structure of 5*H*-[1,2,4]triazolo[3,4-*b*][1,3,4]thiadiazine in the para-position of the benzene ring. Antiexudative activity is associated with the acetyl groups of the thiadiazine ring. The most promising compound IFT_247 was identified, which exhibits a significant analgesic effect in the experiment and is not inferior in activity to the comparison drug ketorolac: "hot plate" + 232.46% and + 112.71%; acetic acid "Cramps" - 66.67% and - 61.02%), respectively.

Conclusions. Significant antinociceptive activity was revealed in a number of new derivatives of 5*H*-[1,2,4]triazolo[3,4-*b*][1,3,4]thiadiazines, which is associated with the modification of the structure in the para-position of the benzene ring. It is shown that the most active structure of the IFT_247 series is superior or inferior to ketorolac in terms of antinociceptive activity.

MOLECULAR DESIGN AND BIOLOGICAL ACTIVITY STUDY OF THIAZOLIDINE DERIVATIVES AS POTENTIAL TUBULIN INHIBITORS

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Keywords: 4-Thiazolidinone, anticancer activity, tubulin inhibitors

Introduction: Since the first reported polymerization inhibitors, tubulin binding sites stay attractive targets for the search and development of new anticancer agents. 4-Thiazolidinone scaffold possesses the features privileged structures in drug design in modern medicinal chemistry logic. A number of totally new drugs and classes of drugs are built, based on this heterocyclic moiety. R. Lesyk's team possesses huge expertise in the development of new anticancer compounds, based on the 4-thiazolidinones scaffold. With the aim to identify potential inhibitors of polymerization, and find some structure-activity relationship, the best 260 compounds with experimentally identified anticancer activity were chosen and tested in silico for their ability to inhibit tubulin polymerization. Colchicine, vinca, and taxane binding site were explored as most pharmaceutically essential for the expression of the antitumor activity

Materials and methods: AutoDock Vina 1.1.2, AutoDock Tool 1.5.6, Avogadro software package

Results and discussion: From the 260 tested compounds, 42 of them demonstrated the binding energy with the tubulin, which is the same or higher than the colchicine showed in the same docking parameters. The range was from -2, 4 to -12.3 kcal/mol. This observation may affirm the inhibition of the tubulin polymerization through colchicine demonstrate more significant anticancer effects. In spite, only 2 compounds have shown the same or slightly higher energy as vinblastine in the vinca binding site (range from -5.4 to -11.7 kcal/mol). In addition, 18 compounds from the set demonstrate an affinity higher than paclitaxel in the same place of the connection (range from -5.1 to -11.1 kcal/mol).

Conclusions: 1. The most potential tubulin binding site for the development anticancer compound based on 4-thiazolidine scaffold is the colchicine binding site. 2. The preferable cores for the most affine compounds to the tubulin are the combination of 4-thiazolidine with pyrazole, isatin, and benzothiazole cores. 3. Some compounds are potential "multisite" inhibitors with an affinity to the colchicine, vinca and taxane binding sites. Les-6370 demonstrated the best binding energies to all three tested binding sites of the tubulin. These affinities make this compound an interesting candidate for the development of potent tubulin polymerization inhibitors with multi-point types interactions.

SEARCH FOR RAW MATERIALS SOURCES OF SQUALENE AND THEIR COMPREHENSIVE RESEARCH

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Keywords: fatty oil, squalene, lectin, triterpenoids, purification

Introduction:

Squalene is used in cosmetology and medical practice. Squalene been used as an adjuvant in vaccines that stimulates the immune response and increases the patient's reaction to the vaccine. The squalene-based oil-in-water emulsion vaccine adjuvant MF59 has been administered to more than 100 million people in more than 30 countries for patient's with influenza, hepatitis B, malaria and shingles.The purpose was to develop a complex scheme for obtaining fatty oil, squalene, the sum of triterpenoids and the lectin from the seeds of Amaranthus caudatus L. in one technological cycle.

Materials and methods: Seeds of the Amaranthus caudatus were gathered from plants that were cultivated near Lviv.

The purified seeds were ground in an electric grinder, then filled with petroleum ether. The solvent was distilled, and the residuum of fatty oil was dried. Defatted seeds were dried after which lectin was extracted with 1% sodium chloride solution. After the lectin extraction, the powdered seeds were dried and extracted with 100% methanol to obtain a substance containing triterpenoids. The molecular weight of lectin polypeptide chains was determined by electrophoresis. Study of the interaction of Amaranthus caudatus seed lectin with human and animal erythrocytes was performed by determining the hemagglutination.

Isolation of pure squalene from amaranth oil was performed by chromatography on silica gel. The presence of squalene and triterpene substances in the obtained extracts was determined by TLC on silulfol plates. Qualitative and quantitative content of squalene and triterpenoids in these fractions was determined using GC-MS.

Results and discussion: When chromatographing amaranth oil on a silica gel column, squalene is obtained in the first fractions of the eluate. About the presence of squalene in this fraction is evidenced by the brown staining of the spot in iodine vapor on TLC in, the refractive index D = 1,499 and high iodine value (381). The mass of squalene is ≈ 4.8% by weight of oil. The purification of lectin before the extraction of triterpene compounds by methanol has an advantage in comparison with the reverse extraction method, as it fully preserves the activity of lectin and allows the purification of triterpene compounds of amaranth, which are not extracted with water. Water extracts significantly more substances than methanol. Therefore, the methanol extract has a lower weight, but is enriched in triterpene compounds. Thus, as

proposed by us, the sequence of extractions can be considered as an additional way to purify them.

Conclusions: We have developed a scheme of obtaining fatty oil, lectin and the sum of triterpene substances from the *Amaranthus caudatus* seeds. A similar scheme for obtaining biologically active substances also allows to obtain the sum of water-soluble substances of the seed, rich in amino acids and carbohydrates. Thus, the technological scheme of purification of biologically active substances of amaranth seeds developed by us can help its more rational use.

SYNTHESIS AND BIOLOGICAL ACTIVITY EVALUATION OF NEW CHROMENO[4',3':4,5]THIOPYRANO[2,3-d]THIAZOLES AND THEIR 3-SUBSTITUTED DERIVATIVES»

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Keywords: chromeno[4',3':4,5]thiopyrano[2,3-*d*]thiazoles and their 3-substituted derivatives.

Introduction: The synthesis of diverse polycyclic derivatives from relatively simple reagents remains an interesting issue of modern organic and medical chemistry. Related to this statement, developing new variants of "domino" reactions is a key element in this issue. The mentioned reaction allows obtaining complex molecules with high selectivity, while the consumption of solvents of reagents is much smaller compared to multi-stage synthesis.

Materials and methods: Organic synthesis, elemental analysis, NMR spectroscopy

Results and discussion: We carried out the *domino*-Knoevenagel-*hetero*-Diels-Alder reaction, in which 4-thioxo-2-thiazolidinone (isorodanine) **1** was used as a methylene active component, which reacted with allylsalicylic aldehyde **2** and its analoqs in an acetic acid medium providing polycyclic thiopyranothiazole derivatives. The obtained derivatives were subsequently modified via an alkylation reaction with ethyl chloroacetate and 1-(2-chloroethyl)piperidine hydrochloride providing corresponding N-substituted derivatives.

Conclusions: The structure of the synthesized compounds was confirmed by the NMR and LC-MS spectrometry. Screening of anticancer activity according to DTP NCI protocol will be carried out for synthesized compounds, and further functionalization by medicinal chemistry methods will be performed.

SYNTHESIS THIOPYRANO[2,3-*d*]THIAZOLE-2-THIONES AS POTENTIAL BIOLOGICALLY ACTIVE COMPOUNDS

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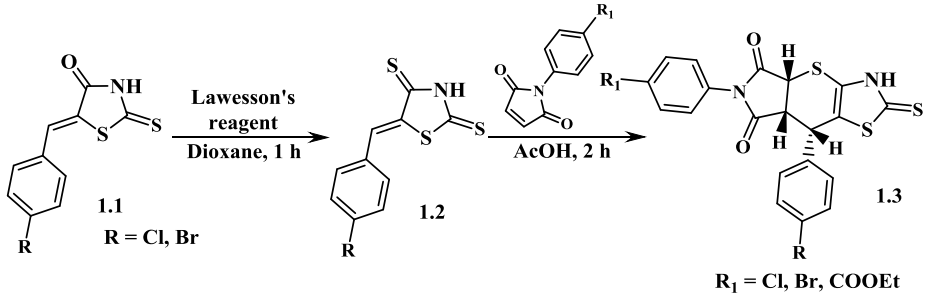
Keywords: thiopyrano[2,3-d]thiazoles, *hetero*-Diels-Alder reaction, drug design.

Introduction: The *hetero*-Diels–Alder reactions have been used as an excellent synthetic instrument for obtaining thiopyrano[2,3-*d*][1,3]thiazole derivatives combining thiazolidinone and thiopyrano fragments in the fixed skeleton. In turn, this fused heterocyclic system has become a promising area of research because of its diverse biological activities, such as anticancer, antitrypanosomal, antimycobacterial, antibacterial and antifungal, and antiviral.

Materials and methods: organic synthesis, liquid chromatography-mass spectrometry, ^{1}H and ^{13}C NMR spectroscopy.

Results and discussion: the 5-benzylidene-2-thioxo-thiazolidin-4-ones **1.1** were used as a starting compound in synthesizing thiorhodanine derivatives **1.2** by reflux for 1 h in dry dioxane with Lawesson`s reagent. *hetero*-Diels–Alder reaction of appropriate *N*-arylmaleimides with the synthesized heterodienes **1.2** under reflux conditions for 2 h in the glacial acetic acid with hydroquinone (0.1 mmol%) led to target thiopyrano[2,3-d]thiazole-2-thiones **1.3** with a good yield. The structures of the synthesized compounds **1.3** were confirmed by ^{1}H, ^{13}C NMR, and LC-MS. Anticancer and antimicrobial activities evaluation of target compounds are in progress (DTP NCI and Department of Microbiology (DHLNMU)).



Conclusions: we have reported an efficient synthesis of novel thiopyrano[2,3-*d*]thiazole-2-thiones via *hetero*-Diels–Alder reaction of 5-arylidenethiohodanines with *N*-arylmaleimides. Screening results of biological activity are in progress.

SYNTHESIS OF ISOINDOLE-THIAZOLIDINONES AS POTENTIAL BIOLOGICALLY ACTIVE COMPOUNDS

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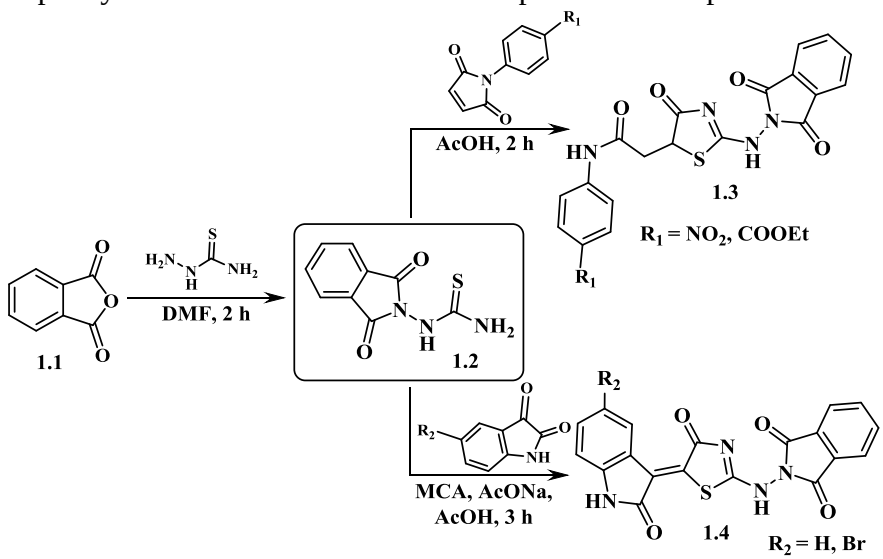
Department of Pharmaceutical, Organic and Bioorganic Chemistry

Keywords: 4-thiazolidinone, isoindole, drug design, anticancer activity.

Introduction: modern research in medicinal chemistry characterizes the thiazolidine core as a decisive pharmacophore fragment in the search for biologically active compounds. The main advantage of using this heterocyclic system in the design of potential drugs is a pharmacological multivector, which is implemented by several molecular mechanisms, among which the anticancer effect should be singled out by inhibition of PPAR-γ, PTP1B, and VEGFR-2. In turn, the pharmacologically attractive isoindole is a long-term object of study by world scientific groups as a potent inhibitor of DPP8, MDM2-p53, SK-2, etc. Thus, combining these heterocycles in one molecule is interesting from the point of view of potentiating the anticancer effect and finding new mechanisms for its implementation.

Materials and methods: organic synthesis, liquid chromatography-mass spectrometry, ^{1}H and ^{13}C NMR spectroscopy, in vitro anticancer screening.

Results and discussion: the starting compound for synthesizing target molecules was used (1,3-dioxo-1,3-dihydroisoindol-2-yl)-thiourea **1.2**, obtained by the interaction of phthalic anhydride **1.1** and thiosemicarbazide in DMF. Derivative **1.2** was introduced as an *S,N*-binucleophilic reagent in the [2+3]-cyclocondensation reaction with the corresponding *N*-arylmaleimides, which allowed to obtain 2-[2-[(1,3-dioxoisoindolin-2-yl)amino]-4-oxothiazol-5-yl]-*N*-phenylacetamides **1.3**. The three-component one-step reaction of the



derivative **1.2** with the corresponding isatins and monochloroacetic acid led to the formation of 5-en-4-thiazolidinones **1.4**. The LC-MS and NMR spectroscopy data confirmed the synthesized compounds' structure. Based on the screening of antitumor activity among the synthesized isoindole-thiazolidinones, compounds with a moderate cytotoxic effect on the standard panel of cancer cell lines (DTP NCI) were identified, which became the basis for the subsequent chemical optimization and modification of the studied molecules.

Conclusions: we have achieved a convenient protocol for synthesizing novel isoindole-thiazolidinones conjugates via [2+3]-cyclocondensation reaction. The biological tests revealed the necessity for an in-depth study of tested compounds to model novel chemical entities with better pharmacological profiles.

SYNTHESIS AND ANTICANCER ACTIVITY OF 3-FURAN-2-YL-2-(4-FURAN/THIOPHEN-2-YLTHIAZOL-2-YL)ACRYLONITRILE DERIVATIVES

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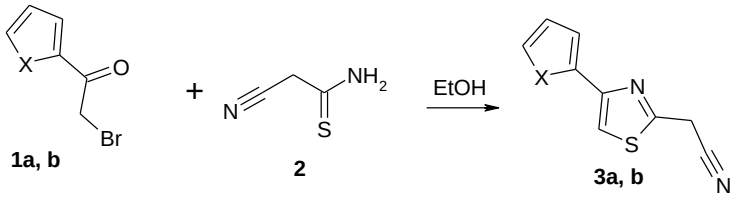
Keywords: furan, thiazol, acrylonitrile, Knevenagel condensation, anticancer activity.

Introduction: The furan cyclic system is the main skeleton of various compounds with a wide spectrum of biological activity. Our previous works showed the biological activity of new synthesized compounds: amides of furancarboxylic acid derivatives, in particular 2,4-dimethyl-*N*-aryl-3-furamides, 2,5-dimethyl-3-furamides and 5-aryl-2-methyl-3-furamides (anti-inflammatory activity), benzofurancarboxamides (antitumor activity), amides and thioamides of 5-arylfurancarboxylic acid derivatives (antimicrobial activity). The combination of a furan core with a thiazole core is an effective approach to the construction of biologically active substances, which we considered in our current study.

Materials and methods: organic synthesis, ^{1}H NMR spectroscopy, pharmacological screening.

Results and discussion: 2-bromoacetylfuran **1a** and 2-bromoacetylthiophene **1b** were used as starting reagents, which reacted with 2-cyanothioacetamide **2**. As a result (4-furan-2-yl-thiazol-2-yl)- **3a** and (4-thiophen-2-yl-thiazol -2-yl)- **3b** acetonitriles were obtained (Scheme 1).

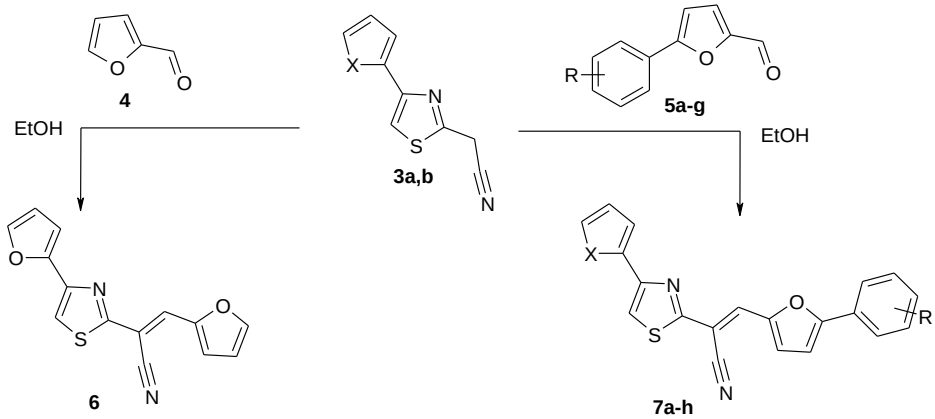
Scheme 1



1, 3: X = O (**a**), S (**b**)

Next, Knevenagel condensation of synthesized (4-furan-2-yl-thiazol-2-yl)- **3a** and (4-thiophen-2-yl-thiazol-2-yl)- **3b** acetonitrile with furfural **4** and 5-arylfurfurals **5a-g** was carried out (Scheme 2). At that stage, the nucleophilic addition of active hydrogen from the acetonitrile part to the carbonyl group of substituted aldehydes took place, followed by splitting off water with the formation of 3-furan-2-yl-2-(4-furan-2-yl-thiazol-2-yl)-acrylonitrile **6**, 3-(5-arylfuran-2-yl)-2-(4-furan-2-yl-thiazol-2-yl)- **7a-f** and 3-(5-arylfuran-2-yl)-2-(4-thiophen-2-yl-thiazol-2-yl)- **7g,h** acrylonitriles as final compounds. The weak base piperidine is used in a catalytic amount.

Scheme 2



5a-g: R = H (**a**), 2-F (**b**), 4-Cl (**c**), 4-Br (**d**), 3,4-Cl_2 (**e**), 3-CF_3 (**f**), 2-Cl-5-CF_3 (**g**);
7a-f: X = O, R = H (**a**), 2-F (**b**), 4-Cl (**c**), 4-Br (**d**), 3,4-Cl_2 (**e**), 3-CF_3 (f);
7g, h: X = S, R = 4-Br (**g**), 3-CF_3 (**h**)

Anticancer activity screening was carried out within the framework of Developmental Therapeutic Program of the National Cancer Institute's (DTP, NCI, Bethesda, Maryland, USA). The structures of the (2E)-3-(2-furyl)-2-[4-(2-furyl)-1,3-thiazol-2-yl]acrylonitrile **6** showed a moderate anticancer effect. 2-(4-furan-2-ylthiazol-2-yl)acrylonitrile derivatives **7a-f** were sensitive to Breast Cancer cell lines MDA-MB-468 and T-47D, **7e** was also sensitive to the cell line TK-10 Renal Cancer line. 2-(4-thiophen-2-yl-thiazol-2-yl)-

acrylonitriles **7g, h** showed a decrease in activity and also stimulated the growth of the TK-10 kidney cancer cell line with GP = 185.06 and 202.55%.

Conclusions: A series of new 3-furan-2-yl-2-(4-furan/thiophen-2-yl-thiazol-2-yl)acrylonitrile derivatives were prepared. Compounds with anticancer activity against the MDA-MB-468 and T-47D Breast Cancer cell lines and the TK-10 Renal Cancer cell line were identified and cytotoxic effect was observed with a range of GP = -38.24 – 1.28%.

THESIS OF THE

MASTER PROJECTS

(MAY 2023)

DEPARTMENT OF GENERAL, BIOINORGANIC, PHYSICAL AND COLLOIDAL CHEMISTRY

(Head of the department – prof. **Iryna Drapak**)

VIRTUAL SCREENING OF 3H-THIAZOLO [4,5-b] PYRIDINE DERIVATIVES AS POTENTIAL ANTIOXIDANT AGENTS

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Scientific supervisor: assoc. prof. **Volodymyr Ogurtsov**, PhD

Keywords: thiazolo[4,5-b]pyridines, DPPH, antioxidant activity, QSAR-analysis, molecular descriptors

Introduction. The intensive researches have been focused on the novel five-membered heterocyclic systems synthesis in nowadays organic, pharmaceutical and medical chemistry as the promising drug candidates whose quotient among the existing drugs is significant. Thiazolopyridines have the wide range of biological actions on account of their isosteric to pyrine and pyrimidine bases structure. Therefore functional modification of the mentioned heterocyclic system and its novel analogs biological activity evaluation is actually purposeful.

Materials and methods. Bibliographic analysis, molecular descriptors calculation, systematic search algorithm for an optimal set of descriptors, multiple linear regression, QSAR analysis

Results. A series of N3 substituted 5,7-dimethyl-6-phenylazo-3H-thiazolo[4,5-b]pyridine-2-one derivatives were evaluated *in vitro* for their free radicals scavenging effect which allowed to identify three lead compounds possessing considerable antioxidant action.

Conclusions. QSAR studies for the compounds were performed incorporating 1D, 2D, 3D and quantum-chemical descriptors into respective models as their computation involved integration of the relevant molecular information regarding molecular composition, atom-centered fragments, size, shape, symmetry, atoms and distances distribution in the geometrical representation of the molecules. It had been demonstrated statistically that achieved QSAR models (possessed considerable R, Q^2, F values) could be used for identifying novel antioxidant agents based on the same congeneric series which may be considered as the systematic approach for rational design and virtual screening of novel 3H-thiazolo[4,5-b]pyridine-2-one derivatives as drug candidates.

OBTAINING OF POLYSACCHARIDE CONJUGATES WITH BIOLOGICALLY ACTIVE SUBSTANSES

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Scientific supervisor: senior lecturer **Lidiia Panchak**, PhD.

Keywords: conjugates, chitosan, dyes, malachite green.

Introduction. Polysaccharides contain various functional groups (such as hydroxyl, amino, aldehyde), which makes possible conjugation with various biologically active substances. Polysaccharides are biocompatible and hydrophilic. Polysaccharide conjugates are widely used in biomedical applications. Development methods for attaching biologically active dyes to the polysaccharides is a well-judged task.

Materials and methods. The paper illustrates the use of following reagents: chitosan (obtained from Shrimp chitin) and cellophane, dyes (malachite green, acid fuchsin, methylene blue, bromophenol blue, erythrosine, eosin-K, variamine blue, neutral red, alizarin blue, bromocresol purple). Chemical (periodic oxidation), analytical (gravimetry, colorimetry, UV spectroscopy) and microbiological methods were used.

Results. The reaction of periodic oxidation of polysaccharides was used to attach biologically active dyes to polysaccharides, in particular to chitosan and cellophane (cellulose), and the influence of different modes of this reaction on the molecular weight of chitosan and the strength of cellophane was investigated. The amount of bound malachite green with chitosan in the adduct and conjugate was determined by the colorimetric method. The conjugate of chitosan with malachite green contained 4.6 ± 0.2% of the dye, which is 59 times more than that of the malachite green-chitosan adduct. The obtained conjugate of malachite green with chitosan retains high antimicrobial activity, in particular, at a concentration of 1 mg/ml it inhibits the growth of *Staphylococcus aureus* by 50.0%, and *Pseudomonas aeruginosa* by 85.3%. The resulting conjugate of malachite green with chitosan may find application in the treatment of aquarium fish infections. For this purpose, the dissolution kinetics of malachite green-chitosan conjugate in aquarium conditions was studied. A cellophane film conjugated with bromophenol blue was produced. It changes color from blue to yellow at pH below 4.0. Such a film can be recommended for packaging products for the purpose of detecting perishable products, in particular, some vegetables.

Conclusions. As a result of the conducted experiments, it is shown that polysaccharides such as chitosan and cellulose (in the form of cellophane) can be used to obtain conjugates with dyes. The use of such conjugates can find practical application and has a certain advantage over the use of unbound dyes.

DIRECTED SEARCH OF NEW INHIBITORS ACE AMONG THE DERIVATIVES OF N-R-PHENYL-2,3-DIHYDRO-1,3-THIAZOLE-2-IMINE AND N1-(4-(R-PHENYL) -1,3-THIAZOL-2-YL)-N1-(R-PHENYL) ACETAMIDE

Volodymyr Tymciv
Scientific supervisor: prof. **Drapak Iryna**, PhD, DSc

Keywords: molecular docking, inhibitors ACE, derivatives of N-R-phenyl-2,3-dihydro-1,3-thiazol-2-imine and N1-(4-(R1-phenyl)-1,3-thiazol-2-yl)-N1-(R-phenyl) acetamide

Introduction. Angiotensin-converting enzyme (ACE) is well known for its role in blood pressure regulation through the renin-angiotensin-aldosterone system (RAAS), but is also involved in fertility, immunity, hematopoiesis, and diseases such as obesity, fibrosis, and Alzheimer's dementia. Therefore, the development of new ACE inhibitors is an urgent issue today.Virtual studies of molecules using computer modeling (in silico methods) make it possible to predict the properties of the intended target structures and the molecular mechanisms of their action, as well as to identify possible binding sites and ligand-receptor and ligand-enzyme interaction energies. This makes it possible to create a theoretical basis for the directed synthesis of new biologically active substances. Thiazole derivatives are promising for the search for biologically active compounds, in particular ACE inhibitors.

Methods: Molecular modeling and optimization of the structures of the studied compounds were carried out by molecular mechanics and semi-empirical quantum chemical methods using the HyperChem 7.5 software package, docking studies were carried out using the AutoDock 4.2 program, the structure of the biotarget was obtained from the Protein Data Bank (PDB).

Results and Discussion: Docking studies were carried out to the biological target 4BZR, which is associated with the mechanism of action of ACE inhibitors. The affinity of a number of derivatives of N-R-phenyl-2,3-dihydro-1,3-thiazol-2-imine and N1-(4-(R1-phenyl)-1,3-thiazol-2-yl)-N1-(of R-phenyl)acetamide for virtual screening of inhibitory activity against ACE, which made it possible to identify promising compounds for further experimental studies.

Conclusions: The parameters obtained as a result of molecular docking of the studied compounds with the 4BZR biotarget can be used as a theoretical platform for the targeted creation of de novo potential ACE inhibitors.

DEVELOPMENT OF A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF AMLODIPINE BESYLATE IN MEDICINAL DRUGS, CALCIUM CHANNEL BLOCKERS

Khrystyna Lubchenko
Scientific supervisor: assoc. prof. **Martha Sulyma**, PhD.

Keywords: amlodipine besylate, sodium 1,2-naphthoquinone-4-sulfonate, spectrophotometry, quantitative determination, validation.

Introduction. The World Health Organization has classified hypertension as one of the leading causes of morbidity and mortality worldwide, accounting for nearly nine million deaths per year. In hypertension, the systemic arteries are characterized by persistently high blood pressure. The early stages of high blood pressure are often asymptomatic, which is why it is called a "silent killer." In addition, uncontrolled hypertension can have a real negative impact on the brain, heart, blood vessels, kidneys, and other organs. The International Society of Hypertension (ISH) has published updated practice guidelines for the treatment of arterial hypertension (AH) in adults over the age of 18. In the guidelines, the ISH took into account the differences between "optimal care", i.e. the scientifically based standard of care, and "essential care" (the minimum standard of care in resource-limited settings). Certain groups of drugs have advantages, and therefore, according to expert recommendations, they form the basis of antihypertensive therapy and are first-line (first-line) drugs.

Long-acting calcium antagonists are among the first-line drugs. Calcium channel blockers are a heterogeneous group of drugs that have antihypertensive and antianginal effects. The basis of the pharmacological activity of calcium channel blockers is the ability to block the transport of calcium ions into the cell through the potential-dependent (slow) L-channels of the membrane. The aim of this work was to develop sensitive, easy-to-use, economical spectrophotometric methods for the quantitative determination of amlodipine besylate based on the reaction with sodium 1,2-naphthoquinone-4-sulfonate and validation of the proposed methods.

Methods: Spectrophotometry determination

Results and Discussion: The optimal conditions for the reaction of amlodipine besylate with sodium 1,2-naphthoquinone-4-sulfonate were determined: water-alcohol mixture (40% ethyl alcohol) was chosen as the optimal solvent for the reaction between amlodipine besylate and sodium 1,2-naphthoquinone-4-sulfonate; it was proved that the reaction between the investigated drug substance and the reagent requires the creation of an alkaline environment (aqueous solution of sodium hydroxide), as well as heating the reaction mixture in a water bath at 90 °C for 1 min; it was found that the product of interaction of amlodipine besylate with sodium 1,2-naphthoquinone-

4-sulfonate remains stable for at least 30 minutes.

The analytical sensitivity parameters of the drug - reagent reactions for amlodipine besylate based on its reaction with sodium 1,2-naphthoquinone-4-sulfonate were calculated. The low value of the opening minimum of 1.12 μg/ml and the high value of the molar light absorption coefficient of 2.54-104, respectively, indicate the high sensitivity of this reaction. The stoichiometric ratio of "drug substance - reagent" was established to be 1:1 in each case.

Conclusions: Original spectrophotometric method for the quantitative determination of amlodipine besylate were developed and validated. The developed method is simple and quick to perform.

THE SEARCHING OF POTENTIALLY BIOLOGICALLY ACTIVE COMPOUNDS AMONG 5,7-DISUBUTITUTED THIAZOLO [4,5-*b*] PYRIDINES

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Keywords: thiazolo[4,5-*b*]pyridines, anticancer activity, drug-likeness parameters.

Introduction. Among biologically relevant molecules there is interest in the pyridine heterocyclic framework, which represents a main structural fragment found in a number of natural compounds many of which displaying activities against a diverse set of biological targets. For instance, polycyclic pyridine architectures including five and six-membered sulfur and nitrogen heterocycles are important structural components of bioactive molecules, and as a result, they serve as attractive targets in the modern drug discovery process. Bicyclic heterocycles, with condensed thiazole and pyridine moieties, the thiazolopyridines have received considerable attention recently due to their diverse biological activity and clinical applications. Many literature reports of these compounds indicate antioxidant, anticancer, anti-inflammatory, antimicrobial, antifungal and herbicidal activities. Earlier it was reported the [3+3]-cyclization of 4-amino-5*H*-thiazol-2-one and □,□-unsaturated derivatives providing series of thiazolo[4,5-b]pyridin-2(3*H*)-one derivatives and further their evaluation of biological activities. As a result the purpose of this work was to explore our continuous research effort in the synthesis of a series of novel thiazolo[4,5-*b*]pyridine derivatives based on [3+3]- cyclization of 4-amino-5*H*-thiazol-2-one and □,□-unsaturated ketones or □-ketoacids and biological activity evaluation of these compounds.

Materials and methods. Synthesized thiazolopyridine derivatives were evaluated by the National Cancer Institute, Bethesda for their anticancer activity at 10-μm concentration toward full NCI 60 cell lines panel representing

nine different types: leukemia, melanoma, lung, colon, CNS, ovarian, renal, prostate and breast cancers. Druglikeness properties was determined based on Lipinski and Veber rules using the SwisAdme of Swiss Institute of Bioinformatics and ProTox-II website.

Results and Discussion. The starting 3,4-dimethoxy diarylidene acetone was synthesized using known methods from appropriate aromatic aldehydes and acetone in methanol medium. The obtained □□□-unsaturated ketone was utilized in the [3+3]-cyclocondensation reaction with 4-amino-5*H*-thiazol-2-one in glacial acetic acid, providing 7-(3,4-dimethoxyphenyl)-5-[2-(3,4-dimethoxy-phenyl)-vinyl]-3*H*-thiazolo[4,5-*b*]pyridin-2-one **2.1**. The target thiazolo[4,5-*b*]pyridine-5-carboxylic acid amides were synthesized from 2-oxo-7-phenyl-2,3-dihydrothiazolo[4,5-b]pyridine-5-carboxylic acids, which were transformed into acid chlorides and used in acylation reaction of respective amines **2.2, 2.3**. In order to diversify a series of 5,7-diaryl-3H-thiazolo[4,5-*b*]pyridin-2-ones, an alkylation reaction with chloroacetamide was carried out with the formation of the corresponding N-substituted derivative **2.4**. The structure of synthesized compounds was confirmed by NMR spectra. The anticancer screening assay (performed according NCI protocol within Developmental Therapeutic Program) allowed detecting some aspects of structure – anticancer activity relationships, most sensitive cell lines and identify the most active compounds for further investigation. Study of the drug-likeness parameters and toxicity predictions of synthesized compounds showed that mentioned compounds possess satisfactory ADME parameters, pharmacokinetic properties and medicinal chemistry friendliness according modern requirements for potential drug-like molecules.

Conclusion. Considering all the above, the construction of novel chemical entities as possible chemotherapeutic agents among thiazolopyridines is justified and promising direction in the modern medicinal chemistry.

SEARCH FOR POTENTIAL BIOLOGICALLY ACTIVE SUBSTANCES AMONG 5-HYDROXY-7-METHYL-3H-THIAZOLO[4,5-*b*]PYRIDINE DERIVATIVES

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Keywords: Thiazolo[4,5-b]pyridines; synthesis; anti-inflammatory activity; antioxidant activity

Introduction. 4-Azolidone core is considered to be an efficient scaffold for drug-like molecules design as the integral part of modern medicinal chemistry. Pyridine derivatives have always been among the most important research areas in the field of drug design. In modern theoretical and clinical

medicine the inflammation problem remains one of the main research focuses. Inflammation occurs as a defensive response which induces physiological adaptations to limit the tissue damage and remove the pathogenic infections. Of no lesser interest is the search for new antioxidants. There is an increasing evidence of the implication of free radicals in a variety of diseases. Free radicals are being formed during normal cellular metabolism and they are known to contribute to healthy functions in human health and development when they are not present in excessive amounts.

The development of new potent antioxidant agents is a major goal for pharmaceutical and medicinal chemistry, as a way of removing the excess of free radicals, and thus, to ameliorate their hazardous effects on human beings.

Materials and methods. The objects of this work was to systematize data on the current state of methods for the synthesis of 3H-thiazolo[4,5-b]pyridine-2-ones, synthesis of 3H-thiazolo[4,5-b]pyridine-2-ones derivatives, study of their physicochemical and spectral properties..

Results. A series of 5-hydroxy-7-methyl-3H-thiazolo[4,5-b] pyridin-2-one derivatives possessing anti-inflammatory and antioxidant activities were prepared by the structural modification of the core heterocycle at C^5 and C^6 positions.

Conclusions. Anti-inflammatory activity evaluated in vivo and free radicals scavenging effect determined in vitro allowed to identify some lead compounds causing significant decrease in edema formation or considerable antioxidant effect. The present results suggest that the core fused heterocycle can be developed as a promising scaffold for anti-inflammatory and antioxidant drug candidates.

PURPOSEFUL SEARCH OF NEW BIOLOGICALLY ACTIVE SUBSTANCES AMONG COMPOUNDS WITH A TETRAZOLE FRAGMENT USING CHEMIOINFORMATICS AND COMPUTER CHEMISTRY METHODS

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Keywords: Computational drug discovery, computer-aided drug design, QSAR analysis, anti-inflammatory activity, virtual screening, tetrazole derivatives.

Introduction. The process of drug development using computer modeling methods includes the identification of potential biological targets for candidate drugs, the creation of chemical libraries of small molecular compounds, virtual screening and quantitative assessment of the affinity of

ligands to the established biological target, further optimization of compounds in silico, and prediction of their potential toxicity.

Materials and methods: pharmacological screening methodologies and *in silico* techniques including molecular modeling and virtual screening were used to discover novel drug-like compounds. Quantitative structure – activity relationship analysis was carried out. Pharmacological *in vivo* screening of antiinflammatory effect of novel compounds was executed.

Results. A series of 13 compounds 2-(5-aryltetrazol-2-yl)- and 2-(1H-tetrazol-5-ylsulfanyl)-N-thiazol-2-ylacetamide were evaluated for their anti-inflammatory activity using carrageenan model of inflammatory paw edema of white Wistar rats of different sexes weighing 180-250 grams and subjected to virtual screening procedure. Preliminary optimization of the studied molecules, in order to achieve the conformation with the minimum energy, was carried out using the software package "Hyperchem 7.5" by the MM+ molecular mechanics method until the RMS gradient was reached less than 0.1 kcal/(mol). The final energies minimization of the studied compounds was carried out by the semi-empirical quantum chemical method AM1 until the RMS gradient was less than 0.01 kcal/(mol?).

The prepared structures were used to calculate RDF molecular descriptors using the "DRAGON" software package. On the basis of the calculated structural parameters, a mathematical multivariate regression QSAR model of the dependence "structure - antiinflammatory activity" was created using the BuildQSAR software package, which allows choosing one- or multiparameter models with the maximum value of the correlation coefficient (r) and the minimum values of the standard deviation (s) and sum of squared prediction error (SPRESS). Based on variance analysis, the Fisher coefficient was calculated, which characterizes the adequacy of the obtained QSAR models. The main criterion of statistical reliability was the predictive ability of the obtained models, the quantitative characteristic of which is the cross-validation coefficient - Q^2. Obtained QSAR models were used for the prediction of the antiinflammation action of novel synthesized tetrazole derivatives.

Conclusions. Statistically reliable QSAR models of the dependence between the anti-inflammatory activity of 12 tetrazole derivatives and the RDF values of molecular descriptors were obtained. Since RDF molecular descriptors are interpreted as the probability of finding atoms in a spherical volume with a radius r, it can be concluded that an increase in anti-inflammatory activity is observed in the presence of atoms in the radii of 6.5, 7.5, 9 and 10, while the presence of atoms in the radii of 6, 12.5 and 10.5 results in decreased activity. To achieve the maximum anti-inflammatory effect, the size of the active molecule of tetrazole derivatives should be between 6.5 and 10. Using the obtained QSAR models, anti-inflammatory

activity was calculated for a test sample of tetrazole derivatives, for which this type of activity had not yet been determined experimentally, and quite promising results were obtained. The values of the predicted anti-inflammatory activity values are within 21-58%, that is, the compounds are quite active in perspective. The resulting models can be used for virtual screening of compounds even before direct synthesis and rational design of similar molecules.

DEVELOPMENT OF A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF VERAPAMIL HYDROCHLORIDE IN MEDICINAL DRUGS, CALCIUM CHANNEL BLOCKERS

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Keywords: verapamil hydrochloride, bromocresol green, spectrophotometry, quantitative determination, validation.

Introduction. Cardiovascular diseases - coronary heart disease and hypertension - are among the leading causes of disability and mortality in all economically developed countries, including Ukraine. Lowering blood pressure can significantly reduce the incidence of complications. Certain groups of drugs have advantages, and therefore, according to expert recommendations, form the basis of antihypertensive therapy. According to the Order of the Ministry of Health of Ukraine No. 384 dated May 24, 2012, long-acting calcium antagonists are among the first-line drugs. Calcium channel blockers are a heterogeneous group of drugs with antihypertensive and antianginal effects. The basis of the pharmacological activity of calcium channel blockers is their ability to block the transport of calcium ions into the cell through the potential-dependent (slow) L-channels of the membrane. There are 3 groups of calcium channel blockers on the Ukrainian pharmaceutical market today. According to the State Formulary of Medicinal Products, they are divided into: selective calcium antagonists with dominant effect on blood vessels C08C (dihydropyridine derivatives); selective calcium antagonists with dominant effect on the heart C08D (phenylalkylamine and benzothiazepine derivatives); calcium antagonists in combination with diuretics C08G (dihydropyridine derivatives in combination with diuretics).The aim of this work was to develop sensitive, easy-to-use, economical spectrophotometric methods for the quantitative determination of verapamil hydrochloride based on the reaction with bromocresol green and validation of the proposed method.

Methods: Spectrophotometry determination

Results and Discussion: For the reaction of verapamil hydrochloride with bromocresol green, optimal conditions are: 0,03% solutions of verapamil

hydrochloride in acetone; adding 1.00 ml of 1.5% BCG solution in acetone for verapamil hydrochloride; measuring the optical density of the analyzed solutions at the analytical wavelengths at which there is observed a maximum of light absorption λ_{max}= 409 nm for verapamil hydrochloride. To establish analytical sensitivity parameters of the investigated reactions, the products absorption spectra in the optimum conditions were measured and the maxima of light absorption were established. Based on the obtained values, the following indicators of sensitivity of this reaction were calculated: molar absorption, specific absorption, Sandell's sensitivity, detection limit. The low values of the opening minima of 1.79 μg / ml, as well as high values of molar absorption coefficients $9.94 \cdot 10^3$, indicate the high sensitivity of this reaction. The most common methods for determining the stoichiometric coefficients of the reacting components in the reaction between the investigated substunce and the reagent were: the method of continuous changes (the method of isomolar series), the method of saturation (the method of molar ratios) and the method of relative yield (the method of Staryk−Barbanel). For all cases, the stoichiometric ratio of "drug substance - reagent" is 1:1.

Conclusions: Original spectrophotometric method for the quantitative determination of verapamil hydrochloride was developed and validated. The developed method is simple and quick to perform.

IN SILICO STUDY OF 3- MORPHOLYL-SUBSTITUTED DERIVATIVES 4-ARYL-2-ARYLIMINO-2,3-DIHYDRO-1,3-THIAZOLES AS POTENTIAL ANTIOXIDANTS

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Keywords: in silico, molecular descriptors, QSAR (Quantitative Structure – Activity Relationship), 3-morpholyl-substituted 4-aryl-2-arylimino-2,3-dihydro-1,3-thiazoles, antioxidant activity.

Introduction. Pre-experimental studies based on a powerful theoretical foundation using the latest in silico technologies, which include QSAR analysis (Quantitative Structure – Activity Relationship) are important for the purposeful creation of potential medicines. The directed search for new effective antioxidant drugs is relevant, as it is of great importance for the prevention and therapy of many diseases in the pathogenesis of which oxidative stress occurs, and the choice of antioxidants is limited due to their insufficient effectiveness. Thiazole derivatives are promising for the search for biologically active compounds, as the thiazole core is a powerful biophoric fragment for the rational design of drug-like molecules.

Methods: The calculation of molecular descriptors and the construction of QSAR models were carried out using the following software packages: HyperChem 7.5, Dragon and BuildQSAR.

Results and Discussion: Modeling of the structure of molecules and analysis of the electron-space structure was carried out, the values of molecular descriptors (electronic, electrostatic, geometric, steric, fragmentary, topological, energetic, etc.) were calculated, and the drug-like parameters of the studied compounds were evaluated. An analysis of the quantitative dependence of structure-activity was carried out, from the array of descriptors, those parameters were selected that probably have the greatest influence on the realization of antioxidant activity; built QSAR models to optimize the search for compounds with AOA. On the basis of QSAR analysis, it was found that the most significant influence on AOA has polarizability, refractivity, lipophilicity, electronic and energy parameters. The antioxidant activity of the studied compounds increases with the strengthening of their hydrophilic and electron-donating properties. AOA is influenced by topological charge indices and connectivity indices, constitutional descriptors, and eigenvalues of the Bourdain matrix. The size of the molecule and its branching also affect the AOA: larger AOA is shown by molecules with small volume and surface area.

Conclusions: The resulting QSAR models can be used to predict the antioxidant activity of the given series of compounds as a theoretical platform for further chemical modification and targeted de novo synthesis of potential antioxidants.

SYNTHESIS OF ISONINDOLE SUBSTITUTED 4-THIAZOLIDINONES AND STUDY OF THEIR BIOLOGICAL ACTIVITY

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Scientific supervisors: associate prof. **Olexandra Roman**

Keywords: synthesis, isonindole, 4-thiazolidinones, [2+3]-cyclocondensation, anticancer activity, druglikeness.

Introduction. Current trends in modern drug discovery are aimed at streamlining the development of new potential drug-like molecules based on the relationship between the drug's chemical structure and biological activity. This approach uses "drug design" methodology in Medicinal and pharmaceutical chemistry, using "biophoric" heterocyclic systems, including isoindole-thiazolidinones. Preliminary studies indicate their prospect in the search for new biologically active compounds with low toxicometric parameters, as among them are identified derivatives with antitumor, antitrypanosomal and anti-inflammatory effects.

Materials and methods. Organic synthesis, spectral analysis, *in vitro* anticancer activity, *in silico* druglikeness.

Results. A new method for synthesizing isoindole-thiazolidinones is based on the [2+3]-cyclocondensation reaction with an equivalent of dielectrophilic synthon as N-arylmaleimides and monocloracetic acid, for modification of thiazolididnone core Knoevenagel reactions conditions with isatin was used. The screening results showed that the synthesized molecule 2.6 has a low level of antitumor activity, and only on four cancer cell lines is there a minor sensitivity of 10 μM. In general, it should be noted that the most sensitive to the effects of synthesized compound 2.6 were kidney, breast, and melanoma cancer cell lines. For 2-[4-oxo-5-(2-oxo-1,2-dihydroindol-3-ylidene)-4,5-dihydrothiazol-2-ylamino]-isoindole-1,3-dione potential druglikeness were investigated, which indicate characterizing the molecule in terms of a potential drug candidate.

Conclusions. Purposeful synthesis of new library of new isoindole-thiazolidinone was performed. Antitumor activity 2-[4-oxo-5-(2-oxo-1,2-dihydroindol-3-ylidene)-4,5-dihydrothiazol-2-ylamino]-isoindole-1,3-dione was studied and potential druglikeness was characterized.

OBTAINING OF CHITOSAN AND STUDY OF ITS PHYSICOCHEMICAL PROPERTIES.

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Keywords: chitin, chitosan, molecular weight, affinity and ion-exchange chromatography.

Introduction. Chitin and chitosan are biopolymers with excellent bioactive properties, such as biodegradability, non-toxicity, biocompatibility, haemostatic activity and antimicrobial activity. The physicochemical nature of chitin and chitosan, which influences the biomedical activity of these compounds, is strongly related to the source of chitin and the conditions of the chitin/chitosan production process. Chitosan derived from arthropod shells is the most investigated, while chitin and chitosan from other raw material sources, including real mushrooms, require further research.

Materials and methods: Shrimp chitin from "Sigma", chitin from lobsters and Basidiomycetes (true mushrooms), and chitosan from shrimp and lobsters were used. The molecular weight of the obtained substances was determined by viscometry. Chitin and chitosan were characterised by infrared spectrometry, and the degree of deacetylation of chitosan was determined by the titrimetric method. Column affinity and ion-exchange chromatography also were used.

Results. It was found that shrimp chitin at room temperature is soluble only in concentrated HCl, H_3PO_4, HBr, and a saturated solution of $BeBr_2$. However, only concentrated HCl at low temperatures does not lead to significant hydrolysis of chitin. It was found that chitin obtained under the same experimental conditions from lobster shells has a molecular weight 5-8 times higher than chitin from mushrooms. Infrared spectra showed that chitins and chitosans from fungal fruiting bodies and arthropod shells have significant similarities, but the obtained chitosans differ in the wavelengths characteristic of NH_2- and CONH-groups. Using potato lectin as an example, the possibility of using lobster chitin for the purification of N-acetyl-D-glucosamine-specific lectins by column affinity chromatography is shown. The possibility of using the obtained lobster chitosan as an ion exchanger is also shown on the example of purification of sophora bark lectin by Japanese ion-exchange column chromatography, although its sorption capacity is lower than that of DEAE cellulose.

Conclusions. Methods for purification of chitin from lobster shells and fruiting bodies of Basidiomycetes and a method for obtaining chitosan have been tested. The similarity of arthropod and fungal chitin was demonstrated by infrared spectroscopy. The physicochemical properties of the obtained compounds and the possibility of their application as affinity sorbents and ion exchangers are investigated.

DEVELOPMENT OF A SPECTROPHOTOMETRIC METHOD FOR THE DETERMINATION OF SULFADIMIDINE IN MEDICINAL DRUGS

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Scientific consultant: assoc. prof. **Volodymyr Ogurtsov**, PhD.

Keywords: sulfadimidine; 3-α,γ-dycarboxypropilrhodanine; spectrophotometry.

Introduction. Sulfadimidine and the whole group of sulfonamides allows for the successful treatment of many diseases caused by bacterial pathogens, especially in the early stages of the disease. They suppress the development of gram-positive and gram-negative bacteria, some protozoa and pathogenic fungi. They act on pneumococci, streptococci, staphylococci, Escherichia coli, causative agents of dysentery. They are used to treat pneumonia, bronchitis, diseases of the biliary and urinary tracts, gastrointestinal tract. In recent years, the spectrum of their research in relation to cancer cells, detection of antitumor activity has expanded. High-performance liquid chromatography, spectrophotometric, electrochemical,

titrimetric, fluorometric and chromatographic methods of analysis are used to control the quantitative content of sulfonamides in pharmaceutical medicinal and veterinary preparations, in food products and in biosubstrates.

Methods: Spectrophotometric method of determining optical density, saturation method, method of continuous changes

Results and Discussion: The method of spectrophotometric determination of sulfadimidine quantitative content in the dosage form of Sulfadimidine based on its reaction with 3-α,γ-dycarboxypropilrhodanine was developed. The stoichiometric ratios of the reactive components as 1:1 were obtained by the methods of continuous changes and the saturation method.

Conclusions: The interaction reaction between the preliminary diazotized sulfadimidine with 3-α, γ- dycarboxypropilrhodanine was investigated which resulted in a colored azo compound obtaining. Quantitative spectrophotometric method was developed for sulfadimidine determination in Sulfadimidine tablets based on thesereactions.

DEPARTMENT OF HEALTHCARE MANAGEMENT, PHARMACOTHERAPY AND CLINICAL PHARMACY

(Head of the department – prof. **Andriy Zimenkovsky**)

MANAGEMENT OF THE EFFICIENCY AND SAFENESS OF MEDICINAL PRODUCTS IN THE SYSTEM OF PHARMACOVIGILANCE

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Keywords: pharmacovigilance, side reactions, medicines, efficiency, safeness.

Introduction: The problem of safety of medicines is becoming more and more urgent throughout the world. First of all, this is due to the wide application of a large number of medicaments with high biological activity, which may be accompanied by the occurrence of side reactions, different manifestations and gravity of the severity.

Materials and methods: The object of our study was the notification of the side effects of drugs that sent to the State Expert Center of the Ministry of Health of Ukraine from the doctors of health facilities of the Lviv region within 2022.

Results: During 2022, 420 messages on the side reactions of medicines received reports of the Ministry of Health of Ukraine on all the health expert Center. The conducted analysis of the message cards showed that the largest amount of side reactions on medicines has been in women - 55% and most often registered in patients of average (30%) and elderly (25%).

Among the medicines, which were assigned to doctors in the health facilities of the Lviv region in 2022, the first place at the frequency of occasional adversary reactions took chemotherapeutic drugs (35.5%), among which leading positions, as in the past years, antibiotic drugs. The second place was taken by medicines that affect the cardiovascular system (20.3%), the third step was taken with nasteroid anti-inflammatory drugs (8%). According to the arrangement of drugs at the frequency of adverse reactions, it is possible to conclude, about the high frequency of appointments by doctors of these pharmacological groups of medicines in the Lviv region in 2022. Among the adverse reactions that arose in patients in 2022, the reactions from the gastrointestinal tract (24.8%) were dominated by the second position, the allegic reactions were taken (the 19-2), the third step took side effects on the skin of the skin and subcutaneous fiber (18.9%). Among the allergic reactions of the immediate type in patients of the Lviv region in 2022, the urticaria (41%), the edema of Queenke (4%) and in one case, anaphylactic shock (1%) was observed.Among all reports of adverse events after immunization, vaccines against Covid-19 took second place, the number of adverse reactions and their background was 27%. The first place was taken by the vaccine Comirnaty (Pfizer-BioNTech) - 57%, the second step was Covishield (AstraZeneca) - 29%, and the third - Moderna - 14%.

Conclusions: 1. In the frequency of adverse reactions in the Lviv region, the leaders were leading chemotherapeutic drugs (35.5%), means that affect the cardiovascular system (20.3%) and non-steroidal anti-inflammatory drugs (8%).

2. Among the adverse reactions to drugs, the dominant positions took the reactions by the gastrointestinal tract (24.8%), allergic reactions (19.2%) and from the skin and subcutaneous fiber (18.9%).

3. In terms of the frequency of adverse events after immunization with antiviral vaccines, the leaders in the Lviv region were the Comirnaty (Pfizer-BioNTech) vaccine – 57%, Covishield (AstraZeneca) – 29%, Moderna – 14%. However, since adverse events were not significant, they cannot influence vaccination.

4. Taking into account the results of the conducted research, we can assume that the management of the safety and effectiveness of medicines can be expressed in special messengers of pharmaceutical care, directed primarily to chemotherapeutic drugs, drugs that affect the cardiovascular system, and nonsteroidal anti-inflammatory drugs.

5. Taking into account the results of the study, we consider it necessary to emphasize to doctors the side reactions of the above-mentioned groups.

6. Taking into account all of the above, consider it necessary in future studies of the management of the safety and effectiveness of medicinal products.

PHARMACEUTICAL CARE OF PATIENTS AT RETINOIDS USING

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Keywords: retinoids, pharmaceutical care.

Introduction. Oral administration of system retinoid isotretinoin, taking into account high efficiency, is recommended for the treatment of heavy-degree acne. As a consensus decision, the system retinoids administration is considered also advisable for a less degree of acne. Isotretinoin is also prescribed for other dermatological diseases. However, pharmacotherapy with systemic retinoids is associated with the risk of developing serious and moderate or minor adverse drug reactions. In particular, isotretinoin has a teratogenic effect, so its use requires ensuring appropriate contraception. It has been proven the possibility of statistically significant, associated with the use of isotretinoin, changes in a number of laboratory tests, including lipid levels and liver tests. Among the adverse drug reactions of systemic and local retinoids, there are a number of manifestations that depend on the patient's medication behavior, in particular, sensitivity to UV rays, and dryness of the

skin and mucous. In order to ensure the appropriate use of retinoids and prevent the manifestations of adverse drug reactions, patients are provided with pharmaceutical care.

Materials and methods. Methods used: system approach, bibliographic, clinical-pharmaceutical, comparative analysis, and questionnaire survey. The anonymous questionnaire online survey among patients with dermatological diseases was conducted using a Google form (from March 22 to April 7, 2023). The criteria for including the questionnaires in the study were the patients' use of isotretinoin drugs and age ≥18 years. Objects of research: available information flows; standards of pharmacotherapy with retinoids, requirements for its monitoring, Pharmacist guide; questionnaires of an online survey of patients who used isotretinoin (n=39). Subject of research: aspects of retinoid use requiring patient-centered pharmaceutical care.

Results. In order to ensure the appropriate use of topical retinoids by patients, pharmacists have to provide pharmaceutical care in accordance with the recommendations of the current guide. Safe pharmacotherapy with systemic retinoids requires monitoring of a number of predicted adverse drug reactions. Whereas laboratory monitoring at systemic retinoids use is carried out for the purpose of prevention and timely identification of adverse drug reactions, and the degree of non-adherence by patients with laboratory monitoring recommendations, according to the results of our survey, is 28.2%, we consider it important to include this aspect as a component of pharmaceutical care. In order to increase the level of patient adherence with laboratory monitoring recommendations, pharmaceutical care should include not only warnings about possible isotretinoin adverse drug reactions but also information about the costs associated with monitoring. Therefore, the costs calculated for 5 months of pharmacotherapy, in addition to the cost of the minimum course of isotretinoin at its minimum dosage (from 15,417.20 to 21,550.00), include the cost of the minimum frequency of laboratory control (from 2,502.00 to 3,757.50) and are from 17919.20 to 25307.50. According to the results obtained in the survey among patients who used methods to prevent pregnancy during pharmacotherapy with systemic retinoids (n=18), in 66.7% of cases the level of contraceptive reliability was insufficient. While in 38.9% of cases, pregnancy tests were performed only 1 time, and in 22.2% of cases they were not conducted at all. Thus, this proves the need to provide pharmaceutical care in order to reduce the risks of pharmacotherapy.

Conclusion. Appropriate provision of pharmaceutical care to patients regarding the use of retinoids should include a number of components, including issues of appropriate laboratory monitoring, contraception, elimination and relieving of adverse drug reactions, cost of pharmacotherapy, warnings for their use, etc.

THE MANAGEMENT OF DRUG INTERACTIONS OF ANTITHROMBOTIC DRUGS

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Keywords: antithrombotic drugs, drug interactions, pharmacotherapy.

Introduction: In Ukraine, a number of studies have been conducted on the use of drugs that affect the blood coagulation system. However, the number of scientific publications that address the issue of their rational use, in particular in terms of drug interactions, is quite limited, which determined the objectives of this study.

The aim of the study consists analyse current strategies for managing antithrombotic drug interactions; to investigate the frequency, structure and impact of these interactions on the rationality and safety of cardiovascular disease treatment/prevention in real clinical practice.

Research methods: bibliographic, system analysis, clinical-pharmaceutical, clinical-pharmacological, method of standardization and comparison.

Result. According to the results of the analysis of written prescriptions (n=46), it was found that the largest proportion of antithrombotic drug users (80.4%) in outpatient settings are patients aged 56-75 years with 1 to 5 nosological units, the vast majority of whom have coronary heart disease (78.2%) and hypertension (86.9%). At the same time, patients take from 2 to 6 medications. It was found that drug interactions involving antithrombotic medicines occurred in 74.4% of written prescriptions by physicians in which interactions were identified. In total, we identified 81 interactions, 90.1% of which involved acetylsalicylic acid. 58.8% of all interactions with antithrombotic drugs were of moderate significance, which requires careful monitoring of the patient's condition, as the consequence of drug interactions may lead to a deterioration in the patient's condition or require a change in treatment tactics, which confirms the relevance of this study and the importance of monitoring drug interactions when prescribing antithrombotic drugs.

Conclusions. The results of the clinical and pharmaceutical assessment of antithrombotic drugs in the pharmacotherapy of cardiovascular diseases have shown that their use is associated with a number of problems related to taking medications that can lead to decreased effectiveness of therapy, drug interactions with other medications, increasing the risk of adverse reactions such as bleedings. According to numerous scientific studies, the risk of these problems can be prevented or minimised through the rational and safe use of antithrombotic medicines and the control of drug interactions.

CLINICAL-AND-PHARMACEUTICAL APPROACHES TO THE USE OF ANTI-ALLERGIC MEDICINES IN PREGNANT WOMEN

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Scientific consultant: Assoc. prof. **Nastyuha Yu. S**.

Keywords: questionnaire, antihistamine drugs, pregnancy periods.

Introduction. According to WHO allergy ranks 3rd place by the level of morbidity. The problem of allergic diseases in pregnant women, which in the last decade ranges from 5 to 20%, is extremely relevant. Today there is a significant arsenal of antiallergic drugs and approaches to the treatment of allergies, but none of the antihistamines is in the A category under the FDA, i.e. it is not completely safe during pregnancy.

Materials and methods. The research covered 15 respondents of different ages and areas which carried a sample questionnaire specially formed protocol with regard to problem issues relating to the treatment of allergy during pregnancy periods. The standardized poll algorithm was used, what allowed to achieve equality of conditions within the study group. The sociological (questionnaire), statistical, clinical-and-pharmaceutical methods are used.

Results. The survey was conducted to evaluate the effectiveness and safety of antihistamine drugs in the treatment of allergy symptoms. A total of 15 respondents participated in the survey, of which 60% reported using antihistamine drugs, while 40% did not. The majority of the respondents who used antihistamines (81%) reported a positive effect on their allergy symptoms, with only 19% reporting no significant improvement. Among those who reported using antihistamines, 82% followed the prescribed regimen, with the majority taking the medication twice a day.

When asked about the occurrence of side effects, 33% of those who used antihistamines reported experiencing them, with the most common side effect being fatigue (71%). Other side effects reported include drowsiness (29%), headache (43%), stomach pain (14%), dry mouth and throat (14%), and diarrhea (29%).In terms of safety during pregnancy, the majority of respondents (87%) believed that antihistamine drugs are safe, while only 6% believed they are not safe. The remaining respondent (6%) was unsure about the safety of these drugs during pregnancy.Overall, the majority of respondents (60%) reported a positive outcome from using antihistamine drugs in the treatment of their allergy symptoms. However, a significant number of respondents (33%) reported experiencing side effects from the use of these drugs. While most respondents believed that antihistamines are safe during pregnancy, further research is needed to fully understand the safety and effectiveness of these drugs during pregnancy.

Conclusions. Consequently, the role of the pharmacist in realizing the non-prescription drugs especially for the pregnant and lactation women with the symptoms of allergy is very important. Qualitatively provided by the pharmacist a standard of the pharmaceutical care is a guarantee for the achievement of the positive compliance, maximum efficiency of the pharmacotherapy and at the same time, it promotes the responsibility of the patient for her own health (responsible self-treatment).

CLINICAL-AND-PHARMACEUTICAL APPROACHES TO IRON-CONTAINING MEDICINES USE

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Keywords: iron deficiency, iron-containing medicines, nutrition, nutritional product, pharmaceutical care.

Introduction: The WHO has recognized iron deficiency (ID) as the most common nutritional deficiency in the world, with 30% of the population being affected by this condition. While ID is more prevalent in children and women, adult men are also susceptible depending on their socioeconomic status and health conditions. Different clinical and functional impairments can occur as a consequence of iron deficiency. It is well known that ID significantly affects the quality of life, and rational treatment of ID improves the quality of life, regardless of the underlying cause for ID. ID treatment is aimed not only at eliminating symptoms but at liquidating iron deficiency (ID) and replenishing its reserves in the body, which can only be achieved with comprehensive therapeutic methods. Today the assortment of iron-containing medicines (ICM) is characterized by a high level of competition and stable demand and a wide range of drugs that have a high efficiency, a sufficient level of safety, and various indicators of availability for patients. However, the clinical-and-pharmaceutical issues of ICM use and the development of the pharmaceutical care model for patients with ID remain relevant and need to be studied more.

The aim of the research to analyze and assess the clinical and pharmaceutical problems of the rational use of ICMs; to outline potential ways to improve the quality, efficiency, and safety of ID correction by applying the pharmaceutical care system.

Materials and methods. Current evidence-based literature and online data materials (adopted from Cochrane, EMBASE, PubMed, Google Scholar, and Research Gate); Clinical guidelines (AAN, ECTRIMS/EAN, NICE, SIGN, ABN, EFNS); information on drugs using (n=37); State Drugs Formulary (12th ed.); foreign drugs information databases (Drugs.com, DrugBank, Drugsdb.com); results of a cross-sectional survey in Ukraine (n=74). Used

methods: literature and online data search, content analysis, clinical-and-pharmaceutical, analytical, frequency, comparative, model development, questionnaire survey targeting patients.

Results. It was established that for the treatment of ID, mostly appointed 37 ICMs, which are dominated the medicines for oral administration. It has been proven that the selection of a medicinal product for the correction of iron deficiency is based on data on the composition of the medicinal product (iron compound and elemental iron content), dosage form, and safety parameters of the medicinal product, as well as taking into account the individual characteristics of the patient. The probability of 57 adverse reactions due to iron-containing drugs of various compositions, 44 contraindications to using iron-containing medications, and 32 potential drug interactions were predicted. It was found that providing all stakeholders of the health care process with current, qualified, and substantiated information is the basis for the rational treatment of patients with ID. It can be implemented successfully by the components of pharmaceutical care.

Conclusions: Analysing the discovered information about iron's biological and physiological function, we concluded that this microelement has a high biological activity, which provides the functioning of many organs and systems of the body. At the same time, iron deficiency can lead to different diseases. Because of their undisputed efficacy and modern advancement, ICMs constitute one of the most important groups of drugs used to treat various conditions caused by ID. Unfortunately, SEs and drug interactions are often seen even when ICMs are used correctly, in short bursts. With the help of pharmaceutical care tools, even the most potent ICMs can be used safely and effectively.

PHARMACOTHERAPY OF PATIENTS WITH NEUROLOGICAL DISORDERS (DEPRESSION, ANXIETY, PSYCHOSOMATICS) AND COMBINED CARDIAC PATHOLOGY.

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Keywords: neurological disorders, pharmacotherapy, risk factors, clinical and anamnestic factors.

Introduction: Stress is a non-specific reaction of the body in response to the action of specific irritating factors. One of the pathological conditions that arise under the influence of acute and chronic stress factors is anxiety. Another manifestation of a pathological reaction to adverse external stimuli is depression. Severe cases of depression can even lead to suicide. Psychosomatic disorders are also common pathological conditions arising as a result of

prolonged exposure to adverse external stimuli. When various neurological diseases are combined with cardiac pathology, their diagnosis and treatment are complicated. Often, practicing doctors are focused on the treatment of the main somatic disease, and the presence of accompanying neurological pathology remains without due attention.

Materials and methods. 84 respondents of both sexes, aged 17-74 years, who were interviewed taking into account socio-demographic indicators, harmful habits and additional risk factors, clinical symptoms and prescribed medicines. The pharmacist analyzed the above indicators and identified their differences in younger, middle and older age subgroups.

Results. According to the results of our questionnaire survey, it was established that out of 84 (100%) respondents who applied for a prescription of drugs in one of the pharmacies, women significantly outnumbered men (76.47% versus 23.53%). According to the results of the research, the most common behavioral risk factors among the respondents were smoking, excessive consumption of strong coffee or tea, difficult financial situation, frequent professional stress, sedentary lifestyle, increased family conflict. Analysis of the prevalence of psycho-emotional disorders among respondents revealed that depression was more common among young people (4 people) and middle-aged people (5 people), less often among older people - 3 people. According to the results of the questionnaire, anxiety was detected in 10, 6 and 3 people, respectively, according to age groups. psychosomatic disorders were present in 4 older persons and 1 younger respondent.

Thus: anxiety was determined most often among respondents using a questionnaire, followed by depression, and psychosomatic disorders were observed relatively less often.

Conclusions. In the master's thesis, a comprehensive study of the main aspects of diagnosis and treatment of patients with advanced neurological disorders and concomitant cardiac pathology was conducted. The expediency of prescribing neurological drugs in real clinical practice from the standpoint of evidence-based medicine has been investigated. Clear differences in the prevalence of certain neurological disorders in respondents of different age groups were established. The impact of bad habits and behavioral risk factors on the occurrence and progression of depression, anxiety and psychosomatic disorders has been revealed. The necessity of using an interdisciplinary approach with the involvement of specialists from various fields of medicine (family doctors, psychologists, pharmacists) is substantiated.

CLINICAL-AND-PHARMACEUTICAL MANAGEMENT OF MAGNESIUM DEFICIENCY

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Keywords: magnesium, magnesium deficiency, magnesium supplements, nutrition, drug-related problems, interactions, evidence-based madicine.

Introduction: Nutrient deficiency is an area of increasing importance in the field of medical and pharmaceutical science and has been found to be an important determinant of the widespread epidemic of chronic disease. As magnesium deficiency (MD) is a common and widespread cause of many everyday physical and mental health problems, supporting health professionals as they endeavor to assist patients presenting with health challenges is very important.

The aim of the research to analyze current management strategies for MD; to outline potential ways to improve the quality, efficiency, and safety of MD correction by applying the pharmaceutical care system.

Materials and methods. Current evidence-based literature and online data materials (adopted from Cochrane, EMBASE, PubMed, Google Scholar, and ResearchGate). Clinical guidelines (AAN, ECTRIMS/EAN, NICE, SIGN, ABN, EFNS); information on drugs and food supplements using (n=38), foreign drugs information databases (Drugs.com, DrugBank, Drugsdb.com); Protocols Drug order Forms (n=27) for the patients with MD. Used methods: Literature and online data search, content analysis, clinical-and-pharmaceutical, analytical, comparative, model development

Results. It was established that magnesium supplements are valuable in the management of many diseases. The results of the investigation have shown that the problem of rational management of magnesium deficiency has many unresolved issues of clinical and pharmaceutical nature, among which the most important are the issues of clinical efficacy and safety of magnesium supplementation. Studies revealed that the magnesium level is found to be low in various pathological conditions such as migraine, diabetes, osteoporosis, bronchial asthma, preeclampsia, cardiovascular diseases, and magnesium supplements have indicated beneficial health outcomes. Taken together, findings indicate that supplemental magnesium could play an important role in the prevention and management of many common diseases. Nevertheless, stronger evidence and more long-term research studies investigating the potential benefits of supplemental magnesium in different disease states are needed. When choosing magnesium supplements for correction magnesium deficiency should take into account several factors, among which are important: the type of magnesium salt, it’s dissolvent and bioavalability, type

of dosage forms, dose and duration of use, limitation, contraindications, and occurrence of side effects. Magnesium supplements impact the administration of various drugs and can alter and be altered by drugs through various mechanisms, including affecting drug absorption through the formation of complexes, interacting with drug membrane receptors to impede drug mechanisms of action, and induction of magnesium imbalance due to decreased renal function. As results of our invesigetion we detected 123 potential interactions of magnesium-containing medicines and others drugs, which can be divided on 3 groups: major interactions – 14.6% (n=18); moderate interactions – 78.9% (n=97); minor interactions – 6.5% (n=8). As results of investigation we conclude, that the real clinical practice of magnesium deficiency correction ofter accompanied several problems related to drugs use.

Conclusions: The results of the clinical and pharmaceutical assessment of systems of magnesium deficiency correction in the pharmacotherapy of different diseases have shown that magnesium supplementation is associated with several problems that can lead to decreased effectiveness of therapy and drug interactions with other medications, increasing the risk of adverse reactions. The risk of these problems can be prevented or minimized through the rational strategy of clinical-and-pharmaceutical management and the monitoring of magnesium supplementation.

MODERN DRUG BEHAVIOR OF PHARMACEUTICAL WORKERS

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Keywords: medicinal behavior, pharmaceutical care, chronic diseases, medication adherence.

Introduction. According to the results of the UN report, in the world there is a global trend to growth and global aging of the population, which poses new challenges to healthcare systems: polymorbidity, syndemic of chronic diseases, polypharmacy. Adherence to prescribed pharmacotherapy (PT) is recognized by the WHO as a worldwide problem and one of the largest global challenges in the field of public health, leading to social and economic consequences, increase in morbidity, mortality and use of additional medical services. Only in the USA, between 33% and 69% of hospitalizations and approximately 125,000 patient deaths are due to non-adherence. A special place in the support and training of patients regarding compliance with the appropriate level of medication adherence (MA) abroad is diverted by intervention with the participation of pharmacists and this is supported by health care systems at the state level. In Ukraine, unfortunately, this problem is

not given adequate attention. There are no comprehensive studies on the role and place of the pharmacist in this process. The aim of the study is to investigate the modern medicinal behavior of domestic pharmaceutical workers and to propose mechanisms and ways of its transformation in accordance with global challenges in the health care system.

Methods and materials. *Object of study* – protocols of questionnaire surveys (n=210); information flows regarding the rational medicinal behavior of pharmacists, medication adherence; scientific publications and systematic reviews on the integration of the pharmacist into the health care system (n=25). *Subjects of research* – medicinal behavior, MA, pharmacist-led intervention. Methods**:** standardizations, anonymous questionnaire, system approach, bibliographic, structural-logical, analytical, clinical-pharmaceutical, comparative-analytical, computer data processing.

Result. A questionnaire survey of 210 pharmaceutical workers in the city of Lviv and the Lviv region was conducted to find out the level of their awareness of the problem of MA and the vision of a possible transformation of the place and role of pharmacists in accordance with modern challenges in the domestic health care system. The average age of respondents was 39,2 ± 11,02 years, the youngest - 21 years, the oldest - 65. According to the gender distribution, 79.9% were women and 20.1% were men. The majority of respondents (93.3%) noted that they are familiar with the problem of non-adherence, however, only 18.6% of them indicated the correct term. The respondents considered the main reasons for non-adherence to be: careless attitude of patients to their own health (61%); forgetfulness (54.3%); cost of medicines (47.6%); fear of potential side effects (SE) (41%); the complexity of PT schemes (41%) and the manifestation of SR (27.1%). At the same time, the greatest danger was seen in the deterioration of the patient's condition (69%); lack of effect from PT (55.2%); probable SR (33.8%); irrational adjustment of PT schemes (24.3%). According to the results of the study, 89% of respondents believe that it is the pharmacist who can help in solving the problem of MA. At the same time, only 47.6% of respondents "always" and 30% - "only sometimes" ask patients how much they adhere to the PT regime. 87.1% of respondents noted the need to include issues related to MA in the professional PC. At the same time, 87.6% of the respondents assessed their knowledge as insufficient on the subject of MA and consider it necessary to learn more information required for professional activity. 38.2% of respondents "do not completely agree" and 19.3% "absolutely disagree" with the statement that the pharmacist, today, is an equal participant of the team of healthcare professionals, and 86.5% are convinced of the need to transform his role corresponding to modern requirements. Respondents consider the following to be the priority ways: reducing the commercial component of activity - 63.8%,

professional PC - 61.4%, professional support of patients with chronic diseases - 44.9%, and training patients to rational medicinal behavior - 43.5%.

Conclusions. Global world challenges in the healthcare system require the transformation and adaptation of modern medicinal behavior of pharmacists all over the world and in Ukraine, which is confirmed by the results of our research. Based on the results of the study of the experience of 12 European countries regarding the integration of pharmacists into the health care system, 5 priority ways of changing the current medicinal behavior of domestic pharmaceuticals are proposed, respectively, to the current challenges of today.

THE CURRENT CONCEPT OF PHARMACEUTICAL CARE: IMPLEMENTATION OF PRINCIPLES, PROSPECTS FOR DEVELOPMENT

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Keywords: pharmaceutical care, standards for pharmaceutical care.

Introduction. According to the current interpretation, pharmaceutical care is the pharmacist's contribution to the care of individuals in order to optimize medicines use and improve health outcomes. The practice of pharmaceutical care is based on the data obtained in clinical pharmacy research as one of the other relevant research disciplines. The cornerstone of pharmaceutical care is the identification, resolution and prevention of drug-related problems (DRPs), which is carried out through the provision of a key service – medication review. The fundamental components of pharmaceutical care also include achieving an appropriate level of adherence. To ensure the responsibility of pharmacy professionals for the outcome of pharmaceutical care lies in the standardization of this type of activities. The purpose of the study was to examine the implementation of the principles of the modern concept of pharmaceutical care and to analyze the ways of development.

Materials and methods. Methods used: system approach, bibliographic, clinical-pharmaceutical and comparative analysis. Objects of research: available information flows; State Register of Drugs of Ukraine (April 2023), State Drug Formulary (issues 14, 2022), Pharmacist's protocols approved by the Ministry of Health of Ukraine. Subject of research: the concept of pharmaceutical care.

Results. The results of the analysis of available information flows show that the theoretical foundations of pharmaceutical care have undergone a number of changes in the process of formation, and pharmaceutical care continues to develop, which directly affects the definition of current standards of practice. Based on the analysis of current regulatory documents, OTC

medicines can be divided into three groups: drugs for which detailed pharmacist protocols have been developed, drugs for which pharmacists can be guided by the theses of pharmaceutical care of the State Drug Formulary, and a group of OTC medicines for which there is a need to develop standards of pharmaceutical care, including non-formulary mono-medicines with resorptive effects that are not included in the protocols (n=47). The OTC status of fluconazole (150 mg, №1) demonstrates the need to develop a pharmaceutical care standard that will allow pharmacists to identify cases requiring mandatory medical consultation and provide recommendations to patients with uncomplicated vaginal candidiasis on responsible self-medication. Promoting the rationality of pharmacotherapy through pharmaceutical care, using fluconazole as an example, involves identifying, addressing and preventing adverse drug reactions, drug interactions, contraindications, correct dosage, special patient conditions, and requires high adherence, including through appropriate communication.

Conclusion. We believe that the perspectives for the development of pharmaceutical care in Ukraine consist in the wider implementation of this concept in the practice of pharmacists.

DRUG BEHAVIOR: OFF-LABEL THERAPY

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Keywords: drug behaviour, pharmacotherapy, off-label drug use, off-label therapy

Introduction. Based on data published by the WHO, dangerous practices and medical errors are the two major causes of preventable damage to health care systems around the world. In addition, the WHO points out that 50% of all registered drugs are prescribed for off-label indications, which results in increased disease incidence, mortality and healthcare costs and is therefore recognised as a global problem. Drug behaviour refers to the behaviour of a person (patient, clinician, pharmacist, clinical pharmacist, etc.) related to drugs. Therefore, the use of off-label drugs is considered a specific type of drug behaviour. Based on the final data, the frequency of prescribing off-label drugs is 47% in neonatal intensive care units, 32% in paediatric inpatient units, 26% in outpatient patients, and 18% in hospitalised oncology patients. As for Ukraine, there are no statistical data reflecting the actual situation with the use of off-label drugs in the country. There is also no integrated research on the level of awareness and attitudes of Ukrainian healthcare professionals towards off-label drug prescribing. The purpose of the research was to conduct an integrated assessment of the off-label therapy problem as a special type of drug behaviour among Ukrainian

healthcare and pharmaceutical professionals as well as to develop pharmaceutical interventions to improve the quality of pharmacotherapy (PT).

Methods and materials. *Subject matter of the study* – protocols of questionnaire surveys (n=370); relevant information flows on the off-label drug use practice, systematic reviews (n=13), scientific papers in international databases PubMed (n=15) and Scopus (n=6), national scientific papers (n=5) on rational off-label therapy. *Scope of the study* – drug behaviour, off-label therapy. Methods: standardisation, anonymous questionnaire survey, systematic approach, bibliographical, structural and logical, analytical, clinical and pharmaceutical, comparative and analytical, computer data processing.

Results. We conducted a questionnaire survey of 370 respondents randomly selected from among specialists in various medical specialties and among pharmacists to determine the level of their awareness of the off-label therapy practice, as well as the advantages, disadvantages and dangers associated with off-label drug prescribing. The average age of the respondents was 34.4 ± 13.1 years, with the youngest respondent aged 21 years and the oldest 75 years. According to the gender distribution, 24.3% were men and 75.7% were women. Only 45.1% of respondents knew the definition of the term, and 37% said that the definition was completely new to them. Moreover, 93% rated their knowledge on this issue as insufficient, 71.4% said they did not have access to sufficient information on off-label drug use, and 58.6% stressed the need to obtain more information required for their routine practice. The respondents saw the greatest risks associated with off-label practice in possible adverse reactions (65.9%), increased number of therapeutic errors (62.4%), and lack of effect of such PT (45.4%). At the same time, 91.9% of the respondents were "not convinced" or "not fully convinced" of the effectiveness of such drug use (61.9% and 30% respectively), and 91.6% doubted the safety of such therapy. At the same time, 19.5% of respondents stated that they had observed adverse reactions when using off-label drugs. The study revealed that 87.8% of respondents were not familiar with the regulations governing the process of off-label therapy in Ukraine, 43.8% said they did not have information on how the process of off-label drug use is carried out in the healthcare facilities where the respondents work, and 29.5% stated that such a process is not regulated in their facilities. At the same time, 75.9% of respondents believe that pharmacist interventions are necessary when using off-label drugs, in particular, special patient-specific pharmacotherapy.

Conclusions. According to the results of the study, there is a low level of awareness of Ukrainian specialists about the practice of off-label drug use. We have developed 59 informational messages and distributed them among specialists in 5 fields of medicine: paediatrics, cardiology, dermatology, psychiatry, and gynaecology. We believe this will help to deepen the knowledge of specialists on rational off-label therapy and will be useful for improving the quality of medical care for patients in the future.

CLINICAL-AND-PHARMACEUTICAL APPROACHES TO THE SYMPTOMATIC HEARTBURN TREATMENT

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Scientific supervisor: assoc. prof. **Oksana Lopatynska**, PhD

Keywords: heartburn, quality of life, medications, nutritional product, pharmaceutical care.

Introduction: Heartburn is one of the dyspeptic manifestations of diseases of the upper gastrointestinal tract, which is considered the most common symptom of a gastroenterological nature in clinical practice. According to the literature, about 20% of people in the world suffer from heartburn at least once a week, 7-12% - daily, 40-50% - at least once a month. At the same time, less than of such patients consult a doctor. Wide spread, long untreated course, untimely medical treatment of patients, decrease in working capacity determine the general medical and social significance of heartburn. Thus, the issues of diagnosis, prevention and therapy of heartburn in patients are important for practical health care, and timely detection of this type of disorder, construction of the structure of the preventive and therapeutic process using elements of pharmaceutical care will contribute to preventing the development of complications, facilitating the functional state of patients and helping social adaptation.

The aim of the research to analyze the patterns of development of heartburn, identify and assess clinical and pharmaceutical problems of the development, manifestation and treatment of heartburn, evaluate the quality of life of patients with heartburn and outline potential ways to improve it.

Materials and methods. Current evidence-based literature and online data materials (adopted from Cochrane, EMBASE, PubMed, Google Scholar, and Research Gate); Clinical guidelines (AAN, ECTRIMS/EAN, NICE, SIGN, ABN, EFNS); information on drugs using (n=187); State Drugs Formulary (12^{th} ed.); foreign drugs information databases (Drugs.com, DrugBank, Drugsdb.com); results of a cross-sectional survey in Ukraine (n=64). Used methods: literature and online data search, content analysis, clinical-and-pharmaceutical, analytical, frequency, comparative, model development, questionnaire survey targeting patients.

Results. The results of the investigation summarize the literature data on the mechanisms of heartburn development and its clinical significance. The role of etiological factors in cases of heartburn is substantiated. According to the questionnaire survey results, potential factors as causes of heartburn were analyzed and divided into 7 categories. The presence of a correlation between the indicators of the intensity of respondents' complaints of heartburn and quality of life ($r = 0.82$, $P < 0.05$) is substantiated. Given that the level of heartburn signs severity has determinacy properties, we suppose that it can

affect patients' quality of life. The main clinical-and-pharmaceutical problems of heartburn are revealed. It was found that more than 30% of respondents are systematically exposed to factors of heartburn development, and do not know and do not informed what measures should be taken to relieve symptoms. Almost a quarter of respondents do not use any ways to correct the effects of heartburn on the body. Less than half of respondents use medicines to correct the effects of heartburn on the body. However, the medicines used is based on the principles of self-administration and self-medication, which is a serious clinical and pharmaceutical problem. The role of the patient's educational programs in ensuring the effective and safe management of heartburn is substantiated. The concept of patient education and self-education is substantiated. It provides for 9 key principles.

Conclusions: It was established the problem of heartburn has many unresolved issues of scientific, clinical, and pharmaceutical directions, the most important of which are the problems of clinical efficacy, the safety of medicines, and improving the quality of life of patients.

PHARMACEUTICAL CARE OF PATIENTS WITH TYPE 2 DIABETES

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Keywords: type 2 diabetes, pharmacotherapy, pharmaceutical care.

Introduction. In recent years, the range of hypoglycemic agents aimed at the correction of hyperglycemia, dyslipidemia, and the prevention of microangiopathy in patients with type 2 diabetes mellitus (T2DM), which is one of the main medical, social and economic problems of modern medicine, has expanded, therefore the issue of the rational choice of drugs) and pharmaceutical care (PF) in their application remain an actual problem.

Materials and methods. Systematic and comparative analysis, clinical pharmaceutical, and bibliographic methods

Results. As a result of the research, it was established that the main elements of the FD of patients with T2DM are: effective communication between the pharmacist and the patient (understanding of the nature of the disease, treatment, diet and physical activity, etc.); providing information on nutrition and physical activity (advice on healthy eating and regular physical activity, which helps lower blood sugar levels and reduce the risk of complications); blood sugar control (helping patients control their blood sugar using special devices for measuring glycemia and explaining the results of the measurements); optimization of pharmacotherapy (help in choosing the optimal treatment regimen, developing an individual medication regimen, selecting the most effective drugs and reducing the risk of adverse reactions); control of

complications (help in monitoring diseases that can develop against the background of diabetes; psychological support (providing help to reduce stress and increase the patient's motivation for treatment).

O when dispensing insulin should also include: compliance with the rules of storage and use of insulin products, as well as teaching patients about the correct use of insulin pens and syringes.

Conclusions. Elaborated elements of the pharmaceutical care of patients with type 2 diabetes can make a significant contribution to the control of diabetes and the maintenance of patient health.

PHARMACOTHERAPY OF DEFICIENCIES IN ARTERIAL HYPERTENSION AND POST-COVID SYNDROME

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Scientific supervisor – Assits. prof. **Bablyak S.D**., MD, PhD

Key words: arterial hypertension, COVID-19, concomitant disorders, pharmacotherapy, side effects.

Introduction. Arterial hypertension is a chronic disease that occurs in high blood pressure on the wall of the artery from the middle. An increase in blood pressure forces the heart to work with a hot load due to an increase in total peripheral vascular resistance to ensure normal blood circulation. To date, according to official data, more than 686 million people have contracted COVID-19, more than 6 million 859 thousand have died. The World Health Organization considers this threatening and deadly disease as a pandemic that posed a serious challenge to humanity at the beginning of the 21st century. Considering that very often, COVID-19 was combined with other chronic pathologies, the term "syndemic" also became used in the medical community. Sometimes, COVID-19 significantly aggravated the course of hypertension, sometimes provoked the appearance of hypertension in several previously healthy individuals.

Materials and methods. The objects of the study were the data obtained during the questionnaire survey of 102 respondents (58 women and 44 men) aged 17 to 74 who suffered from COVID-19 during 2021-2023. In addition to gender and age, we also investigated other socio-demographic indicators, main symptoms associated with the clinical course of coronavirus infection and arterial hypertension. The questionnaire survey also studied the prescription of antihypertensive and other cardiovascular drugs, which made it possible to conduct an in-depth analysis of the peculiarities of pharmacotherapy in patients of different age groups. In the process of completing the thesis, the following methods were used: system analysis, bibliographic, modern information search,

analytical, clinical-pharmaceutical, clinical-pharmacological, modeling. The study is retrospective.

Results. According to the results of the questionnaire we conducted, it was established that 57% of the 102 respondents who applied to purchase medicine in one of the pharmacies were women and 43% were men. The frequency of incidence of coronavirus disease showed that 43% of our respondents were infected in 2020, 36% in 2021 and 21% in 2022. The frequency of use of various vaccines for primary or secondary prevention of COVID-19 was the following in the total group of respondents: "AstraZeneca", "Pfizer", "Jonson&Jonson", "Moderna" and "Sinovac". The results of the questionnaire, it was found that the most common among 46 respondents of the younger group (17-44 years old) with COVID-19 were: fever, sore throat and headache pain and in 56 respondents of the older age group - shortness of breath, severe fatigue and dry cough. According to the survey, we determined that the main complaints related to the clinical course of arterial hypertension in the general group (102 respondents) were: rapid heartbeat, sleep disorders, headache in the back of the head, swollen legs, frequent mood swings, pain and discomfort behind the sternum, shortness of breath during exertion and general weakness. The analysis of drugs used in the pharmacotherapy of arterial hypertension in a total group of 102 respondents established that doctors most often prescribed beta-blockers - 25.5% of people, ACE inhibitors - 13.7%, and diuretics - 11.8%. The use of angiotensin-2 receptor antagonists was much less frequently reported by 6.9% of respondents, calcium channel blockers by 4.9%, and imidazoline receptor agonists by 2.0%. The results of the questionnaire established that the share of people with controlled blood pressure (less than 140/90) was 27% in the total group of respondents; Among younger people, controlled pressure was reached in 58%, and in older people - 42%. 15 respondents from the general group did not suffer from arterial hypertension.

Conclusions. The master's work presents an overview of international data on the problem of COVID-19 as a global pandemic of the 21st century. The relationship between the transferred infection and the occurrence or progression of arterial hypertension in different age groups was revealed. Socio-demographic differences with arterial hypertension and a history of COVID-19 were analyzed, the frequency of behavioral risk factors and bad habits among younger (17-44 years; 46 people) and older (45-74 years; 56 people) respondents was disclosed. The features of advanced complaints and prescribed cardiac drugs were studied, also the main vaccines, which were used for the prevention of COVID-19. The results with obtainment of controlled blood pressure were determined. The necessity of using an interdisciplinary approach with the involvement of specialists from various fields of medicine (family doctors, cardiologists, pulmonologists, and pharmacists) is substantiated..

CLINICAL-AND-PHARMACEUTICAL APPROACHES TO THE USE OF TOPICAL DECONGESTANTS

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Scientific supervisor: assist. prof. **Tetiana Ryvak**, PhD.

Keywords: questionnaire, local decongestants, self-medication.

Introduction. Topical decongestants are over-the-counter drugs that are widely used by patients for the symptomatic treatment of nasal congestion, which is common in a number of conditions. Often, patients without control take these drugs, so they have the potential for serious adverse reactions. Therefore, the importance of rationalization pharmacotherapy associated with the use of nasal vasoconstrictors is increasing.

Materials and methods. The study covered 300 respondents of different ages and fields of activity, who filled out a questionnaire according to a specially formed protocol regarding problematic issues of the use of local decongestants. Methods used: system analysis, questionnaire, statistical, clinical and pharmaceutical.

Results. Irresponsible self-medication, frequent and long-term use of local decongestants leads to a number of problems, in particular tachyphylaxis and medicamentous rhinitis. For symptomatic treatment, respondents use drugs with active substances: oxymetazoline, xylometazoline, naphazoline, and phenylephrine. Most respondents (62.6%) suffer from symptoms of runny nose and nasal congestion in the winter-autumn period, 33.3% don`t associate the existing symptoms with seasonality, and 4.0% of respondents note that their symptoms appear in the spring-summer period. Since 62.0% of respondents have manifestations of adverse reactions to local anti-edema drugs; 58.0% - when choosing nasal medications, they rely on their own experience; 25.7% - are not knowledgeable of the addiction risk. 24.7% - exceed the dosage, using drugs from 5-6 to 8 times a day; 21.6% – use vasoconstrictor from 8 days to more than 1 month; 17.0% - don’t know that the uncontrolled use of nasal drugs can cause toxicity, we consider the pharmacist's advice when dispensing local decongestants to be essential.

Conclusions. Thus, the pharmacist's role in dispensing local decongestants consists of 1) finding out drug-related problems and taking specific measures to prevent them; 2) provision of pharmaceutical care regarding the effective and safe use of this group of over-the-counter drugs; 3) contributing to the formation of a responsible attitude of the patient to his own health.

CLINICAL-PHARMACEUTICAL METHOD IN THE USE OF ANTIVIRAL DRUGS FOR COVID-19

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Scientific supervisior: assistant professor **Marta Zayats**.

Keywords: Covid-19, antiviral drugs, quality of pharmacotherapy, pharmacoeconomics analysis.

Introduction: influenza and acute respiratory viral infections are the most common diseases in the modern world. This group corresponds to most of 95% of infectious diseases. Antiviral drugs help fight infection. Many of them are able to activate the virus "on the way" to the cell, in other words, protect it from infection. But if the virus is already in the body, there is only a limited range of drugs that can destroy it, not the cells.

Materials and methods: informative, searching, analytical, comparative, questionnaire survey

Results: in the process of work, 200 respondents were interviewed. A large percentage of those interviewed are young people aged 20-35. The risk of the disease is high because among the respondents 46,5% are medical workers who have direct contact with infected persons. According to the survey on the use of antiviral drugs, we learned that 45% of people took antiviral drugs for Covid-19. Thus, we discovered that remdesavir was prescribed to 7,5% of respondents; Molnupiravir was prescribed to 8,5%; oseltamivir (18%) respondents; Famipiravir was prescribed to 2% of participants and Intervax to 4% of respondents; 3% of participants were prescribed enisemium; Bamlanivimab was taken by 1,5% of participants; lopinavir+ritonavir was prescribed to 1,5% of respondents. Covid-19 is a complex disease that includes a list of different symptoms, such as: headache, aches, general weakness, fever. To alleviate these symptoms, analgesics or nonsteroidal anti-inflammatory drugs are recommended, taking into account the nature of the headache, age and existing chronic diseases of the patient; drugs of choice are paracetamol (31,5%) or ibuprofen (36,5%).

Conclusion:a number of modern Ukrainian and foreign scientists and doctors are developing different approaches to the treatment of Covid-19 and the complications it leads to. However, a single algorithm for the treatment of coronavirus with the help of antiviral drugs has already been developed and tested.

CLINICAL-AND-PHARMACEUTICAL FEATURES OF THE PHARMACOTHERAPY OF RHEUMATIC DISEASES BEFORE AND AFTER THE DISEASE WITH COVID-19

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Keywords: rheumatic diseases, rheumatoid arthritis, SARS-CoV-2, COVID-19, pharmacotherapy.

Introduction. Today, the incidence of rheumatic diseases is high worldwide, including in Ukraine. Rheumatoid arthritis (RA) is the most common form of inflammatory joint disease, observed in 1% of the world population. Compared to individuals of the same sex and age who do not suffer from RA, patients with this pathology have a 2.5 times higher mortality rate. For various reasons, RA reduces patients' life expectancy by 5-10 years.

However, society has faced new challenges in recent years, with the COVID-19 pandemic being the most significant. The pandemic has challenged people with rheumatic diseases since COVID-19's consequences are primarily affected by associated diseases or treatment methods.

Materials and methods. Systematic and comparative analysis, clinical pharmaceutical, and bibliographic methods

Results. For the pharmacotherapy (PT) of RA, immunosuppressive therapy should be used, which leads to general immunosuppression and can increase the risk of developing COVID-19 infection as well as contribute to its severe course. Therefore, it is necessary to ensure a balance between immune system support and reducing its activity when treating RA patients with COVID-19.

Patients with RA and positive SARS-CoV-2 test results or mild COVID-19 symptoms with risk factors for negative outcomes should stop taking immunomodulatory agents and consider the possibility of PT with antiviral drugs.

Vaccination, including booster doses, can provide additional protection against COVID-19 infection for patients with RA, which is especially important for patients with immunosuppression.

The analysis of drug prescription forms showed that the percentage of patients receiving combined basic PT for RA is higher for the group that recovered from COVID-19 and accounts for 67% against the 22% for the group that did not encounter COVID-19.

Conclusions. In our opinion, the examined clinical pharmaceutical specifics of PT for RA before, during, and after COVID-19 can improve the effectiveness of the treatment and prevent risks of severe disease course.

CLINICAL-AND-PHARMACEUTICAL ASPECTS OF RATIONAL USE OF ANTIPLATELET AGENTS

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Keywords: questionnaire, antiplatelet drugs, acetylsalicylic acid (ASA), treatment, and prevention of cardiovascular diseases (CVD).

Introduction. Over the last decade, antiplatelet agents have significantly improved clinical outcomes for patients, particularly by reducing mortality rates from CVD. However, complications, primarily bleeding, remain relatively common. The presence of a significant number of antiplatelet agents on the pharmaceutical market, the belonging of low-dose ASA to the group of OTC drugs, and the possibility of using it for self-treatment in Ukraine make the research topic relevant.

Materials and Methods. The research covered 185 respondents of different ages and fields of activity who carried a sample questionnaire specially formed protocol concerning problem issues relating to the antiplatelet drug's use. The standardized poll algorithm was used, which allowed to achievement equality of conditions within the study group. The system approach, sociological (questionnaire), statistical, clinical-and-pharmaceutical methods are used.

Results. It was found that 59.5% of respondents use antiplatelet agents for both treatment and prevention of a significant number of pathologies, using the following drugs: ASA; clopidogrel, cilostazol, ticagrelor, and prasugrel. Most often (41.1%) of the respondents take drugs to thin the blood to prevent the development of a heart attack or stroke (primary prevention), 37.8% to prevent thrombosis during Covid-19, each 22.2% after a heart attack or stroke (secondary prevention), and as part of complex treatment of heart diseases. Considering that 78.8% of the respondents have side effects when using antiplatelet drugs, 59.4% temporarily or completely stop taking blood thinners, 34.6% independently replace one antiplatelet agent with another. 26.5% - when choosing antiplatelet agents, they rely on their own experience, advice from relatives and acquaintances, advertising, and online resources; 18.9% - take a so-called "vacation from medicines" (days free from taking any medication), 9.7% - take medications depending on their well-being. We consider the role of the pharmacist dispensing antiplatelet agents to be important to warn of all possible complications of pharmacotherapy.

Conclusions. 1. Since practically all antithrombotic drugs belong to prescription drugs, except low-dose ASA, we consider it unacceptable to use this group of drugs at one's discretion or for self-medication. Before using any medication for thrombosis prevention, it is necessary to consult a doctor and/or a pharmacist.

2. Based on the results of our research, we have developed a project of a pharmacist protocol for dispensing non-prescription drugs for "Thrombosis Prevention".

CLINICAL PHARMACEUTICAL MANAGEMENT OF POST COVID SYNDROME

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Key words: COVID 19, post-COVID syndrome, antiviral medicines, Pharmaceutical care.

Introduction. Post COVID syndrome is unidentified signs or symptoms which are kept for 12 weeks and longer after the transmitted COVID-19 and developed during or after the therapy. Although the mechanism of its flow is not studied enough, the passage of the blood-brain barrier resulted in the growth of the level of C-reactive protein and interleukin of most of the patients.

Materials and methods. Highly evidential data of evidence-based medicine (Cochrane Collaboration, Google Scholar, PubMed) have been used as materials. Such methods of investigation as bibliographic, research, informational, analytical, statistical, method of system analysis and a method of conducting a questionnaire were used.

Results. The anonymous randomized poll was conducted and 205 responds received. The questions concerned COVID-19 and post COVID syndrome. Based on the received data, the following conclusion can be made: vaccination cannot guarantee that the human body will not be infected with a virus. Thus, 37,0 % of the respondents have completed the vaccination course but were infected with COVID – 19. It has been determined that 30,7% respondents had post COVID syndrome symptoms which are fatigue (22%), loss of smell and taste (13%), headache (12%), cough (10%), sleep disorder (9%), an intense heartbeat (6%), alert (6%). Most of the respondents did not consult the doctor and it made the process of recovery longer and more complicated. The most popular medical preparations used by the respondents were antiviral (Favipiravir, Sotrolizumab, Amiksin, Novirin), anti-inflammatory (diclofenac) and fever-reducing medicine (Paracetamol, Ibuprofen).

Conclusion. Post COVID syndrome is the most complicated sequence of COVID-19 for the reason of its duration and the wide-ranging symptoms which are difficult to cure. Doctors use different schemes of pharmacotherapy however all of them include antiviral medicines. Also, the reprofiling of medicines is widespread because at the moment of virus emergence it was not mentioned in the instructions an indication for the appointment.

CLINICAL AND PHARMACEUTICAL ASPECTS OF INFECTIOUS DISEASES MANAGEMENT IN GYNECOLOGY

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Keywords: management, gynecological infections, vulvovaginal candidiasis, pharmacotherapy.

Introduction: Infectious diseases in gynecology are serious medical and social problems. The most common disease is vulvovaginal candidiasis (VVC), which affects more than 75% of women of reproductive age. The treatment of infectious diseases (including VVC) includes medicines for **etiologic t**herapy, inappropriate use of which is related to the global threat (antimicrobial resistance). Thus, rational etiologic therapy is crucial in the management of gynecology infections.

The study aimed to carry out the analysis and clinical-pharmaceutical evaluation of evidence-based strategies of gynecological infections management; to determine the problems related to the management of VVC in clinical practice. Research methods: bibliographic, system analysis, clinical-pharmaceutical, clinical-pharmacological, method of comparison, and survey.

Results. In this study, the main gynecological infections and their treatment were considered. The analysis of (1) WHO guidelines, (2) The British Association of Sexual Health HIV recommendations, and (3) The guidelines German, Austrian, and Swiss Society of Gynecology and Obstetrics revealed the main strategies of evidence-based management of VVC. According to the results of the questionnaire survey, 68,0% of study participants had VVC, 32% of them during the last year. It should be mentioned that 5,4% of women had VVC at least 4 times during the last year which could be assumed as recurrent VVC.

Emotional tension/stress (67,3%) and antibiotics (43,1%) were the most frequent factors that contributed to the VVC. Women mentioned different ways of VVC treatment, some of which are inappropriate. For instance, 14.8% and 13.6% of participants used oral medicinal forms of nystatin and pimafucin, which are indicated only for gastrointestinal candidiasis; 10.3% - douched, 8.6% - took warm water bathtubs.

Another 22.4% of women indicated that they treated a sexual partner, which has no complaints. Not a mandatory element of candidiasis management was to avoid sexual contact, which, however, was followed by 17,2% of women.

Conclusions. The treatment of gynecological infections (in particular, VVC) in clinical practice is often inappropriate. In this study, we found the main problems associated with the management of VVC and gave recommendations on how to improve the quality and safety of its treatment.

DEPARTMENT OF DRUG TECHNOLOGY AND BIOPHARMACY

(Head of the department – accoc. prof. **Svitlana Bilous**)

DEVELOPMENT OF THE COMPOSIYION AND TECHNOLOGY OF REMEDY FOR PREVENTION OF POSTACNE

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Keywords :acne , post acne , serum , AHA- acids.

Introduction. Acne is one of the most common skin diseases which dermatologists are working with. Usually acne affects adolescents and it passes without big consequences, but some people have to cure postacne - it happens when the acne disease has a recurrent course with a significant complication. Care for the problem skin should prevent the occurrence of post acne and work in complex. It is very important for the composition of the agent include substances that exhibit antimicrobial, anti-inflammatory, moisturizing and regenerative effects. There are a lot of many cosmetic forms for the prevention of post-acne: creams, gels, masks, scrubs, tonics, lotions, etc. But these cures are weak to deal with post-acne. Since the disease brings discomfort and has a psychological impact on patients, the actual task is to develop a new, safe, affordable and effective method to prevent the occurrence of post-acne.

Materials and methods. The object of the study is serum based on ANA-acids.. The subject of research is the development of cosmetic cure for the prevention of post acne. Methods: pharmaco- technological, physico-chemical, analysis of literature.

Results. An analysis of the range of products for the treatment and prevention of postacne in three pharmacies in Lviv was carried out. It is established that the leader among the countries of producers is France. There are preservatives and surfactants that have a negative effect on the skin, namely irritation and allergic reactions what are included into many cosmetics. The data obtained as a result of market analysis indicate the prospect of creating a new domestic cosmetic in the form of serum, which will be safe and universal.

On the basis of theoretical and experimental studies, the composition of serum was developed. As biologically active components, ANA-acids were introduced: almond and lactic, which exhibit keratoticic, moisturizing, restorative and bleaching effects, which will lead to the effective removal of postacne, deeper penetration of active substances into the skin and quick solution of the problem. Also the composition includes rosemary hydrolate exhibiting bactericidal and regenerative effects; grape seed oil as an antioxidant and moisturizing component; allantoin as a soothing ingredient; glycerol as a softening and natural broad-spectrum preservative - Optiphen MIT Ultra.

Serum technology is developed and technological scheme of production is proposed. Serum quality was assessed by external parameters, pH value and

consumer properties. It was found that the cosmetic form is stable when it stored for 6 months.

Conclusion. Theoretically and experimentally, the composition of a new cosmetic product in the form of serum for the prevention of postacne with almond and lactic acids is substantiated. The results of the studies indicate that the developed serum meets the requirements of current regulatory documents and this sample can be recommended for further studies for introduction into production.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF TOOTHPASTE BASED ON THE PLANT COMPONENT– CHAMOMILE FLOWERS

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Keywords: toothpaste, Matricaria Chamomilla, oral cavity, oral hygiene.

Introduction. Hygiene products have an important role in the daily care of the oral cavity. An untreated oral cavity is an accumulation of a whole complex of factors that damage the periodontium. Even though the pharmaceutical market presents a large number of items meant for oral hygiene, in particular, brushes, floss, interdental brushes, as well as toothpaste, rinses, elixirs, powders, and many other items and tools. It is quite difficult for the consumer to understand this list. In addition, everyone's oral health is unique, so an individual approach is important, preferably with the consultation with a dental hygienist. Toothpaste is the most common and convenient tool for oral care. Therefore, we chose this hygienic form for research.

Materials and methods. Methods of information search and processing of data from scientific sources available in the form of Internet resources and magazine articles were used, and experimental research was carried out.

Results. The direct purpose of toothpaste is to clean the surface of teeth, gums, interdental spaces, and tongue from food residues, plaque, and mucus, remove dental plaque and prevent microbial contamination due to chemical and mechanical effects. Toothpaste not only prevents the development of dental diseases but also reduces the infectious load on the body as a whole. We chose Matricaria Chamomilla (M. Chamomilla) flowers as an active ingredient for the toothpaste. Matricaria Chamomilla contains 120 chemical components, in particular, chamazulene, apigenin, and luteolin, which have anti-inflammatory, bactericidal, and anti-allergic effects. M. Chamomilla products are effective for acute inflammation of the gums, periodontitis, the condition after tooth extraction, and mechanical irritation of the mucous membrane of the oral cavity, for example, with dentures and braces. We analyzed literary sources

and determined organoleptic indicators, such as color, smell, taste, determination of compliance of filling mass, and acid-alkaline balance (pH 7-7.5). The antimicrobial activity of aqueous M. Chamomilla extract was determined on standard strains, in particular mesophilic aerobic and facultative anaerobic microorganisms, Candida yeast, Enterobacteriaceae, Pseudomonas aeruginosa, Staphylococcus aureus, since, according to research, the extract of M. Chamomilla like shows antimicrobial activity. As a result of extemporaneous production, the composition of a cosmetic product in the form of toothpaste with an aqueous extract of M. Chamomilla was developed to achieve a better anti-inflammatory effect and a more pronounced antimicrobial effect in the care of the oral cavity.

Conclusions. The development of toothpaste with M. Chamomilla is an improved approach to the prevention of inflammatory diseases of the oral cavity, the possibility of more active cleaning of teeth from plaque, and freshening of breath, which is important for the daily care of the oral cavity.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF PRODUCT FOR THE TREATMENT OF FOOT CRACKS

Iryna Basai

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Keywords: foot cracks, water-in-oil emulsion, dexpanthenol, sodium lactate.

Introduction. The issue of the foot cracks -is a problem that affects both women and men equally. In the absence of proper and timely care, the cracks of the feet become deeper and deeper, begin to bleed, cause pain with physical exertion and walking, increase the risk of infection, which can potentially lead to the occurrence of an open wound and a deep infection of the feet, which is especially dangerous for patients with diabetes and disease peripheral vessels. Despite the wide range of cosmetics for the care of dry and cracked skin of the feet, the urgent issue is the development of a domestic medicinal product with a high concentration of active pharmaceutical ingredients, which will effectively and safely counteract excessive dryness of the skin of the feet, have softening and regenerating effects.

Materials and methods. The following methods were used to perform the study: data analysis of literature; technological, quality control methods of analysis; generalization, systematization and comparison of information; technological experimental studies, quality control studies: organoleptic (color, smell); physico-chemical and chemical (determination of pH, colloidal stability and thermal stability); microscopic studies (determination of the type of emulsion).

Results. Literature data on the causes of xerosis and cracks of the foot, possible negative consequences in the form of infectious complications and deterioration of the quality of life of patients as a whole were analyzed. Rational treatment of xerosis of the feet preserves the function of the epidermal barrier, helps protect the deeper structures of the skin from infection and physical damage. For the treatment of cracks on the heels, softening, moisturizing, keratolytic and regenerating agents are used.

For the development of the cream, an emulsion base of the "water in oil" type was chosen, which will ensure the delivery of active ingredients to the deep layers of the skin, long-term softening and hydration of the epidermis. Based on literature data, the composition of the cream for the treatment and prevention of xerosis and cracked feet is proposed: dexpanthenol in a concentration of 2%, sodium lactate - 5%, CO2-extract of calendula - 1% and CO2-extract of rosehip - 2% were selected as active pharmaceutical ingredients. The emulsion base includes vegetable oils (sunflower, olive, grape seed, cocoa) and wax.

The required amount of emulsifiers was calculated according to the values of the gyrophilic-lipophilic balance, theoretical calculations were experimentally confirmed by making model samples of the emulsion base of the cream. A laboratory technology for obtaining an emulsion cream has been developed and substantiated, which involves a high-high temperature mode of preparation, a certain order and method of introducing active substances. A block diagram of production in industrial conditions is proposed, which includes 8 stages. Organoleptic quality indicators, determination of pH, colloidal stability and thermal stability were determined for test samples of the cream. Stability of quality indicators during 3 months of storage was established.

Conclusion. The composition of emulsion cream with dexpanthenol, sodium lactate, CO2-extracts of calendula and rosehip for the prevention and treatment of foot cracks was worked out, laboratory technology was developed and a technological scheme of industrial production was propo.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF SEMI-SOLID MEDICINAL PRODUCT WITH ANTIBACTERIAL AND WOUND HEALING ACTIVITY FOR USE AFTER COMPLEX AND ATYPICAL TOOTH EXTRACTIONS

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Keywords: oromucous gel, chlorhexidine bigluconate, hyaluronic acid, carbomer, prevention of alveolitis.

Introduction. Today, tooth extraction is the most common intervention in the outpatient practice of surgical dentistry. The search for medicaments and methods for use in the postoperative period after complex and atypical tooth extractions for the prevention of complications and treatment of alveolitis in the future remains an urgent problem, since modern pharmacotherapeutic agents cannot completely solve it.

Materials and methods. It is utilized methods of information search, data analysis of literature; technological, quality control methods of analysis; generalization, systematization and comparison of information; technological experimental studies, quality control studies: organoleptic (color, smell); physico-chemical and chemical (determination of pH, colloidal stability and thermal stability).

Results. Data from literary sources regarding the features of the tooth extraction operation and subsequent pharmacotherapy for the prevention and treatment of complications have been processed. The most common complications after removal surgery are postoperative pain, swelling, trismus, infection, prolonged bleeding, and alveolitis. Medicaments and medical products that are registered in Ukraine and used in hospitals and polyclinics in Lviv were analyzed. It was established that medicinal products of various groups with antibacterial, antiseptic APIs, anesthetics, as well as medical products of various effects, which can only be used by a doctor, are used. The expediency of creating a new combined medicinal product in the form of a gel was determined. Gels belong to the new generation of dentistry, as they provide a long-lasting effect of active substances and are convenient to use. The optimally selected composition of gel bases ensures the necessary adhesion to mucous membranes and high bioavailability of active pharmaceutical ingredients. It was established that during the pharmaceutical development of orumucous gels, it is necessary to justify the introduction of various groups of auxiliary substances: gelling agents, solvents, penetrants, humectants and preservatives.

Based on literature data, the composition of the combined gel for use after complex and atypical tooth extractions is proposed: chlorhexidine bigluconate 0.2%, hyaluronic acid in the form of sodium hyaluronate 0.2%, and lidocaine hydrochloride 2% in order to provide antibacterial, wound-healing, and anesthetic effects, respectively. Hydroxyethyl cellulose (gelling agent), carbomer (gelling agent), glycerin (moisturizer) and triethanolamine (pH regulator) were selected as auxiliary substances.A laboratory technology for obtaining a combined gel has been developed and substantiated, which involves the preparation of a concentrated gel base, a certain order and method of introducing active substances.

A block diagram of production in industrial conditions is proposed, which includes 7 stages. The selection of the main quality indicators of the

developed drug, limits of acceptability, as well as methods of their control was made. Organoleptic quality indicators, determination of pH, colloidal stability and thermal stability were determined for the experimental samples.

Conclusion. The compositions of oromucosal gels from chlorhexidine bigluconate, sodium hyaluronate and lidocaine hydrochloride for use after tooth extraction were developed, the manufacturing technology was developed in pharmacy conditions, and a technological scheme for industrial production was proposed.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF COSMETIC PRODUCT FOR PROBLEM SKIN

Khrystyna Petryshyn
Scientific supervisor: prof. **S.B. Bilous,** PhD, DSci.

Keywords: creams, problem skin, acne, silver nanoparticles, sodium hyaluronate, adsorbents.

Introduction: Problem skin, as a type of oily skin, has its own characteristics compared to other types of skin, which requires the use of special approaches to care. Despite the large assortment of cosmetics for the oily skin care on the pharmaceutical and cosmetic market of Ukraine, the correction of conditions associated with problem skin remains an important issue, therefore, there is a need to develop new cosmetic products for this direction of action.

Materials and methods: Methods of information search, literature data analysis and technological methods have been used.

Results: The oiliness of the skin is related to hormone levels and lifestyle, as well as the environment, diet, stress, genetic predisposition and gastrointestinal diseases. Increased activity of sebaceous glands leads to clogging of pores and their expansion. At the same time, a favorable environment is created for the development and reproduction of bacteria that provoke not only acne, but also more complex inflammatory processes on the surface of the skin and in its internal structure and make the skin sensitive.

The optimal product for the problem skin care is a combined cream based on an oil/water emulsion, which includes antimicrobial, moisturizing and adsorbing components. Thanks to this component composition, the cream will moisturize the skin well, adsorb excess sebum, will not leave a greasy feeling after application to the skin, and will have an antimicrobial effect.

When developing a cream for the problem skin care the following components were selected - silver nanocomposition and eucalyptus oil, which provide antimicrobial action, zinc oxide and white clay as drying components, sodium hyaluronate, which will promote the regeneration of the epidermis and

protect tissues from drying, and emollients - white soft paraffin and grape seed oil.

The following ingredients were used as auxiliary components of the cream for problem skin: hostacerin as an emulsifier, carbopol as a thickener, glycerin as a humectant, ammonia solution as a pH regulator, phenoxyethanol as a preservative, and purified water as a solvent.

The cream technology is substantiated and a block scheme of production is developed, which involves the use of the following technological stages: preparation of the aqueous phase, preparation of the oil phase, emulsification, introduction of the suspension phase, introduction of thermolabile biologically active substances and packaging.

Conclusions. The composition and technology of the combined cream based on an oil/water emulsion have been developed, which can be effective both for eliminating the symptoms of excessive skin oiliness and for the prevention and treatment of acne and other conditions associated with problem skin.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF SEMI-SOLID DOSAGE FORM WITH PHYCOCYANIN

Mariia Feger
Supervisor: prof. **N.I. Hudz**

Topicality. The use of natural dyes in food and cosmetic products and medicinal products due to the toxic effect of synthetic dyes is considered a promising direction of research in pharmaceutical technology. Phycocyanin is one of the pigments of cyanobacteria, which is extracted from cells by cycles of freezing/thawing, ultrasonic destruction, precipitation with ammonium sulfate, and dialysis. The use of phycocyanin has expanded since its approval by the Food and Drug Administration in the United States of America. Phycocyanin has antioxidant, anti-inflammatory, anti-cancer, wound-healing and hepatoprotective properties. Antimicrobial properties were also revealed, in particular, antibacterial and antifungal activity against *Candida albicans*, *Streptococcus* sp., *Staphylococcus* sp., *Escherichia coli*, *Bacillus* sp., and *Pseudomonas* sp., *Bacillus subtilis*, and *Xanthomonas* sps. Therefore, the development of creams with phycocianin for the treatment of wounds in the second and third phases is topical issue of pharmaceutical technology.

The purpose of the study was to develop the composition and technology and to conduct research on the wound healing cream on the base of oleum Lini and phycocianin.

Materials and methods. While carrying out the research the following methods were used: analysis, synthesis, systematization and comparison of the

information for processing of published scientific data on the composition and assignment of semisolid dosage forms depending on the phase of the wound process; biological method for the estimation of safety of the developed cream (test with the chorioallantoic membrane).

Results. As a result of the performed work, the composition features of creams were characterised. The composition of the wound healing cream is proposed. Lini oleum and phycocianin were main components of the developed cream. The functional purpose of the cream components was justified. Cetostearyl alcohol and glycerol monostearate serve as emulsifiers w/o and thickeners of the emulsion system. Twin 20 is a type I emulsifier. Vitamins E and A are lipophilic antioxidants and agents that affect the biochemical processes in the skin.

The high/high temperature regime was used in the preparation of the developed cream. The essense of this regime consists in a separate preparation of the oily and aqueous phases, heating the two phases to a temperature higher than the melting point of the cream component with the highest melting point (70-90 °C). Then the two phases were combined with the subsequent stirring of the coarse emulsion to form a creamy mass during gradual cooling. After cooling phycocianin and vitamins were added as tempolabile substances.

Conclusion: The developed cream is of blue colour and light look. According to the classification of the irritation index, the cream with 1% phycocyanin does not cause irritation in the test with the chorioallantoic membrane.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF ANTIFUNGAL MEDICINAL PRODUCT FOR TOPICAL USE

Maryana Salash
Scientific supervisor: assoc.prof. **K. F. Vashchenko**, PhD, PhD.

Keywords: mycoses, antifungal agents, ointments, composition, technology, calendula tincture, tea tree essential oil, lavender essential oil.

Introduction. According to the World Health Organization, every fifth inhabitant of our planet suffers from some fungal disease. One of the most common fungal infections is microsporia, which ranks second after mycosis of the feet and hands. Many drugs have been proposed for the treatment of microsporia, but the problem of effective treatment cannot be completely solved. Most of the drugs have many contraindications and side effects, and, in addition, as a rule, have a narrow spectrum of antifungal activity, therefore the development of antifungal agents based on plant raw materials, which will provide a combined effect and have significant advantages compared to agents containing active pharmaceutical ingredients of synthetic origin, is actual.

Materials and methods. Objects of research – tincture of calendula, essential oils of tea tree and lavender, and experimental samples of ointments on a hydrophilic basis. Methods included literature monitoring, grouping and systematization of information, logical analysis, physical, physical-chemical and pharmacotechnological methods.

Results. Classification and characteristics of fungal diseases, treatment methods are considered. The results of the analysis of information sourcshowed that an effective method of treatment of fungal skin diseases, in particular microsporia, is local therapy.

The assortment of antifungal drugs registered in Ukraine was analyzed. It has been established that drugs in soft dosage forms predominate. Hydrophilic ointments are the most rational medicinal form for the treatment of dermatomycoses, because along with high fungicidal effect, they have significant advantages compared to other medicinal forms for external use. Combined drugs that combine antifungal ingredients with different mechanisms of action are optimal for local treatment. Promising active components of such products are extracts from plant raw materials and essential oils. The inclusion of calendula tincture and a mixture of essential oils – tea tree and lavender as active ingredients in the composition of the hydrophilic ointment, which will provide the product with an antifungal, antibacterial, and anti-inflammatory effect, is justified. As a result of physico-chemical and technological studies, the composition of the hydrophilic base of the ointment – a mixture of PEO 400 and PEO 1500 in a ratio of 1:1, respectively, was substantiated. Propylene glycol is included in the ointment base, which quickly and easily penetrates into the skin cells and creates an osmotic balance between the cell cytoplasm and the osmotically active drug, which allows to avoid osmotic shock of the tissues of the affected skin surface.

A rational ointment technology has been developed, which provides for a certain temperature regime, the order of introduction of ingredients, and the mode of mixing. Based on the proven technology, a technological block diagram of ointment production in industrial conditions was developed, which consists of 6 stages. Quality indicators of antifungal ointment and stability during storage were studied.

Conclusions. The composition and technology of antifungal ointment based on plant raw materials have been worked out. The specially selected composition of the ointment, taking into account the properties of the active ingredients, will provide antifungal, antiseptic, and anti-inflammatory effects.

DEVELOPMENT OF COMPOSITION AND TECHNOLOGY OF MEDICINAL PRODUCT WITH ANTIVIRAL ACTIVITY

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Keywords: herpes simplex virus, mangiferin, gel, technology.

Introduction. A promising area of modern pharmaceutical technology is the search for effective compounds based on natural biologically active substances, which, due to their multicomponent composition, have a wide range of pharmacological effects. Medicinal plant raw materials and/or their components contain a number of natural biologically active substances that are easily incorporated into the body's metabolic processes, characterized by low toxicity and soft effects. Such complex preparations are less toxic, which distinguishes them from medicines of microbial and synthetic origin. In this sense, a natural product such as mangiferin is promising, as it has a wide range of pharmacological properties, including antiviral activity against DNA-containing viruses (herpes viruses of the first and second types, varicella-zoster virus, human immunodeficiency virus, cytomegaloviruses). Studies have shown the ability of mangiferin to penetrate the stratum corneum and pass into the epidermis and dermis, which indicates the feasibility of using mangiferin in preparations for topical use.

The aim of the study was to analyze the literature data, determine the prospects for the use of mangiferin in medicine and pharmacy, and develop the composition and technology of an antiviral gel.

Materials and methods. The study materials were experimental samples of antiviral gel. Methods of system analysis (study of literature data, Internet); organoleptic and physico-chemical methods were used.

Results. According to the results of the study of the pharmaceutical market of antiviral drugs, it was found that many antiviral drugs are used to treat HSV-1 and HSV-2 infections, the main active substances of which are acyclovir, penciclovir and imiquimod. The composition of the antiviral gel was developed, which contains mangiferin as an API and carbopol as a gelling agent, glycerin (a nonaqueous hydrophilic solvent that prevents gel drying), triethanolamine (pH regulator) PEG-400 as a co-solvent, potassium sorbate as a preservative, and purified water (solvent). The technology for manufacturing the gel in industrial conditions is proposed, consisting of the following stages: preparation of raw materials, preparation of the gel base, preparation of the API solution, preparation of the gel, packaging of the gel in tubes, packaging of tubes in packs, packaging of packs in group containers. The gel was studied in accordance with the requirements of regulatory documents for the following indicators: description, pH value, colloidal and thermal stability, and it was

confirmed that the developed gel meets all these parameters and, after a series of studies, can be introduced into industrial production.

Conclusion. As a result of the study, an experimental solution to the scientific problem was presented, which is to develop the composition and technology of a gel with mangiferin for the treatment of herpes simplex virus type I and II.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF THE ANTI-AGING CREAM

Seif Marina Maher Aslan
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Keywords: cream, skin aging, emollients, vitamins, hyaluronic acid, rose oil, mandarin oil.

Actuality. Skin aging is a natural process that occurs as we grow older. It is characterized by the gradual loss of skin elasticity and firmness, as well as the appearance of wrinkles, fine lines, and age spots. Despite the fact, that in the pharmaceutical and cosmetic market there is a large number of cosmetics with anti-aging effects, the search for new effective products to slow down skin aging is relevant.

Aim. To study the factors that can accelerate the aging process, the nomenclature and composition of anti-aging cosmetics, and to develop the composition and technology of cream with anti-aging action.

Materials and methods. Information search in scientific literature and web-resources, technological methods.

Results. Skin aging is a natural process that occurs over time as the body's cells and tissues change. Skin aging linked to alterations of dermal connective tissue due to the changes at the cell, gene and protein levels. These changes occur due to both intrinsic factors (genetics, hormonal changes) and extrinsic factors (environmental factors, lifestyle choices). To slow down the aging process and maintain healthy skin it is important to protect skin from sun exposure and use skin care products that contain antioxidants and other anti-aging ingredients. It is important to carefully choose the right anti-aging skin product that will ideally and specifically suit the skin type. The anti-aging product must be non-hypoallergenic, non-comedogenic and non-photo toxic.Based on the study of the modern approaches to the aging skin care, it has been found that non-greasy emulsion creams containing oils rich in unsaturated fatty acid are optimally used for this purpose. For preparing of cream we used: grape seed oil as emollient and anti-inflammatory agent; vitamins A, E and D as components that can help improve skin texture, reduce the appearance of fine lines and wrinkles, stimulate collagen production and act like antioxidant;

hyaluronic acid that can help improve skin hydration by attracting and retaining moisture in the skin; essential rose and mandarin oils to improve elasticity and lift the skin. Like auxiliary components in cream were used: carbomer as gelling agent for water phase, hostacerin as emulsifier, phenoxyethanol as antimicrobial preservative and glycerol as humectant. Designed cream has white color and pleasant smell. According to the organoleptic characteristics is stable for 3 months. pH of cream 6,3±0,5 that correspond to the pH of healthy skin.

Conclusion. Cream with grape seed oil, vitamins A, E and D, hyaluronic acid, essential rose and mandarin oils will help to slow down the aging process and maintain healthy skin. Designed cream will extend the range of cosmetic anti-aging products.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF CREAM WITH LAVENDER EXTRACT

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Supervisor: Prof. **N.I. Hudz**

Keywords: cream, technology, olive oil, extract, lavender flowers, wound-healing.

Introduction. A wound is any tissue damage that disrupts its integrity. The wounding process is a complex of general and local biological reactions of the tissues that develop in response to the presence of infection and tissue destruction aimed at healing. The development of wound-healing creams is a highly relevant topic in view of the large-scale war of the russian federation against Ukraine.

The aim of the study was to develop a composition and technology and conduct the research of cream with anti-inflammatory and antimicrobial properties, which in turn promote wound healing.

Materials and methods. While carrying out the research the following methods were used: analysis, synthesis, systematization, and comparison of the information for the processing of published scientific data on the composition. Experimental and analytical studies.

Results. According to the results of this work, information on the botanical characteristics of lavender and its physical and chemical properties is summarized. Due to the presence of a large amount of biologically active substances, it was decided to develop the composition and technology of emulsion-based creams, which include an alcoholic fluid extract (tincture) of lavender flowers, which has anti-inflammatory antimicrobial activity, which is a prerequisite for wound treatment. The functional purpose of each of the components of the cream is substantiated. Olive oil has an anti-inflammatory

and wound-healing effect. Cetostearyl alcohol and glycerol monostearate serve as emulsifiers and thickeners of the emulsion system. Twin 80 is an emulsifier of the first type. Vitamins E and A are used as lipophilic antioxidants and agents affecting biochemical processes in the skin.

The lavender fluid extract was prepared with aid of 70% ethanol in a ratio of 1 to 5. The tincture was made by remaceration at room temperature. After that, the extracts were filtered using a paper filter. 70% ethyl alcohol was chosen as a solvent to extract hydrophilic and lipophilic biologically active substances of lavender at the same time. As a result of the performed studies, light green tinctures of varying intensity were obtained. HLB indicators were determined for each of the studied samples and olive oil.

In the preparation of the cream, a high/high temperature mode was used, in which the oil and water phases were prepared separately by heating to a temperature higher than the melting point of the component of the cream with the highest melting point. The two phases were combined with subsequent mixing of the emulsion to form a creamy mass with gradual cooling. The tincture and vitamins were introduced into cream mass after its cooling.

Conclusion: A creamy white mass of dense consistency with a pronounced smell was obtained. The cream is used only externally, applying it to wounds or affected areas.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF MEDICINAL PRODUCT WITH ANTISEPTIC ACTIVITY

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Scientific supervisor: assoc. prof. **K.F. Vashchenko**, PhD.

Keywords: antiseptic preparations, chewing lozenges, chamomile extract, sage tincture, orange essential oil.

Introduction. Currently, antiseptics are widely used in medical practice for various infectious diseases, including diseases of the oral cavity and throat, but the range of oromucous antiseptics in the pharmaceutical market of Ukraine is quite limited. Therefore, a promising direction of research is the development of new oromucosal agents of combined action in a convenient dosage form (DF).

Materials and methods. Research objects: medicinal plant raw materials with antiseptic action, chewing lozenges with chamomile extract, sage tincture, orange essential oil. Methods: informative, physical, physical-chemical, and mathematical.

Results. The analysis of the literature data showed that among oromucous antiseptic agents, there are preparations based on plant raw materials, such as agents with extracts of eucalyptus, marigold flowers,

chamomile, Islamic moss, sorrel, etc., but most of the agents are produced in the form of rinsing solutions and sprays, which provide a short-term effect. Lozenges are a promising and convenient DF of oromucous antiseptic agents based on plant raw materials. Lozenges have significant advantages compared to other DF: they ensure the long-term presence of the medicinal substance in the oral cavity and comfort of use; they can be used by children and adults without problems; the retention time of the drug in the oral cavity increases, which increases its bioavailability. Therefore, chewable lozenges were chosen as the release form of the new oromucous agent. We have analyzed the composition of chewing lozenges, and systematized data on manufacturing methods and auxiliary substances used in the production of chewing lozenges. It is noted that natural thickeners - hydrocolloids - are often the basis for the production of lozenges. In addition to the base, pH regulators, emulsifiers, plasticizers, preservatives, as well as taste, smell, and color correctors are added to the lozenges as auxiliary substances.

The composition of chewing lozenges is theoretically and experimentally substantiated. Chewable pastilles include tincture of sage, dry chamomile extract, and orange essential oil; as auxiliary substances: gelling agent - agar-agar, moisturizer and plasticizer - glycerin, solvent - purified water, preservative - sorbic acid, taste corrector - sugar.

Based on the conducted experimental studies, rational technology of chewing lozenges was developed in industrial conditions and the conditions of a pharmacy. A technological block diagram of the production of chewing lozenges in industrial conditions is proposed. The technological process of production consists of 10 technological stages. The quality indicators of the developed medicinal product meet the basic requirements of the analytical and regulatory documentation. Lozenges are stable during storage.

Conclusions. The composition and technology of chewing lozenges with chamomile extract, sage tincture, and orange essential oil have been developed. Taking into account the properties of the introduced ingredients, lozenges will provide an antiseptic, anti-inflammatory, and analgesic effect.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF PHYTOPRODUCT WITH ANTI-INFLAMMATORY ACTIVITY

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Keywords: Anti-inflammatory drugs, herbal remedy, hydrogel, Callisia fragrans juice, Capsicum Tincture, Ginger essential oil.

Introduction. Inflammation is the most common pathological process. Rational pharmacotherapy of inflammatory diseases includes the usage of pain

relief and anti-inflammatory drugs. Despite the variety of such medications, sometimes their usage is insufficiently effective and safe. Therefore, there is a need to create new medicines that would have the above-mentioned properties and would not cause adverse reactions. Phyto-pharmaceuticals are among such means of drugs. Among the medicinal plants used in the therapy of inflammatory processes, callisia fragrans, which is widely used in folk medicine, deserves attention, however, in official medicine, the assortment of callisia remedies is limited. Hence, it is relevant to develop new anti-inflammatory herbal remedies from callisia fragrans for the purpose of implementing them into domestic manufacturing.

Materials and methods. The object of the research is a gel on the basis of herbal raw materials with anti-inflammatory effect. Methods included data monitoring, grouping and systematization of information, and logical analysis. Physical-chemical and technological methods were also used.

Results. The role of inflammation in the body was considered. The up-to-date state and prospects for the development of phytotherapy for inflammatory joint diseases were studied. Data from the literature on the chemical composition and pharmacological actions of Callisia fragrans were analyzed. The efficiency of anti-inflammatory phytoremedies of combined action and their insignificant range, and also the advantages of soft drugs for the treatment of external joint diseases were proven. A hydrogel was chosen as the form of release. As the active ingredients in the composition of the gel the Callisia fragrans juice, Capsicum pepper tincture, and Ginger essential oil were introduced. Based on the conducted experimental researches, the composition and rational technology of the hydrogel with the chosen herbal components were developed. A technological block diagram of hydrogel production in industrial conditions was prompted. The technological process of hydrogel production consists of 7 technological stages. The quality control of the developed medical product was conducted.

Conclusions. It was established that complex herbal remedies are optimal for effective therapy of inflammatory diseases. On the basis of the conducted experimental research, the composition, and technology of the new Phyto-pharmaceutical in the form of hydrogel including the Callisia fragrans juice, Capsicum pepper tincture, and Ginger essential oil were developed, and it can be recommended for further research. The combination of natural herbal components in the composition of the gel will relieve inflammation, will provide an analgesic effect, and will stimulate local immunity.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF COSMETIC PRODUCTS WITH ANTI-AGING EFFECT

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Keywords: skin aging**,** antiaging cosmetics, serums, creams, composition, technology

Introduction. Today, the share of anti-aging cosmetics among cosmetic products is growing. Anti-aging cosmetics allow you to influence the problems of a specific age, and prevent or mitigate their manifestation. The range of anti-aging cosmetic products is quite large, but the majority of such products are produced by foreign manufacturers, therefore the development and introduction into the production of new effective anti-aging cosmetic products, affordable, is an urgent and promising task of modern cosmetology and pharmacy.

Materials and methods. The object of the research is serum and cream with a vitamin complex and grape oil. Methods included data monitoring, grouping and systematization of information, and logical analysis. Physical-chemical and technological methods were also used.

Results. The mechanisms of skin aging were considered and the main approaches to the prevention and correction of skin aging were analysed. Systematized data on cosmetology products for the care of aging facial skin. The use of antiaging cosmetology products in various forms is important for the prevention of skin aging.

The choice of release forms of new face cosmetics with anti-aging effect is substantiated - water-based serum and emulsion-based cream of the m/v type. The serum is a means of intensive action. Due to the high concentration of active substances, the use of serums allows you to significantly improve the appearance of the skin and complexion, reduce the appearance of wrinkles, and increase the elasticity and tone of the skin. It is optimal to use the serum before applying the cream. The cream will enhance the effect of the serum.

The basic principles of component selection in the creation of new formulations of antiaging serums and creams have been studied and systematized, consideration of which will contribute to the creation of effective short-term care for aging skin.

The composition of the antiaging serum and cream for the care of aging facial skin, which contains low molecular weight hyaluronic acid and a complex of vitamins (C, A, E) as active components, has been theoretically and experimentally substantiated. As auxiliary substances for the serum used: purified water - solvent, glycerin - co-solvent, viscosity regulator, moisturizer; Euxyl is a preservative. The composition of the emulsion base of the cream includes purified water, glycerin - the hydrophilic phase; grape seed oil, and

lemon essential oil - hydrophobic phase, a mixture of emulsifiers - polysorbate 80 and glyceryl monostearate - stabilizers. Dimethicone is added to improve the texture of the cream.

The technology of anti-aging cosmetics - serum and cream, has been developed, technological block diagrams of the production of products in industrial conditions with the indication of critical control parameters during production have been proposed. The technological process of serum and cream production consists of 8 stages. The quality control of the developed tools was carried out.

Conclusions. The composition and technology of antiaging serum and cream with a vitamin complex have been developed. Taking into account the pharmacological properties of the active ingredients, the use of cosmetic products in the form of serum and cream will improve the appearance of the skin in terms of brightness, hydration and reduction of wrinkles.

DEVELOPMENT OF THE COMPOSITION AND TECHNOLOGY OF MEDICINAL PRODUCT FOR THE TREATMENT OF SCABIES

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Keywords: scabies, treatment, gels, benzyl benzoate, clove essential oil.

Introduction. Despite significant achievements in the treatment and prevention of infectious diseases, the treatment of scabies remains a relevant issue today. In particular, there are some difficulties with prescribing external treatments for scabies, which are associated with the weak efficacy of widely used antiparasitic therapies, the emergence of resistance to drugs, and the inconvenience of their use. Therefore, the development of new combined drug therapies for scabies in a convenient drug form is currently a relevant issue.

Materials and methods. The research object is a combined gel with benzyl benzoate and clove essential oil. Methods included literature monitoring, grouping and systematization of information, logical analysis, physical, physical-chemical and pharmacotechnological methods.

Results. We have examined the causes, course, and typical symptoms of scabies. The main approaches to treating scabies have been processed and systematized. The results of the analysis of information sources have shown that local therapy is an effective method for treating scabies. The most commonly used medicinal ingredients for external treatment of scabies are benzyl benzoate and sulfur. Based on methodological approaches to the development of soft medicinal products, the choice of an optimal pharmaceutical form for treating scabies a gel has been substantiated. When choosing a form of medicinal product for local application, the main

advantages of gels were taken into account: they are quickly made, do not clog skin pores, and are quickly and evenly distributed. Due to the formation of water-based internal structures, chemically incompatible substances can be introduced into the gel, since the water shell prevents a chemical reaction between them. Gels also provide sustained release of active ingredients.

The main components of the gel are benzyl benzoate and clove essential oil. Benzyl benzoate provides acaricidal action against various types of mites, including scabies mites and Demodex mites. Clove essential oil has acaricidal, antifungal, bactericidal, anti-inflammatory, and analgesic properties.

The combination of medicinal ingredients with different mechanisms of action in the gel uarantees a high therapeutic effect by potentiating the action of active ingredients, and the use of the medicinal composition in the form of a gel provides a sustained action of the agent. The gel-forming agent - hydroxypropyl cellulose, solvent - purified water, moisturizer and penetrant propylene glycol were introduced as excipients.

As a result of theoretical and experimental research, we have developed a composition and technology for a gel for treating scabies and proposed a technological scheme for production. The developed gel meets the requirements of the State Pharmacopoeia of Ukraine and is stable during storage.

Conclusions. A composition and technology of gel with benzyl benzoate and clove oil have been developed. The developed gel meets the requirements of the National Pharmacopoeia, is stable during storage, and can be recommended for further research aimed at implementation into production.

DEPARTMENT OF ORGANIZATION

AND ECONOMICS OF PHARMACY

(Head of the department – prof. **Bohdan Hromovyk**)

STUDY OF THE ECONOMIC AVAILABILITY OF LEADING BY RETAIL SALES MEDICINES FOR THE POPULATION IN UKRAINE

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Keywords: economic availability of drugs, drug ratings, solvency adequacy ratio.

Introduction: The economic availability of medicines for the population is a fundamental factor in the accessibility of medicines in general. In Ukraine, the state finances only 12% of the total cost of medicines. This means that the lion's share of medicines is purchased by patients with their own funds, so the question of their ability to pay is critical and directly correlated with the availability of medicines.

Materials and methods: The method of systematic analysis of a set of data on the availability of medicines and top lists of medicines, the method of literature search, the method of assessing the economic availability of medicines and the survey method were used. Materials for the research were scientific and literary data and the results of questionnaires.

Results: The leaders in terms of pharmacy sales in Ukraine in 2022 were Xarelto, Nimesyl and Nurofen. The analysis of the economic affordability of the top 20 medicines was carried out on the basis of the calculation of the solvency adequacy ratio (S_{AR}). It was established that the largest share of drugs with S_{AR} of 0.01 (45%, 9 drugs, 8 of which are OTC-drugs (Nurofen, Evkazolin, Novirin, Fervex, Creon, Valsakor, Amiksin, Tivortin), and one is prescription (Gidazepam)); 5 drugs have a S_{AR} of 0.02 (4 OTC-drugs (Detralex, Bifren, Sinupret, Magne-B6), one prescription (Triplexam)); two OTC-drugs have a S_{AR} of 0.004 (Spazmalgon, No-shpa); each drug has a S_{AR} value of 0.001 (Citramon-Darnytsia, OTC-drug), 0.03 (Nimesyl, prescription drug), 0.05 (Xarelto, prescription drug) and 0.08 (Heptral, prescription drug). So the most economically affordable are: Spazmalgon, No-spa and Citramon-Darnytsia, and the least economically affordable – Nimesyl, Xarelto and Heptral.

An online population survey was conducted (64 respondents, 82.8% of whom are residents of the Ivano-Frankivsk region, 78.1% are women, and the average age is 33). 26.6% of respondents are employees and 23.4% - workers and students. The monthly income of 20.3% of respondents is from 5 to 10 thousand UAH, 17.2% - less than 5 thousand UAH and 20-25 thousand UAH, and 15.6% - 10-15 thousand UAH. Vitamins, painkillers and anti-inflammatory, anti-cold, anti-allergic, anti-hypertensive drugs and agents affecting the gastrointestinal tract are in the greatest demand. The most important factors when making a decision to purchase a drug are a doctor's appointment (79.7%) and a pharmacist's advice (28.1%). Regarding the cost of

pharmaceuticals, 40.6% of respondents are willing to pay for a blister / bottle / package of ampoules of medicines from UAH 100 to UAH 200, and 23.4% - only up to UAH 100. The average indicator of economic availability of drugs on a 5-point scale is 2.9.

Conclusion: The study of the economic availability of medicines for the population in Ukraine showed that it is at the level of 2.9 points on a 5-point scale, and the most important factors when making a decision to purchase medicines are the appointment of a doctor (for 8 out of 10 respondents) and advice pharmacist (for 3 out of 10).

STUDY OF THE PHARMACEUTICAL COMPONENT OF HELMINTOSES

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Keywords: parasitic diseases, helminth infections, anthelmintic drugs.

Introduction. Incidence of infectious and parasitic diseases is a significant threat to health. Almost a quarter of the population of Ukraine suffers from them every year. The relevance of the problem of helminthiasis is due primarily to the significant prevalence - 89% of all parasitic diseases, as well as the pronounced negative impact on the human body. Therefore, the substantiation of a set of measures to optimize the pharmaceutical component of helminthiasis based on marketing research is relevant.

Materials and methods. Statistical, marketing analysis, comparison, positioning, logical, analytical, bibliographic methods were used.

Results. Based on the generalization of scientific information and the study of official statistics, an analysis of the situation regarding the incidence of helminthiasis in the population of Ukraine was carried out. It has been established that 300-400 thousand cases of helminthiasis are registered in Ukraine every year, 80% of them in children. The specific weight of enterobiosis among the population of the state in the sum of all helminthiasis is 75-70%, ascariasis – 15-18%, trichocephalosis – 4-6%. The main reasons for the high incidence of helminthiasis in the population of Ukraine have been identified. A structural analysis of the segment of anthelmintic drugs according to the ATC classification was carried out. It was established that the largest assortment of drugs is represented in the P02C group – means used for nematodes. The marketing characteristics of the market segment of anthelmintic drugs were studied. It was established that domestic producers have the largest share (42%), Indian producers are in second place (23%), and Hungary is in third place (11%). The leaders among Ukrainian producers of anthelmintic drugs are LLC "Kusum Pharm" and LLC "Pharmaceutical

company "Zdorovya" with a market share of 18% each. The analyzed group of drugs is represented by oral dosage forms: tablets (45%), registered oral suspensions (33%) and chewable tablets (21%). Since children are the main group infected with helminths (84%), the presence of such a small number of children's dosage forms on the market is a negative sign. A study of the distribution channels of anthelmintic drugs was conducted by analyzing the offers of 7 wholesale drug intermediaries. The largest product range of the analyzed group of drugs is offered by the companies BaDM and OLKAR Pharm-Service. In 2023, the drugs Wormil chewable tablet 400mg 'Mili Healthcare' (Great Britain), Pirantel suspension 250mg/5ml and Pirantel tablet 250mg, Albela, enjoyed the greatest demand in 2023 tab. 400 mg manufactured by "Gledpharm Ltd" Ukraine – they were offered by all the wholesale intermediaries analyzed by us. The average purchase prices for the analyzed group of drugs were calculated, as well as the range of price fluctuations for each of the investigated drugs. In order to assess the availability of anthelmintics, the liquidity ratio (CL) of the prices of the studied group of drugs was calculated when assessing the price situation.

Conclusion. The results of the conducted research can be used to improve pharmaceutical care for patients with helminthiasis, as well as to optimize the assortment policy of the retail sector of the pharmaceutical market.

ANALYSIS OF THE PHARMACEUTICAL MARKET IN NIGERIA

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Keywords: drugs, pharmaceutical market, manufacturers, distributors, pharmacies

Introduction: The Nigeria pharmaceutical market is a growing market with significant potential for growth, driven by factors such as large population, increasing healthcare expenditure, and a growing middle class. However, the market faces several challenges, the including a lack of adequate funding, weak regulatory framework, and poor infrastructure.

Materials and methods. The materials for the research were scientific publications on the pharmaceutical market in Nigeria, the official website of the Ministry of Health of Nigeria, and our own calculations as well as survey results. Methods of literary search, system analysis, price liquidity analysis, and online survey method were used.

Results. Among manufacturers the GlaxoSmithKline Nigeria has the biggest share higher than 17%, four companies have similar high shares in the market as well above 8% and these are May & Baker Nigeria Plc, Fidson

Healthcare Plc, Emzor Pharmaceutical Industries Ltd and Juhel Nigeria Ltd, and companies such as Evans Medical Plc, Swiss Pharma Nigeria Limited (SWIPHA), Nigerian German Chemicals Pls (NGC Plc) and Ranbaxy Nigeria Limited has shares of 5-7%. Among the biggest wholesalers 44 companies (81.5%) of 54 have the lowest shares from 0.04% to 0.79%, seven companies (13%) have 1% - 3.12% and three companies (5.50%) have shares of 9.78% - 53.3%. The leader of the market is Swiss Pharma Nigeria Limited, its share is 53.3%.There are 21,892 registered pharmacists in Nigeria, however, the data suggest that only 12,807 (58.5%) are in active professional practice as indicated by the number of licensed pharmacists as of 2016 and then in 2020-2021 we had about 25,000 pharmacists in the country, which was not enough to serve the whole country.

As a result of the online survey, we interviewed 90 Nigerian citizens, the average age of which is 27.4 years, and more than half of them (52.2%) are women. By social status, these are mainly students (45.6%) and working people (28.9%). 71.1% of respondents receive pharmaceutical assistance (medicines, medical devices, information) in a pharmacy. 58.9% of respondents indicated that pharmaceutical products of domestic production are affordable for them, and 28.9% - that they are of good quality. Respondents buy medicines (94.4%) at the pharmacy, less often - cosmetics, dietary supplements, hygiene products and medical devices (20.0%, 18.9%, 17.8% and 16.7%, respectively). Medicines prices are generally adequate (38.9%), high (34.4%) and high for imported products (16.7%). This year, drug prices have increased significantly (45.6%) and slightly (30.0%). 71.1% of respondents buy medicines even if they are expensive. 53.3% of respondents buy what they need regardless of the price, while 18.9% said that discounts encourage them to buy more / more often, and 16.7% stated that they did not encounter discounts in pharmacies. The professionalism of a pharmacist's consultation depends on his personality (50.0%) and the consultation is always professional (42.2%). In order to improve the work of pharmacies, it is necessary for pharmacists to be friendlier (47.8%) and to help visitors (31.1%), in particular visitors with additional needs (24.4%), and also a 24-hour working schedule (45.6%), places to sit (22.2%) and drinking water (21.1%) are important. The level of satisfaction with pharmaceutical services is at the level of "3" (45.6%) and "4" (36.7%) on a 5-point scale, and the average value is 3.54.

Conclusions. The study of the pharmaceutical market in Nigeria showed that the market has strengths (the market is growing, the population and healthcare costs are also increasing) and weaknesses (lack of funding, underdeveloped infrastructure and legal framework), and potential for development.

DIETARY SUPPLEMENTS MARKET RESEARCH

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Keywords: dietary supplements(DS), market conditions.

Materials and methods. Generalization, systematization, comparison.

Introduction. The analysis and comparison of the content of the regulatory documents regulating the circulation of DS in Ukraine and the latest changes in them revealed a number of contradictions, namely: the provision of different definitions of DS, the use of different classification approaches, and the absence of a single understandable traceability system for control of the quality and safety of DS. The main problem of DS is the lack of reproducibility of the results of their consumption, which is related to the fact that the standards of good practices - GMP, GLP, GCP, which provide a guarantee of effectiveness, safety and quality for medicinal products, are not applied to these products.

Results. The number of items presented on the website of the Compendium.online directory under the heading "Dietary food supplements" has increased 26 times since 2012 and is now 3301. The classification distribution contains 17 groups that imitate the ATC classification of drugs. The largest specific weight is occupied by group 02 "DS to food products, which mainly affect metabolic processes in tissues" - 648 items, which is 20% of their total number. The leaders in terms of the number of DS positions presented on the website of the Compendium.online directory are domestic companies “Klyuchi zdrovya” LLC (Kharkiv) - 157 positions, and “Krasa i Zdrovya” LLC (Dnipro) - 136 positions. In total, 544 manufacturers are represented in the analyzed population, including 68 manufacturers of drugs, which offered 673 positions of DS, which is 20% of the total population of DS. According to the form of release, capsules (37%) and tablets (24%) were most often presented in the analyzed DS. A total of 55 forms of release were presented, including manufacturers using the names of dosage forms, food products and packages. As a result of the content analysis of the recommendations for the use of DS presented on the Compendium.online website, it has been established that the quantitative indicators of the content of ingredients are given in only 34% of the analyzed cases, and in 39% of the DS medical diagnoses are given in the recommendations, often with an indication of their code according to the international classification diseases, which is prohibited by law.

Conclusions. As recommendations for improving the situation with DS at the domestic pharmaceutical industry, it is possible to propose the creation of a system for monitoring compliance with existing legislative requirements and improving their individual points, in particular: introducing a mandatory

requirement for labeling "The product is not a medicinal product and is not intended for the treatment of diseases" and of the legal ban on doctors prescribing and recommending DS.

CONTENT ANALYSIS OF PHARMACY WEBSITES

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Scientific supervisor: assoc. prof. **Kateryna Dorykevych**, PhD.

Keywords: medicines, e-commerce, pharmacy websites, telepharmacy

Introduction: Telepharmacy is an independent scientific and practical direction of pharmacy regarding the remote provision of high-quality pharmaceutical care, including e-commerce of medicines.

Materials and methods: The method of systematic analysis of the collection of data on the online trade of medicines, the method of literature search and the interview method was used. The materials were normative and legal acts, scientific and literary data and the results of questionnaires.

Results: As a result of usability testing of the sites (top-10 pharmacies and two online services), it was established that the structure of the analyzed sites is concise, hierarchical, and clear (with the exception of the "3i" and “Med-service" pharmacies); site navigation is convenient (with the exception of the “Med-service” pharmacy); the search function is convenient (with the exception of "Med-service" and "Farmacia" pharmacies); the highest download speed (0.1 s) is on the sites "Good day" pharmacy and Liki24, and the lowest (3-4 s) - on "Plantain" and "3i" pharmacies; all pharmacies and services use a white background, blue is also popular ("ANC”, "We Wish You Health”, "3i", and "Med-Service” pharmacies) and green ("Plantain" pharmacy, "Good Day” pharmacy, "Healthy Family” pharmacy, tabletki.ua) colours; no technical errors were found on the analyzed sites (with the exception of the "We Wish You Health" pharmacy); no technical errors were found on the analyzed websites (with the exception of the "We Wish You Health" pharmacy).

The content analysis of the sites showed that pharmacies (ANC, "We Wish You Health", "911", "Plantain", "3i", "Good day” pharmacies and services tabletki.ua, Liki24) have the function of switching to the russian language; all pharmacies, except for "3i" and "Farmacia" pharmacies, have the function of sorting by price and rating; discounts for online purchases are not available only at the "Med-service" pharmacy; almost all sites (with the exception of tabletki.ua and “Plantain” pharmacy) contain promotions / profitable offers on the main page; Liki24, "Healthy family" pharmacy, “D.S”. pharmacy, "Good day” pharmacy and “3i” pharmacy focus on "new products"; delivery by mail / courier delivery is available only to “ANC”, “911”, “Plantain”, “D.S.” pharmacies and Liki24; all pharmacies are present on

Facebook and Instagram; sites use their own classifications of goods and the format of presenting information about drugs.

The survey (55 citizens of Ukraine were interviewed, 65.5% of whom live in the Lviv region, the average age of the respondents is 32.5 years old) showed that 65.5% of the respondents use the search and reservation of medicines and medical products, and a total of 70 .9% are positive about it; reasons for refusing to use the sites - lack of need (18.2%), habit (12.7%) or ability (9.0%); in the opinion of 69.1% of respondents, the website should provide basic information about medicines (instructions, cost, availability in pharmacies, conditions of promotions); reasons for using websites - convenience (36.4%), economy (12.7%) and all together (it`s convenient, economical and faster) (38.2%); the website should also include information about the pharmacy schedule (72.7%), pharmacy contacts (70.9%) and a map of the pharmacy network (65.5%); at the moment, the information content on the sites is sufficient (43.6%), while there is a lack of comparative data on prices (40.0%), a list of additional services (23.6%) and conditions for returning goods (21.8%); respondents prefer the sites tabletki.ua (43.6%), "Plantain" (20.0%) and "D.S." pharmacies (10.9%).

Conclusion: The ability to obtain pharmaceutical goods (and, in the future, other pharmaceutical services) online contributes to the improvement of the pharmaceutical provision of the population, in particular, in view of the difficult times of war and viral pandemics (Covid-19).

MONITORING OF PHARMACEUTICAL WAREHOUSE ULCER DISEASES OF THE STOMACH

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Keywords: medicines, ulcer disease, Helicobacter pylori, proton pump inhibitors, consumption of medicines, therapy, analysis.

Introduction: Diseases of the digestive organs are the second reason for referrals of all ages population groups for medical assistance after respiratory diseases. Diseases of the digestive organs are widespread and large social meaning. Over the past 10 years, the prevalence of gastroenterological pathology increased by 30%. The situation is aggravated under difficult conditions socio-economic situation and deterioration of the ecological situation, which, as is known, has a direct impact on the occurrence of organ pathology digestion.

Peptic ulcer disease of the stomach and duodenum is one of the most common of common diseases in the clinic of internal diseases and represents a serious health problem because it carries a chronic character, often recurs and

gives numerous complications, leading to large costs of treatment and maintenance remissions. According to official statistics on 10-20% of the population suffers from it.

Materials and methods: Informational search in scientific editions and medical databases, (Pubmed, Researchgate, Google Scholar), the State Register of Medicines of Ukraine, legal acts, scientific and literary data; methods of analysis, systematization, comparison, generalization of information data.

Results: On the basis of the analysis of scientific literary sources, relevant ones have been determined directions of marketing study of the pharmaceutical market and justified the methodology of its comprehensive research. Etiological and pharmacotherapeutic aspects are elaborated diseases of digestive organs, their classification and analyzed dynamics and the level of diseases of the digestive organs. Conducted analysis of directions pharmacotherapy of gastric and duodenal ulcers indicates prospects of the market of complex drugs for eradication Helicobacter pylori and proton pump inhibitors. An analysis of the dynamics of the structure of the range of products registered in of drugs for the treatment of gastric and duodenal ulcers in Ukraine, the offers of suppliers in the wholesale segment were analyzed domestic pharmaceutical market, established trends and features consumption of anti-ulcer drugs. The results of the study of the commodity and price situation of gastroenterological medicines indicate an increasing trend market share of domestic gastroenterological medicinal products, which explained by the availability of prices, the expansion of the assortment and volumes production According to the results of our analysis of coefficients adequate solvency, we can conclude that the most available for the domestic consumer in 2022 are Ukrainian medicines manufacturers as well as India. As a result of the conducted pharmacoeconomic analysis pharmaceutical component of anti-helicobacter anti-ulcer regimens of therapy by the "cost-effectiveness" method, it was established that scheme 4, as well as Schemes 8, 9 and 11 have lower costs per unit efficiency compared to other schemes analyzed by us anti-helicobacter therapy.

STUDY OF THE PECULIARITIES OF THE FEATURES OF MERCHANDISING IN PHARMACIES

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Keywords: merchandising, pharmacy, respondents, visitor preferences

Introductions. Today, merchandising, as a component of marketing, has become an integral part of pharmacy activity and a guarantee of economic prosperity of pharmacies. Merchandising is aimed at the promotion of

medicines and other products of the pharmacy assortment and allows to achieve not only an increase in profit, but also the level of satisfaction of visitors to pharmacy institutions.

Materials and methods. The methods of questionnaire, generalization and interpretation of the results were used.

The research materials were the results of an anonymous questionnaire survey of 321 visitors to pharmacies using the Google Form online service. Most of the interviewees are women (78.5%). The age of more than half of the respondents (56.4%) is 19-35 years.

Results. Based on the results of the research, significant factors affecting the choice of pharmacy were established. Respondents attach importance primarily to the attractiveness of the price (60.4%), the convenience of the location of the pharmacy (57.3%), the level of qualification of pharmaceutical specialists (52%) and the proper quality of pharmaceutical service (54.8%).

The study of the factors that attract the attention of respondents to pharmacies showed that first of all visitors pay attention to the size, color, and lighting of pharmacy establishments (39.3%), a good design of the window display is no less important (38%), less important - promotional events (20.2%).

As for purchasing behavior, it was established that almost three-quarters of respondents make unplanned purchases in general, while most often on the advice of a pharmacist (41.4%) and under the influence of promotional events held in pharmacy establishments (39.6%). A study of respondents' opinions regarding attractive and convenient display of goods as an important element of merchandising showed that more than half (57%) of visitors note this. However, for 29.6% and 13.4% of respondents, respectively, this is not important or does not attract attention. The analysis of the attitude towards the use of neuromarketing elements in pharmacy establishments showed that the majority of consumers prefer white (26.2%), green (25.2%) and blue (9.7%) colors in the design of the pharmacy, although by 31.8 % of respondents it does not matter.

Conclusions. Through a questionnaire survey of 321 respondents, the factors that influence their choice of pharmacies and their response to the use of elements of pharmacy merchandising were studied.

FEATURES OF LABOR RELATIONS IN PHARMACEUTICAL ORGANIZATIONS

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Keywords: labor relations, survey, pharmacist, salary, motivation.

Introduction. Labor resources are a key factor in the development of any enterprise, including a pharmaceutical one. The number of pharmaceutical organizations is growing, the level of competition is increasing, the modern pharmaceutical market needs qualified and motivated employees, therefore it is important that the employees of the pharmaceutical industry are interested in the results of their work.

Materials and methods. The materials of the study were: the regulatory framework governing labor relations in the pharmaceutical sector, information posted on the work.ua website, survey results. During the research, the methods of content analysis, system- analytical analysis, generalization, logical analysis, questionnaire survey were used.

Results. The national regulatory legal framework in the field of labor relations regulation is aimed at ensuring the rights of employees, although certain restrictions on their rights were introduced during the period of martial law in Ukraine. As a result of the conducted survey of 126 senior students of pharmaceutical faculties, it was established that, mainly, they prefer working in pharmacy chains (31%) to private ownership (57.9%). Respondents consider the possibility of career growth as additional advantages when choosing a place of work (80.2%). The majority of respondents named the job search site work.ua (70.4%) as the main source of information about vacant positions. According to the work.ua website, employers offer pharmacists a higher salary than applicants indicate in their resumes, there is an increase in the number of offers of vacant positions and a decrease in the number of resumes. In order to carry out successful professional activities, pharmacists, in addition to professional skills, should be endowed with skills, such as communication, responsibility, etc. As a result of the analysis of vacancies for the work of 12 pharmacy chains, it was established that the employers' offers relate mainly to wages, social packages, the possibility of career growth and loyalty to the continuous professional development of employees.

Conclusions. The successful functioning and level of competitiveness of pharmacies is significantly influenced by the interest of employees in effective activities. The level of qualification of the staff is important, and their motivation is no less important. Therefore, the comprehensive development of personnel is an important factor in increasing the competitiveness of the enterprise and should become an important task of the personnel policy of pharmaceutical enterprises.

MARKET RESEARCH OF IMMUNOMODULATORS

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Keywords: immunomodulators, product and price situation, economic availability.

Introduction: The presence of various disorders of the immune system can be the cause of secondary immunodeficiency and lead to the appearance or serious complications of diseases. One of the groups of medication used for the purpose of immunotherapy are immunomodulators, which, if taken in therapeutic doses, restore the functions of the immune system (effective immune protection). Since the drug market is dynamic, and the results of the analysis of research literature indicate the absence of modern academic papers that provide the results of research on the range of MI, this study is quite topical.

Research materials and methods: The materials consist of special and academic publications; the State Register of Medicinal Products of Ukraine; information on the minimum and maximum retail prices for immunostimulants and the value of the determined daily dose. The methods applied are as follows: information search, analysis, generalization, marketing research. The Microsoft Excel package of application programs was used to process the results.

The results. It is established that as of February 1, 2023, 114 drugs from the group of immunostimulators (12 INNs) and 134 medicinal products from the group of immunosuppressants (27 INNs) were registered in Ukraine. At the same time, the largest group of immunostimulators is alfa-2b interferon drugs (35.96%). In total, lenalidomide (23.13%), tacrolimus (15.67%) and mycophenolic acid (9.70%) make up almost half of the investigated range of drugs from the group of immunosuppressants. The nomenclature of drugs from the group of immunostimulators is available in Ukraine and 15 foreign producing countries. Domestic manufacturers supply the market with 70 medicinal products from the studied group (61.41% of the nomenclature); foreign manufacturers, 44 products (38.59%). Among domestic manufacturers, the maximum number of drugs (23 assortment items, 32.85% of the nomenclature) is produced by "Interpharmbiotek Research and Production Company". The range of immunosuppressants is manufactured by Ukraine and 24 foreign producing countries. Foreign manufacturers supply the Ukrainian market with 133 drugs from the studied group (99.25%), and the Ukrainian producer "Farmak" produces only 1 position (0.75%). The firm Sinton Hispania, SL (Spain) supplies the Ukrainian market with the largest number of names of immunosuppressants: 11 products (8.28% of the nomenclature).A situational analysis of the economic availability of 14 immunostimulators is

based on the cost of the defined daily dose (DDD) at the minimum retail price in Lviv pharmacies, and it shows that the most economically available products are 4 drugs, the DDD cost of which is in the range of UAH 51.03 to 81.41. There are also 4 other drugs available, the DDD price of which is in the range of UAH 148.62 to 207.05. Low economic availability is characteristic of 4 products of filgrastim and 2 products of glatiramer acetate, the DDD cost of which ranges from UAH 403.75 to 978.77. The study of the economic availability of 9 analysed immunostimulators according to the maximum retail price shows that the most economically available drug is the product of Laferon-Pharmbiotek: lyophilisate for injection solution, 3 million IU No. 10 in a vial (produced by "Interpharmbiotek", Ukraine), the DDD cost of which was UAH 69.64. There are also 5 drugs which are economically available, the DDD cost of which is in the range of UAH 104.40 to 253.53. Low economic availability is characteristic of 3 drugs of filgrastim.

Conclusions. The results of the research can be used to form the optimal nomenclature of immunomodulators in various market entities engaged in pharmaceutical supply for consumers.

RESEARCH OF THE MARKET OF DRUGS FOR THE TREATMENT OF ONCOLOGICAL DISEASES

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Scientific supervisor: assist. prof. **Iryna Horodetska**, PhD

Keywords: monoclonal antibodies for the treatment of oncological diseases.

Introduction. The market of drugs for the treatment of oncological diseases shows impressive growth due to the increase in their prevalence, the expansion of patient groups, as well as innovative technological achievements, especially in biomolecular medicine, therefore the study of the marketing characteristics of innovative oncology drugs is relevant.

Materials and methods. Generalization, systematization, comparison.

Results. According to the Compendium.online website and the State Register of Drugs, as of the beginning of April 2023, 196 drugs were included in subgroup 2 of ATC classification L01 "Antineoplastic drugs". The largest share was occupied by two subgroups of the third level of the ATC classification: L01B "Antimetabolites" and L01X "Other antineoplastic agents" - 21% each (41 positions each). The second place was occupied by subgroup L01E "Protein kinase inhibitors" (18%, 36 positions), the third - subgroup L01C "Alkaloids of plant origin and other preparations of natural origin" (16%, 32 positions). Since 2000, the number of assortment items in subgroup L01 "Antineoplastic agents" has more than doubled: from 84 to 196 items, the

largest number of items was noted in 2011 - 211. Among oncology drug manufacturers, Roche (Switzerland) is the leader – with 35 positions, closely followed by Mistral Capital Management Ltd (Romania) – 32 positions and Medac (Germany) – 30 positions. The predominant form of release of oncological drugs are vials (71%), pills make up 18%, capsules - 10%, ampoules occupy a small part of the total - 2%. The national list of basic drugs does not contain any position of oncology drugs - monoclonal antibodies, 2 drugs were included in the lists of state medical purchases in 2021 and 2022: rituximab and trastuzumab. As of the beginning of April 2023, 25 positions of monoclonal antibodies were registered in the State Register of Medicines, 72% of them were registered for the first time during 2017-2022, 28% were re-registered indefinitely in 2019-2023. 11 drugs (44%) were absent from the retail segment of the domestic pharmaceutical market. A comparison of the registered wholesale prices with the minimum values of retail prices for drugs - monoclonal antibodies made it possible to establish that in only one case out of 11 analyzed items was the retail price higher than the wholesale price by 20% ("Erbitux" 5 mg/ml bottles of 20 ml each). In all other cases, the retail price was from 47.7% to 87.3% of the declared value of the wholesale price, the most significant difference was demonstrated for the following drugs: "Tecentrik" 1200 mg/20 ml flak. (47.7%), "Gaziva" 1000 mg flak. (55.9%) and "Kadsila" 100 mg flak. (59.7%).

Conclusions. Wholesale and retail prices registered by manufacturers for drugs - monoclonal antibodies in the vast majority of cases exceed the minimum values of retail prices.

PROFESSIONAL HEROISM AND VOLUNTEERING OF PHARMACY SPECIALISTS AND STUDENTS IN CONDITIONS OF RUSSIAN MILITARY AGGRESSION

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Keywords: war, volunteering, pharmacist, pharmacy student.

Introduction: Volunteering is one of those social phenomena that have a direct relationship to the formation of realities and prospects for the development of society in all of the spheres of its activity. Volunteering is especially relevant in wartime, when society needs help in solving complex social, economic and humanitarian problems. Since the study of the professional contribution and involvement of pharmaceutical specialists and pharmaceutical students in volunteer activities in wartime conditions was not conducted, this determined the relevance of our study.

Results: Using the information searching, it was investigated that the formation of the history of volunteering in independent Ukraine dates back to the beginning of the 90s of the 20th century. Since the beginning of the full-scale war, Ukrainians have created dozens of charitable foundations, fundraising platforms and volunteer headquarters. It has been established that manufacturers and wholesale suppliers of medicines from the first days of the war took all possible measures to continue providing the citizens of Ukraine with the necessary treatment. A large number of pharmacy chains take an active part in the volunteer process, in particular: they transfer funds for the needs of the army, transfer medicines and medical products, purchase harnesses, purchase ammunition, generators, thermal imaging devices, drones, etc. Using an anonymous questionnaire, we have conducted a study, in order to know how pharmaceutical specialists and pharmaceutical students were engaged in volunteer activities and what their motivational figures were. Thus, it was established that the respondents (517 respondents) were people of different ages (from 17 to 73 years old), most of whom were women (472 people, 91.3%). More than a third of the respondents were practical workers in the pharmaceutical sector (202 people, 39.07%), a little more than 1/5 were students (121 respondents, 23.4%), as well as about 1/5 of the respondents (100 people, 19 .34%) combined studying and work in a pharmacy. It was established that the concept of "volunteer activity" is known to almost all respondents, and more than half of the respondents (55.71%, 288 people) indicated that they occasionally engage in volunteer activity. Among the main sources of information about volunteering, respondents most often noted: pages, channels and groups of volunteer organizations in social networks (22.21%), information from friends, relatives or acquaintances related to volunteering (21.86%), various announcements in social networks (20.83%).When asked about the motivational factors for providing volunteer assistance, the majority indicated a desire to help the army (43.57%), a large number indicated a desire to help temporarily displaced persons (25.73%). Regarding the form of participation in volunteer work, respondents most often indicated: participation in the collection of funds, things, products, food and medicine (24.31%), transfer of funds for the needs of the army (17.36%), transfer of funds for volunteer activities (17, 26%), sorting medicines and medical products (9.6%), weaving camouflage nets for the military (8.78%), etc.

Conclusion: Thus, with the help of an information search and an anonymous questionnaire survey, the essential role of pharmaceutical specialists and pharmaceutical companies in the volunteer movement during the full-scale armed aggression of the russian federation against Ukraine was determined.

STUDY OF THE ACTIVITIES OF PHARMACIES IN UKRAINE IN THE CONDITIONS OF WAR

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Keywords: medicines, consumption of medicines, pharmacies, pharmacists.

Introduction: As a result of Russia's full-scale invasion of Ukraine in 2022, it led to a sharp decline in economic activity, a humanitarian crisis, as well about 25% of pharmacies have been destroyed, closed, or are located in temporarily occupied territory.

Materials and methods: The method of systematic analysis of the data, the method of literature search and the survey method were used. Materials: legal acts, scientific and literary data and the results of the survey.

Results: The dynamics of the number of pharmacies were studied. As of April 2022, in 16 regions the number of pharmacies decreased slightly (91-97% of the pre-war number); in Kyiv, Sumy, and Chernihiv regions it decreased more (83-88%), in Mykolaiv, Kharkiv, and Zaporizhzhya regions it decreased significantly (49-64%), and in Donetsk, Kherson, and Luhansk regions it decreased critically (0-16%).

According to the sales volume and weighted average of drugs and pharmacy products (medical devices (MD), dietary supplements (DS), cosmetics (Cs)) analysis in 2020-2022 yy., the share of Cs is the smallest, while the shares of DS and MD in monetary terms are approximately the same (1.9 - 2.5), and the largest is the share of medicines - 24.0 - 23.7. The generalized weighted average cost of one package of pharmaceutical goods was the highest in 2022 (102.0 UAH), and compared to 2021 (78.1 UAH), it increased by 30.6%.

The opinion of pharmacists was studied (67 people aged 18 to 58 were interviewed, 88.1% of whom live in the Lviv region) regarding changes in the activity of pharmacies during the war. The number of visitors has not changed (according to 41% of respondents) and has decreased (41%); the purchasing power of the population has decreased (62.7%); the establishment's price policy (74.6%), work schedule (32.8%) and product range (23.9%) have changed; staff turnover increased and the number of employees decreased in general (32.8% each), the amount of overtime work and the duration of the work shift increased (14.1% and 12.5%, respectively); wage did not change (59.1%), increased (24.4%) and in some pharmacies it decreased (18.2%); increased competition (50.0%), decreased / increased effectiveness of cooperation with doctors (27.3% and 21.2%, respectively); the impact of military actions on pharmacies is negative (87.7%), the average score of the impact is 3.4 on a 5-point scale.

Conclusion: Pharmacies, like the entire country, is currently going through the most difficult times, but the coherence of the legislative sphere and the practical activity of pharmacists makes it possible to keep the pharmaceutical supply until the complete victory of Ukraine at the proper level where possible.

IMPLEMENTATION OF THE MARKETING MIX IN RELATION TO ANTIEPILEPTIC MEDICATIONS

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Academic supervisor: Doctor of Pharm. Sc., Associate Prof. **Oksana Levytska**

Keywords: epilepsy, antiepileptic drugs, affordability, affordable drugs, market.

Introduction: Epilepsy is one of the most common neurological diseases in the world and requires appropriate medical treatment. Providing the population with medicines as well as increasing accessibility of medicines is an integral part of the state health policy. This fully applies to patients with epilepsy as well.

Methods and objects of research. Methods**:** information retrieval, comparison, analysis, generalization, bibliosemantic, marketing (product, price market conditions), ATC/DDD analysis. Objects: pharmaceutical, medical-technological, regulatory, marketing information on antiepileptic medications, their assortment and reimbursement characteristics within the framework of the government program "Affordable Medicines". The following sources of information were used: domestic and foreign web resources, the Pharmacy software package, the State Register of Medicines of Ukraine, the Registers of the Government Program "Affordable Medicines" for 2021-2022.

Results. It was found that as of February 01, 2023, 325 antiepileptic medications were registered in Ukraine in the form of various dosage forms, which represented 16 INNs. Almost half of the entire range of these drugs are pregabalin-based drugs (48.85%). Lamotrigine and levitraceptam drugs accounted for almost an eighth of the assortment (12.92% each). In total, these three INNs account for almost 72% of the antiepileptic medications nomenclature. The nomenclature of the studied medicinal products is represented by Ukraine and 18 foreign manufacturing countries. Ukrainian manufacturing pharmaceutical companies supply 86 medications from the analyzed group to the market (26.46%), while foreign companies - 73.54%. Among the foreign manufacturing countries, almost a third of the assortment of 101 drugs (31.08%) of antiepileptic drugs is supplied by Indian companies. About 10% of the analyzed drugs are represented by manufacturing enterprises

in Slovenia, and about 6% each - in Greece and Poland. A small portion of antiepileptic drugs (1 - 3 drugs each) is represented by manufacturers from Austria, Cyprus, the Slovak Republic, Switzerland, Croatia and Hungary.

Applying a situational analysis of the information posted on the website "Pharmacy online.ua" in the section "Prices for medicines" regarding the offers of 61 antiepileptic medications, it was found that the investigated medications were offered by 12 resellers. Among them, 3 distributors (JV Optima-Pharm, PE O.L.KAR Pharma-Service and BaDM LLC) presented 95-100% of the nomenclature of antiepileptic medicaments. Seven wholesale intermediaries offered from one-third to slightly more than three-fourths of the analyzed drugs. Such companies as Dolphi-Ukraine LLC (Dnipro) and Pharma Life LLC (Lviv) offered 9.84% and 8.20% of antiepileptic medications, respectively.

Based on the results of the study of purchase prices and DDD cost of antiepileptic medications offered by three national distributors (BaDM LLC, Venta LLC and Optima-Pharm LTD JV), it was found that the largest number of these drugs with the lowest DDD cost was offered by BaDM LLC - 34 nomenclature items (or 32.38% of the total number of analyzed drugs). At the same time, 26 medicinal products (24.76%) offered by Venta LLC had a lower DDD price than their competitors. The most expensive were the offers of JV "OPTIMA-PHARM, LTD".

Conclusions. To conclude, antiepileptic medications are quite widely represented in the pharmaceutical market of Ukraine and have a different price range. The results of the study can be used to optimize the range of antiepileptic medications by wholesale intermediaries and pharmacies, as well as in the formation of their pricing policy.

STUDY OF THE PHARMACEUTICAL COMPONENT OF PSORIASIS

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Keywords: medicinal products for biological therapy of psoriasis, marginal wholesale and retail prices.

Introduction: According to the unified clinical protocol for providing medical care in psoriasis, patients with severe forms of psoriasis are treated with biological therapy, however market research of such medicines in Ukraine was not conducted.

Materials and methods: Generalization, systematization, comparison.

Results: According to the State Register of Drugs as of the beginning of February 2023 in Ukraine 15 positions of means for biological therapy of psoriasis are registered, including: 9 positions adalimumab (60.0%), 4 - etanercept (26.6%), and one each of infliximab and ustekinumab (6.7%), the

vast majority of them - 13 out of 15 (86.7%) were registered for the first time. 2 drugs passed re-registration and registered in Ukraine for an unlimited period in 2019 and 2021.

Medicinal products for biological therapy of psoriasis are produced in the form of 5 dosage forms, the vast majority of items are in the form of a pre-filled single-dose syringe (14). In 20 are involved in all stages of the production of drugs for biological therapy for the treatment of psoriasis manufacturers from 12 countries. Among the countries of origin of manufacturers, Germany dominates (7 enterprises). Among the applicants for state registration in Ukraine, an Austrian company is leading Sandoz GmbH (6 positions). From 15 items of biological medicinal products for treatment psoriasis, registered in the State Register of Medicinal Products as of the beginning of February In 2023, 4 positions were absent from the pharmaceutical market of Ukraine ("Hadlima"®, "Julio"®, "Brenzis"®, "Erelzi"®), which accounted for 26.6% of the total number of registered positions).

The register of declared wholesale and retail prices (WRP) contained 10 biological medicinal items means for the treatment of psoriasis, including 3 positions of adalimumab, 4 positions of etanercept, 1 position infliximab and 2 – ustekinumab. Comparison of retail prices of analyzed drugs on domestic pharmaceutical market with limit values of WRP showed that only in three cases, the retail prices were higher than the WRP: Humira® 20 mg/0.2 ml in November 2022. and Enbrel® 50 mg/ml and Stelara® 45 mg - in June 2022. It was established that the shortest term therapy of psoriasis with the drug Enbrel® - 12 weeks, the longest - with the help of the drug Stelara® - 28 weeks. The cheapest course of treatment with Humira® is 46,705.56 UAH., the most expensive - LZ Stelara® - from UAH 247,500. up to UAH 495,000 depending on body weight.

Conclusions: 86.7% of biological therapy drugs for the treatment of psoriasis are registered in For the first time in Ukraine during 2018-2022, 4 registered positions are absent in retail segments of the domestic market, retail prices on the market in 70% of the analyzed items are lower for the registered value of WRP.

URINARY STONE DISEASE FROM THE VIEWPOINT OF PHARMACEUTICAL SUPPLY

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Keywords: urolithiasis, herbal preparations, kidney stones.

Introduction: Urolithiasis can be classified as a chronic disease prone to relapses, which is often characterized by an aggressive, burdensome course, which affects the quality of life of a person and can lead to disability of the patient. The relevance of the socio-economic and general medical aspects of urolithiasis lies in the fact that this disease is one of the most common in urology and ranks second in the structure of diseases after inflammatory non-specific diseases of the kidneys and urinary tract and occurs in almost 3% of the population. The lack of comprehensive monitoring of pharmaceutical support for urolithiasis based on modern marketing methodology determined the relevance of our research.

Materials and methods. Statistical, marketing analysis, comparison, positioning, logical, analytical, and bibliographic methods were used.

Rresults. Based on the analysis of scientific literary sources, the medical and social aspects of urolithiasis in Ukraine and the world were investigated, as well as the modern view of the influence of urolithiasis on the quality of life was analyzed. Epidemiological characteristics and etiological aspects of urolithiasis, their classification, causes, methods of prevention, and treatment are elaborated. The marketing characteristics of the market segment of anthelmintic drugs were studied. It was established that Ukrainian producers have the largest share (50%), followed by Germany (29%). There are also drugs produced in Poland, Spain, and India on the Ukrainian market. The leader among domestic manufacturers is Zdorovya LLC (50%). A smaller share of the market is occupied by "Halychpharm", "DKP Vishfa" and PJSC "Technolog". The analysis of registered herbal medicine for the treatment of urolithiasis by dosage forms showed that the analyzed group is represented on the market by capsules, tablets, and drops with the same share - 26% each, syrups are somewhat less 9%, and the share of solutions, pastes, and gels is 4%. The average purchase prices for the analyzed group of drugs were calculated, as well as the range of price fluctuations for each of the studied drugs. To assess the availability of anthelmintics, the liquidity coefficients (LC) of the prices of the studied group of drugs and the solvency adequacy coefficients were calculated when assessing the price situation. It was established that the coefficient of completeness of the assortment is 64%. The drugs Fitolit Forte N, Fitolit, Trinephron Health, and Cystinol Aurin have a minimum solvency adequacy ratio, which guarantees their sale in conditions of low solvency demand of the population. The value of the liquidity coefficients

calculated by us for the analyzed group of drugs ranges from 0.2 to 1.41. The available assortment of herbal preparations for the treatment of urolithiasis at domestic wholesale distributors of the pharmaceutical market was analyzed. It was established that the largest product range of the analyzed group of drugs is offered by the wholesale firms BaDM and Konex (100%). The drug Urolesan and Uroholum, Kanefron, Uronefron are in the greatest demand - they are offered by 8 wholesale firms out of 9 represented on the market. The ABC analysis of medicinal products of plant origin for the treatment of urolithiasis was carried out using the example of a pharmacy. Urolesan and Kanefron, included in group A, became the leaders among the drugs of the analyzed group according to the results of implementation in the 1st-3rd months of 2023, both in terms of physical and value indicators.

Conclusion. The results of the conducted research can be used to optimize pharmaceutical care for patients with urolithiasis, as well as to optimize the assortment policy of the retail sector of the pharmaceutical market.

ONLINE LEARNING DURING THE PANDEMIC, THE VIEV OF STUDENTS

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Keywords: online learning, pandemic, poll.

Introduction. Distance learning is considered the educational system of the 21st century. An online form of learning is a type of distance education. It has been used for educational purposes worldwide and in Ukraine during the Covid-19 pandemic. In our country, it continues even now, during the time of war.

Materials and methods. Information search, analysis, comparison, survey, generalization. Research objects: scientific, pharmaceutical information, information from questionnaires for assessing students' attitude to online learning.

Results. An opinion poll was conducted among 687 students regarding their attitude toward online learning. Among the respondents, 85.2% were women and 14.8% were men. The majority of respondents (62%) were between the ages of 17 and 20. 60.6% of students were pursuing a master's degree, 24.3% a bachelor's degree, and 15.1% an associate's degree. Almost half of the respondents (46.4%) were third- or fourth-year students. The respondents represented 20 higher education institutions. It was found that 86.9% of the respondents' future professions were related to healthcare. Additionally, nearly 86% of the respondents in the field of "Healthcare" will

obtain a degree in the specialty of "Pharmacy, Industrial Pharmacy." 33.48% of the respondents studied at Danylo Halytsky Lviv National Medical University, 17.61% at Lviv Polytechnic National University, and 14.56% at Zaporizhzhia State Medical University. In total, students from these three higher education institutions accounted for 65.65% of the analyzed sample size. Accessibility and comfort (average 4.4 points out of 5), as well as the possibility of saving time due to the absence of trips to the university (4.3 points), are assumed the most important advantages of online education by students. The interviewees consider the convenience of studying in emergency cases (4.0 points), as well as saving money in terms of paying for a dormitory (renting an apartment) and transportation costs (4.0 points), to be quite significant advantages of online education. The respondents believe the major disadvantage of e-learning to be technical problems that prevent high-quality online learning (3.2 points). Respondents also identified several significant drawbacks, including the fact that not all subjects can be properly studied remotely (3.1 points); excessive screen time can lead to a deterioration in health (3.0 points), and online learning requires strong motivation and strict self-discipline (2.9 points). It was found that 41.8% of respondents consider the teaching methodology, completeness, and quality of educational materials during online learning to be mostly good, while 36.8% find them satisfactory. Almost 47% of those surveyed are completely satisfied with their communication with teachers during online learning. In addition, over 43% of respondents believed that the quality of their knowledge had improved during online learning, while 43.2% stated that it had not changed. The following platforms and programs were used for online learning in higher education institutions: Zoom - 74.2%, Google Meet - 36.8%; Moodle - 29.3%; Misa - 32.5%; Google Forms - 24.9%; Google Classroom - 24.7%, and Adfarm - 12.4%. An analysis of the impact of online learning on students' health showed that 27.8% of them felt a deterioration in their physical health due to excessive sitting at the computer, and 24.6% of those surveyed felt a deterioration in their psycho-emotional state due to constant confinement in a closed space. Among the respondents, 38.6% observed a low level of physical activity due to the prevalence of sedentary behavior. However, a significant portion of those surveyed (41.8%) indicated that online learning had no impact on their health, and 30.4% noted that they had more time for sports during online learning. More than half of the respondents (56.3%) want to continue learning online or, at least, in a blended format (21.4%).

Conclusion. The research results have shown that the transition to online learning was positively perceived by the majority of surveyed students. However, this was a necessary step in the context of the pandemic and now the state of war. Therefore, in our opinion, the future of the educational process lies in the integration of electronic and traditional learning.

PECULIARITIES OF THE USE OF MEDICINES IN THE DEPARTMENT OF ANAESTHESIOLOGY AND INTENSIVE CARE (ON THE EXAMPLE OF RADYVYLIV CENTRAL CITY HOSPITAL)

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Key words: AIT, analysis of medicines, ATC classification, ATC/DDD, prescription sheets.

Introduction: Intensive care is defined as the identification, monitoring and treatment of patients with critical illnesses through initial and long-term support of vital organ functions. It is an interdisciplinary and interprofessional specialisation dedicated to the comprehensive treatment of patients with acute life-threatening organ dysfunction or at risk of developing such diseases. In Ukraine, intensive care is provided in anaesthesiology and intensive care units (ICUs). Treatment in ICUs involves the use of medicines from different pharmacotherapeutic groups. Thus, the study of drug consumption in ICUs is relevant.

Methods and objects of the study: The methods used were information search, logical, retrospective, frequency, ATC/DDD and content analyses, comparative, and generalisation. The objects of the study were: special scientific medical and pharmaceutical information from professional sources, medical records and prescription sheets of patients with AIT of Radyvyliv Central City Hospital in 2022.

Results. The study showed that patients with AKI of Radyvyliv Central City Hospital were prescribed 70 drugs by INN or INN from 9 anatomical groups according to the ATC classification. The maximum share was occupied by drugs affecting the blood system and haemopoiesis (group B - 29.6%). The share of drugs in group N (drugs acting on the nervous system) was 16.9%. And the share of drugs in group A (drugs acting on the digestive system) and group C (drugs affecting the cardiovascular system) was 15.5%, respectively. The proportion of drugs in these 4 anatomical groups totalled 77.5%. The study of prescriptions for patients with AKI in Radyvyliv City Hospital by individual medicines showed that almost 84% of patients were prescribed sodium chloride, 62.50% - dexamethasone, 46.43% - ceftriaxone, 42.86% - furosemide. Almost 40% of patients were prescribed 3 medicines: magnesium sulfate, rheosorbilact and dextrose. Drugs such as ondansetron, ascorbic acid K-Mg asparaginate and ambroxol were prescribed to about one third of patients. Every fourth patient was prescribed omeprazole, heparin, metamizole sodium and diphenhydramine. Almost every fifth patient was prescribed corvitin, paracetamol and meldonium. Slightly more than 16% of patients were prescribed 2 medications (Ringer's solution and mannitol), slightly more than 14% - 3 medications (Ringer's lactate, dexketoprofen and theophylline), and

slightly more than 12% - 2 medications (sodium enoxaparin and inosine). Every tenth patient was prescribed famotidine, drotaverine, amikacin and choline alfoscerate. Other medications were prescribed to 1 to 5 patients. Determination of the volume of drug consumption by patients with ARDS in Radyvyliv Central City Hospital showed that during the study period, the highest consumption of heparin and enoxaparin (40,000 DDDs each) was observed; ascorbic acid (845 DDDs) and dexamethasone (706.7 DDDs) were consumed. Consumption of omeprazole and fluconazole was the same and amounted to 70 DDDs each, and furosemide - 60.5 DDDs. For 11 medicines, consumption was in the range of 10.8 - 44 DDDs. For the rest of the drugs, it was less than 10 DDDs.

Conclusions. The results of the clinical and epidemiological analysis and monitoring of drug prescriptions make it possible to establish objective trends in consumption, and thus to optimise the use of drugs in PACUs.

MARKETING ASPECTS OF ANTIVIRAL DRUGS

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Keywords: antiviral drugs, infectious diseases, questionnaires, market analysis, influenza.

Introduction. One of the relevant problems in the field of health care is the high morbidity and mortality of patients with viral infections, which can attack almost all organs and systems of the human body and aggravate chronic diseases. Viruses are the cause of acute mass infections, their share is accounted for 90% of all infectious diseases. Viral diseases not only significantly affect the quality of life of every person, but sometimes become important factors of the development of society: in the past, smallpox had such an effect, nowadays - AIDS, Covid-19.

Materials and methods. The research materials were normative documents which regulates the pricing of antiviral drugs, the State Register of Medicines, and the results of a questionnaire survey. The methods of analysis, comparison, generalization, questionnaire were used.

Results. When studying the specifics of providing the population with antiviral drugs, it was determined that with the programs of centralized procurement it is possible to purchase drugs for the treatment of AIDS, hepatitis B and C, COVID-19. Four antiviral drugs are exempt from VAT and import duty, as they are included in the List of drugs intended to prevent the spread of COVID-19. During the outpatient treatment of AIDS patients, it is possible for dispensing medicines free of charge if they have any other diseases.

Analysis of the assortment of antiviral drugs for influenza treatment showed that as of April 1, 2023, 34 drugs were registered, which belong to groups J05A H – Neuraminidase inhibitors, J05A C - cyclic amines, J05A X – other antivirals and 5 drugs that belong to group L03 A B – Interferons by the ATC Classification System.

As a result of conducting a questionnaire survey of 312 respondents, it was found that, in general, the respondents have a negative attitude towards influenza vaccination. A third (35.7%) consider influenza vaccination to be inappropriate. It was found that a significant number of respondents self-diagnose the flu (42.2%) and prescribe treatment for themselves (31.3%). The majority (69.6%) do not take antiviral drugs for the prevention of influenza. 29.5% of respondents use antiviral drugs to treat the flu. Among antiviral drugs, Groprinosin (19.6%) is used more often than others.

Conclusions. As a result of the conducted research, the mechanisms of providing the population with antiviral drugs were studied, the assortment of antiviral drugs used in the treatment of influenza was analyzed, and with the help of a questionnaire, the specifics of influenza diagnosis, the use of antiviral drugs for the treatment and prevention of influenza were studied.

RESEARCH OF THE PHARMACEUTICAL COMPONENT OF THE STATE GUARANTEES PROGRAM OF MEDICAL CARE FOR THE POPULATION

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Keywords: Affordable medicines, health care, reimbursement, Medical Guarantee Program

Introduction. In Ukraine government provides appropriate health care by using the Medical Guarantee Program. Due to its pharmaceutical component patients have opportunity to obtain medicines they are in need of for free or with a small co-payment if they have electronic prescription. Nowadays that program includes 486 medicines and 10 disease categories and continues to develop further. The aim of this study is to conduct analysis of development of the pharmaceutical component of the Medical Guarantee Program.

Materials and methods. There were used such research materials as regulatory and legal acts that regulate the Medical Guarantee Program and publications in scientific journals. The methods of information research, generalization and comparative analysis have also been used.

Results. 15 registers of reimbursable medicines and INN to be refunded lists have been analyzed. There were established, that in the period of 2017-

2021 the number of disease categories had risen from 3 to 4 and the number of reimbursable medicines – from 157 to 297. After the reimbursement program was joined to the Medical Guarantee Program the number of disease categories and reimbursable medicines increased: in the period of 2021-2023 6 new disease categories were added and the number of reimbursable medicines changed from 293 to 486. Also the ratio of free of charges medicines to medicines which come with co-payment has been established. Therefore, the dynamic of development of pharmaceutical component has been researched.

In addition, there has been researched structure, dynamic of development, mechanisms of funding the Medical Guarantee Program and peculiarities of the process of concluding a contract between hospitals and National Health Service of Ukraine (NHSU).

Conclusions. The research revealed that since the reimbursement program joined to the Medical Guarantee Program there was noticed its significant development and success that showed up in amount of entirely or partially reimbursable medicines and adding new disease categories. That program makes appropriate health care more accessible and affordable for patients and provides them with better treatment conditions. In general, the pharmaceutical component created a good base for the others reforms in area of health care, proved the ability to begin great changes national health care system and showed that medicine-providing is forming a very important part of giving medical care.

PECULIARITIES OF THE PROFESSIONAL ACTIVITY OF PHARMACEUTICAL COMPANIES' REPRESENTATIVES

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Keywords: pharmaceutical companies' representatives

Introduction. Medical and pharmaceutical representatives act as a link between pharmaceutical companies, doctors and practical pharmacy workers. The main goal of their activity is the ethical promotion of drugs among healthcare professionals and patients. Researching the specifics of the professional activity of pharmaceutical companies' representatives, establishing positive aspects of their work, as well as difficulties during communications aimed at various circles of promotional consumers (wholesale pharmaceutical companies, pharmacies, health care institutions, doctors, pharmaceutical specialists and patients) is relevant.

Materials and methods. In order to collect primary information, the questionnaire "Peculiarities of the activities of pharmaceutical companies' representatives" has been developed, according to which 39 respondents have

been interviewed. The methods of information search, questionnaire and data analysis of primary information were used.

Results. It has been established that for successful work as a medical or pharmaceutical representative, it is important to possess a number of competencies, in particular: orientation to the result, to the development of knowledge and skills, self-efficacy, and most importantly, focus on the needs of the patient. The main consumers of drug promotion from medical representatives are doctors, their number ranges from 10 to 190 specialists of various specialties, as well as pharmacies (from 6 to 200). In addition, they work with distributors and offices of pharmacy chains. Pharmaceutical representatives focus their attention on pharmacies (from 10 to 184 establishments), offices of pharmacy chains and distributors. Regional managers collaborate with all named health care workers and supervise the work of medical and pharmaceutical representatives. During the introduction of martial law during the first two months of the russian armed aggression, 94.6% of respondents suspended their activities, however, from the second half of April 2022, when the enemy's active offensive was stopped and the situation somewhat stabilized, a resumption of visiting activity and other forms of work was observed.

In their professional activities, all respondents interviewed by us prefer individual visits and presentations (94.9% and 76.3%, respectively), considering them to be effective forms of work. Among the positive aspects of their professional activities, medical representatives rank first in the prospect of career growth, regional managers have the opportunity to plan their work independently, and pharmaceutical representatives have the opportunity to participate in interesting trainings. The opinion of all respondents was unanimous regarding the presence of a company car and irregular working hours.

In addition to the advantages of their profession, the representatives of the pharmaceutical companies interviewed by us noted a number of difficulties, in particular, about half of them are tired of the busy work schedule (48.3%), it is also quite difficult for medical and pharmaceutical representatives to fulfill the product sales plan, they often observe emotional burnout as a result of communications (27.2% and 26.7%, respectively).

Conclusions. Pharmaceutical companies' representatives are an effective means of communication policy of enterprises, as they ensure the promotion of drugs to a wide range of consumers. Effective forms, positive aspects and main difficulties of their professional activity have been established.

DEPARTMENT OF PHARMACEUTICAL, ORGANIC AND BIOORGANIC CHEMISTRY

(Head of the department – prof. **Roman Lesyk**)

SYNTHESIS AND TRANSFORMATION OF NEW 2,3-DISUBSTITUTED THIAZOLIDINONE DERIVATIVES

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Keywords: synthesis, 4-thiazolidinones, 2,3-disubstituted thiazolidinone, anticancer activity.

Introduction. One of the most promising groups among azolidinone heterocyclic derivatives is 2,3-disubstituted 4-thiazolidinones, based on which RNA-dependent DNA polymerase inhibitors with antiviral activity, MurB inhibitors as antimicrobial agents, rhamnose incorporation inhibitors and Rml(A-C) families have been identified, enzymes with anti-tuberculosis effect, CCR4 receptor antagonists as potential anti-asthmatic drugs, COX-2 inhibitors with anti-inflammatory and analgesic activity, etc. 2,3-disubstituted 4-thiazolidinones deserve special attention as new antitumor agents, in particular, potential agents for the treatment of prostate cancer. Which is the basis for subsequent chemical optimization.

Materials and methods. Organic synthesis, spectral analysis, *in vitro* anticancer activity.

Results. New 3 - (-(4 - hydroxyphenyl)-2-[3-(4-methoxyphenyl)-1-phenylpyrazol-4-yl]thiazolidin-4-one, 3-(3-methyl-1H-pyrazol- 5-yl)-2-phenylthiazolidin-4-ones and 2,3-diaryl-4-thiazolidinones based on the interaction of the corresponding carbonyl compounds and amines. The structure of the synthesized compounds was confirmed by 1H NMR spectroscopy, chromatography-mass spectrometry, and elemental analysis data. Synthesized 3-(4-hydroxyphenyl)-2-[3-(4-methoxyphenyl)-1-phenyl-1H-pyrazol-4-yl]-thiazolidin-4-one 2.2 was subjected to in vitro antitumor activity screening based on the Institute of Molecular and Translational Medicine of Palatskyi University (Olomouc, Czech Republic) and under the NCI DTP program. The anticancer activity of 3-(4-hydroxyphenyl)-2-[3-(4-methoxyphenyl)-1-phenyl-1H-pyrazol-4-yl]-thiazolidin-4-one was established, which showed moderate antiproliferative activity against cells T-lymphoblastic leukemia CCRF-CEM (IC_{50} = 28.59±2.58 μM), daunorubicin-resistant cell subline CEM-DNR (IC_{50} = 38.87±1.60 μM), paclitaxel-resistant subline K562-TAX (IC_{50} = 35.57±2.46 μM) and osteosarcoma cell line U2OS (IC_{50} = 37.02±1.03) and did not show cytotoxic effect against pseudonormal human cells BJ (IC_{50} = >50) and MRC-5 (IC_{50} = >50). According to the results of DTP NCI screening, it was established that 3-(4-hydroxyphenyl)-2-[3-(4-methoxyphenyl)-1-phenyl-1H-pyrazol-4-yl]-thiazolidin-4-one 2.2 has cytotoxic activity on cell lines UO-31 (kidney cancer) with a growth inhibition rate of 46.41%, PC-3 (prostate cancer) 55.12%, MCF7 (breast cancer) 56.35%, A549/ATCC (non-small cell lung cancer) 62.58%.

Conclusions. Synthesis of new library of 2,3-disubstituted thiazolidinone derivatives was performed. Antitumor activity of 3-(4-hydroxyphenyl)-2-[3-(4-methoxyphenyl)-1-phenyl-1H-pyrazol-4-yl]-thiazolidin-4-one was studied which is the basis for subsequent chemical optimization/

MODERN MEDICINES FOR PARKINSON'S DISEASE TREATMENT AND PROSPECTS OF NEW DRUGS SEARCH

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Keywords: Parkinson`s disease, levodopa, pramipexol, dopamine lack, dopamine agonists, inhibitors COMT and MAO-B, synthesis.

Materials and methods. Research object: drugs used for Parkinson`s disease treatment. Methods: bibliographic analysis, systematic approach, meta-analysis.

Results. The work presents an overview of modern drugs for the treatment of Parkinson's disease: the main classes of drugs used for the treatment of Parkinson's disease, such as levodopa, dopaminergic agonists, catechol-O-methyltransferase (COMT) inhibitors, monoamine oxidase-B (MAO-B) inhibitors and other. Their mechanisms of action, effectiveness and side effects are considered in detail. An assessment of the advantages and limitations of modern and promising drugs was carried out: side effects, interactions with other drugs, issues of long-term effect and availability for patients are considered.

Conclusions. Current drugs such as levodopa, dopaminergic agonists, COMT and MAO-B inhibitors are effective in the treatment of Parkinson's disease. They provide relief of symptoms and improvement of patients' quality of life.

Despite the success of modern drugs, there is a need for further research into new drugs for the treatment of Parkinson's disease. This is due to the fact that existing means have their limitations, such as side effects or degradation of effectiveness during long-term use.

STUDY OF NEW PYRIDINE-THIAZOLE HYBRID MOLECULES AS POTENTIAL ANTI-CANCER AGENTS

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Keywords: cancer, synthesis, thiazoles, pyridines, anticancer activity.

Introduction: Cancer is viewed as a complex disease with multiple

genetic alterations including altered expression of oncogenes and tumor suppressor genes, DNA repair, tumor metabo-lism and other dysregulations leading to overgrowth, metastasis and drug resistance. Nowadays, the total number of licensed anticancer drugs in 2021 counted for 270, and 243 of which were approved by the Food and Drug Administration (FDA). Searching for novel anti-cancer agents is an important and topical issue of modern medicinal chemistry because current chemotherapeutics are susceptible to a common mechanism of induced drug resistance. It should be noted that small molecules are one of the most interesting and important objects for studying pathways of decreasing cancer cell development and proliferation, as opposed to the large biotech molecules that require evaluation in clinical trials to assess their benefits. Based on reported research, it can be concluded that small thiazole-containing molecules provide different mechanisms of cancer growth blocking via inhibition of MMP, Bcl-2, HDACs, STAT3, HEC1, and targeting VHL tumor suppressor gene. As a result, the aim of present work was to design novel hybrid pyridine-thiazoles and investigate their antitumor properties in accordance with our systematic study of biological activity of thiazolidinone related derivatives

Methods: Organic synthesis, ^{1}H and ^{13}C NMR spectral data, X-ray diffraction analysis, anticancer activity screening according DTP NCI protocol, MTT assay, clonogenic assay.

Results and Discussion: Novel hybrid pyridine-thiazole derivatives were synthesized and subjected to physico-chemical characterization and screening of their cytotoxic action towards a panel of cell lines representing different types of tumors (carcinomas of colon, breast, and lung, glioblastoma and leukemia), as well as normal human keratinocytes for comparison. High antiproliferative activity of 3-(2-fluorophenyl)-1-[4-methyl-2-(pyridin-2-ylamino)-thiazol-5-yl]-propenone 2.3 and 4-(2-{1-(2-fluorophenyl)-3-[4-methyl-2-(pyridin-2-ylamino)-thiazol-5-yl]-3-oxopropylsulfanyl}acetylamino)-benzoic acid ethyl ester 2.4 was revealed. The IC_{50} of the compound 2.3 for HL-60 cells of the acute human promyelocytic leukemia was 0.57 μM, while for pseudo-normal cell lines this compound did not reach IC_{50} at 50 μM which suggests them as perspective anticancer drug-like substances. Such a selectivity of the derivatives 2.3 and 2.4 for cancer cell lines inspired us to study the mechanisms of their cytotoxic action. These compounds caused morphological changes in nucleus structure, thus, suggesting that the mechanism of action of the novel pyridine-thiazole derivatives might be caused by the genetic instability in tumor cells.

Conclusions: The results obtained herein provide a platform for structure-based optimization of these newly identified thiazole-based compounds for the anticancer drug design.

DESIGN, SYNTHESIS AND SCREENING OF ANTICANCER ACTIVITY OF INDOLE-4-THIAZOLIDINONE HYBRID HETEROCYCLES

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Keywords: 4-thiazolidinone, indole, anticancer activity, molecular docking, pharmacophore modelling.

Introduction. Among a variety of biologically active nitrogen heterocycles molecules bearing indole moiety represent a widely known class of natural compounds with biological significance. Various indole derivatives are available in market preparations, such as Pindolol, Indapamide, Perindopril, Carvedilol, Zafirlucast, Delavirdine. Moreover, recently this class of compounds attracts researches as a source of possible anticancer agents. **S**electing of highly effective starting moieties is crucial for the development of synthetic drug-like molecules. The thiazolidinone and indole heterocycles belong to the scaffolds which possess proven biological activity and are attractive for the purposes of hybrid-pharmacophore approach. The purpose of this study was to design new hybrid molecules containing [6+5]-heterocycles as potent anticancer agents.

Materials and methods. Organic wet synthesis, analytical and spectral methods of the structure determination (^{1}H, ^{13}C NMR-spectroscopy, LC-MS-spectrometry), pharmacological screening, SAR analysis, *in silico* studies.

Results. A series of 3-[(4-oxo-3-carboxy-2-thioxo-thizolidin-5-yl)]-1*H*-indole-2-carboxylic acids was synthesized in Knoevenagel reaction, and 3-[(2-amino-4-oxo-thiazol-5-yliden)methyl]-1*H*-indole-2-carboxylic acids was synthesized in the one-pot three-component reaction of [2+3]-cyclo-condensation followed by Knoevenagel reaction. Novel synthetic hybrid thiazolidinone-indole-carboxylates were screened for anticancer activity towards human hepatocarcinoma (HepG2), human glioblastoma (U251), breast adenocarcinoma (MCF-7), and promyelocytic leukemia (HL-60) cell lines. The lines of hepatocarcinoma, glioblastoma and breast adenocarcinoma were not highly sensitivity to the studied compounds. The growth of human promyelocytic leukemia cell line HL-60 was inhibited by 5-fluoro-3-[2-(4-hydroxyanilino)-4-oxo-thiazol-5-ylidene]methyl]-1*H*-indole-2-carboxylate at micromolar concentration (IC_{50} = 8.36 μM). The antiproliferative activity of this hit-compound was investigated at 10 μM concentration according to the NCI protocol. The most sensitive to its action were leukemia cell line (HL-60) whose growth was inhibited by >50%, melanoma cell line (MDA-MB-435), ovarian cancer (OVCAR-3) and breast cancer (MCF7) cell lines. In general, identified 4-thiazolidinone-indolecarboxylate inhibited growth of 21 tumor cell

lines by >50%. *In silico* studies of putative binding mechanisms of the hit-compound **2.8** showed its good affinity to the colchicine site of tubulin.

Conclusions. *In vitro* screening of the biological effects of synthesized compounds allowed identifying a hit-compound **2.8** with high antileukemic action against HL-60 cell line. Docking simulation showed good affinity of **2.8** to colchicine site in tubulin (-10.22 kcal/mol), which was higher than such for colchicine (-9.12 kcal/mol). Although further experimental in-depth study is needed for the establishing of **2.8** molecular mechanism of action.

N-(3-IMIDAZOL-1-YLPROPYL) CARBOXAMIDES BASED ON ACIDS OF THE 4-THIAZOLIDONE SERIES. SYNTHESIS AND BIOLOGICAL PROPERTIES

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Keywords: organic synthesis, biological properties, thiazolidine, druglikeness, antitumor activity.

Introduction. Imidazole derivatives exhibit various types of biological activity, such as antibacterial, anti-mycobacterial, anti-inflammatory, anti-tumor, anti-diabetic, anti-allergic, antipyretic, antiviral, antioxidant, anti-amoebic, anthelmintic, antifungal and anti-ulcer activity, etc. There are various examples of commercially available drugs on the market that contain the imidazole cycle, such as clemizole, etonitazen, enviroxime, astemizole, omeprazole, pantoprazole, thiabendazole, nocodazole, metronidazole, nitrosoimidazole, megazole, azathioprine, dacarbazine, tinidazole, ornidazole. Many drugs from this list contain amide groups in the molecule. Therefore, the synthesis of 4-thiazolidone and imidazole derivatives connected by an amide bond is interesting.

Materials and methods. Methods of organic synthesis, spectral methods of confirming the structure of synthesized compounds, and in silico research of druglikeness, toxicity parameters, and in vitro highly effective screening of antitumor activity.

The results. Several new *N*-(3-imidazol-1-ylpropyl)carboxamides based on 4-thiazolidone acids were synthesized. Their physical properties have been studied. NMR spectroscopy methods reliably confirmed the structure of the obtained derivatives of *N*-(3-imidazol-1-ylpropyl)carboxamides based on 4-thiazolidone series acids. In the spectra, there are signals of all protons with chemical shifts that correspond to the structure of the molecules. Calculations of drug-likeness and bioactivity parameters were carried out, according to which the derived *N*-(3-imidazol-1-ylpropyl)carboxamide derivatives based on 4-thiazolidone series acids meet the criteria of druglikeness and, therefore, they

are promising for studies of biological activity. The parameters of the potential bioactivity of the synthesized derivatives of *N*-(3-imidazol-1-ylpropyl) carboxamides were evaluated based on acids of the 4-thiazolidone series. It was established that it is most suitable to study the obtained compounds as inhibitors of enzymes, in particular proteases. The risk of toxicity of the synthesized compounds was predicted. The antitumor activity of 2-[5-(2-chloro-3-phenyl-allylidene)-2,4-dioxo-thiazolidin-3-yl]-*N*-(3-imidazol-1-yl)-propyl)-acetamide was studied.

Conclusions. We have reported an efficient method for preparing novel derivatives of *N*-(3-imidazol-1-ylpropyl)carboxamides, and potential druglikeness, and toxicity parameters was characterized. Also antitumor activity of 2-[5-(2-chloro-3-phenyl-allylidene)-2,4-dioxo-thiazolidin-3-yl]-*N*-(3-imidazol-1-yl)-propyl)-acetamide was studied.

SYNTHESIS AND PROPERTIES OF 3-[5-(1-*R*-1*H*-INDOL-3-YLMETHYLENE)-4-OXO-2-THIOXOTHIAZOLIDIN-3-YL] PROPIONIC ACID AMIDES

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Scientific supervisor: assoc. prof. **Volodymyr Horishny**

Keywords: synthesis, biological properties, thiazolidine, antimicrobial activity, druglikeness.

Introduction. Indole is a universal privileged pharmacophore, which causes a broad spectrum of pharmacological activity due to various mechanisms of action of such compounds. The indole fragment is promising in drug design. In recent years, many studies have been intensively conducted on the synthesis and study of various therapeutic perspectives of derivatives of this heterocycle. Another favored scaffold is the rhodanine scaffold. Compounds containing this heterocycle have a broad spectrum of biological activity of various profiles. One of the current concepts of the principle of drug design is molecular hybridization, which is a strategy based on the covalent fusion of two or more existing pharmacophores to design a single molecule.

Materials and methods. Methods of organic synthesis, spectral methods of confirming the structure of synthesized compounds, *in silico* research and *in vitro* highly effective screening of antimicrobial activity.

The results. Methods of synthesis of 3-[5-(1-*R*-1*H*-indol-3-ylmethylene)-4-oxo-2-thioxothiazolidin-3-yl]propionic acids and their chloride anhydrides were developed. The interaction of 3-[5-(1-*R*-1*H*-indol-3-ylmethylene)-4-oxo-2-thioxothiazolidin-3-yl]propionic acid chlorides with several primary and secondary amines, as well as hydrazides of carboxylic acids, was investigated. Several amides of 3-[5-(1-*R*-1*H*-indol-3-ylmethylene)-

4-oxo-2-thioxothiazolidin-3-yl]propionic acids, not described in the literature, were obtained. The structure of the synthesized compounds was reliably confirmed by NMR spectroscopy. The synthesized compounds were evaluated according to the druglikeness parameters, which indicate the compliance of the characteristics of the substances under study with the drug-likeness criteria. In addition, the antimicrobial activity of parts of the synthesized compounds was studied. Highly active compounds 2.8e and 2.8f were identified as effective inhibitors of the reproduction of Escherichia coli strain ATCC 25922 and Staphylococcus aureus strain ATCC 43300 bacteria, with a MIC value of 8-16 μM/ml. It was found that both active substances (2.8e and 2.8f) are, respectively, indolyl- and 5-F-indolyl-ethylamides of 5-(indol-3-yl-methylene)rhodanine-3-propionic acid.

Conclusions. Synthesized amides of 3-[5-(1-R-1H-indol-3-ylmethylene)-4-oxo-2-thioxothiazolidin-3-yl]propionic acids as effective antimicrobial agents.

SYNTHESIS OF 2- AND 3-SUBSTITUTED 5-(1*H*-PYRROL-2-YLMETHYLENE) THIAZOLIDIN-4-ONES AND THEIR PROPERTIES

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Introduction. Pyrrole is a privileged structure in medicinal chemistry because its fragment is found in a wide range of biologically active natural products and pharmacologically active molecules of synthetic origin. 4-thiazolidone derivatives are also widely used in organic synthesis and directed search for new medicinal substances. Furthermore, they can be used as intermediates in synthesizing biologically active compounds or as independent, active substances. Therefore, pyrrole and 4-thiazolidinone rings belong to privileged azaheterocycles, and their combination in one molecule is promising for drug design.

Materials and methods. Methods of organic synthesis, heterocyclization and condensation reactions, spectral methods of confirming the structure and synthesized compounds, *in silico* research and highly effective screening of antimicrobial activity.

The results. The methods of synthesis have been reproduced and optimized. Methods of synthesis of 3-(4-oxo-2-thioxothiazolidin-3-yl)alkanecarboxylic acids, 3-arylrhodanines and *N*-(4-oxo-2-thioxothiazolidin-3-yl)carboxamides were reproduced and optimized. Their interaction with 1-methylpyrrole-2-carbaldehyde was studied. A number of 2- and 3-substituted 5-(1*H*-pyrrol-2-ylmethylene)thiazolidin-4-ones, not described in the literature, were obtained. The structure of the synthesized compounds was reliably

confirmed by the NMR-spectroscopy method. The synthesized compounds were evaluated according to the drug-likeness parameters, which indicate the compliance of the characteristics of the studied substances with the drug-likeness criteria. The forecast of acute toxicity of synthesized compounds was made. It was established that they potentially belong to the 3rd and 4th classes of toxicity and are promising for creating medicinal products. It was established that compounds 2.19c and 2.22d,e are characterized by moderate antibacterial and antifungal activity. And the highest indicator of antifungal activity (99.0%) is possessed by the 3-phenylaminorhodanine compound 2.21 relative to the Candida albicans ATCC 90028 strain.

Conclusion. Several 5-(1*H*-pyrrol-2-ylmethylene)thiazolidin-4-one derivatives were synthesized, and their physicochemical properties, spectral characteristics, parameters of drug-likeness and toxicity, and antimicrobial properties were studied.

SYNTHESIS AND BIOLOGICAL PROPERTIES OF N-(1,1-DIOXO-TETRAHYDRO-3-THIENYL)CARBOXAMIDES

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Keywords: synthesis, biological properties, 1,1-dioxo-tetrahydro-thiophene, carboxamides, antitumor activity

Introduction. Compounds containing the thiophene ring occupy an important place in medicinal chemistry. On the other hand, derivatives of tetrahydrothiophene and sulfolane have been studied little and are not represented on the pharmaceutical market. Tetrahydrothiophene-1,1-dioxide (sulfolane) is characterized by lower lipophilicity, better water solubility, the ability to form H-acceptor bonds and, due to this, effectively interact with potential biological macromolecules. The object of research in our work was N-(1,1-dioxo-tetrahydro-3-thienyl)carboxamides of acids of the 4-thiazolidine series. Due to their properties, 4-thiazolidinones are widely and successfully used in drug design. Molecular hybridization, or the so-called hybrid pharmacophore approach, is one of the effective approaches in the search for new biologically active compounds. This method consists in combining several pharmacophore units in one molecule, which creates prerequisites for obtaining new chemical objects with promising biological properties. It is obvious that the appearance of valuable pharmacological properties should be expected from the combination of the 4-thiazolidinone cycle with the sulfolane cycle in one molecule.

Materials and methods. Methods of organic synthesis, heterocyclization, condensation and acylation reactions, spectral methods of

confirming the structure of synthesized compounds, in silico research and highly effective screening of anticancer activity.

The results. Methods of synthesis of 5-ylidene-substituted rhodanine-3-alkane carboxylic acids from 3-R-amino-1,1-dioxo-tetrahydro-thiophene were reproduced. A series of new N-(1,1-dioxo-tetrahydro-3-thienyl) carboxamides was obtained. The structure of the synthesized N-(1,1-dioxo-tetrahydro-3-thienyl)carboxamides was reliably confirmed by NMR spectroscopy. The spectra contain signals of all protons with chemical shifts corresponding to the molecular structure. The druglikeness criteria of the synthesized compounds were calculated and their antitumor activity was investigated.

Conclusions. Synthesized N-(1,1-dioxo-tetrahydro-3-thienyl) carboxamides of 4-thiazolidine acids and studied their antitumor properties. Compounds were found to exhibit significant antitumor activity against NCI-H522 and NCI-H460 lines of non-small cell lung cancer.

TARGETED DESIGN OF 5-(4-OXO-4*H*-CHROMEN-3-YLMETHYLENE)-2-THIOXOTHIAZOLIDIN-4-ONE DERIVATIVES AND STUDY OF THEIR BIOLOGICAL PROPERTIES

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Keywords: synthesis, biological properties, thiazolidine, chromene, antimicrobial activity, antifungal activity, druglikeness.

Introduction. Chromenes are a group of natural compounds common in nature, predominantly plants. The word "chromene" comes from the Greek word chroma, which means "color" and indicates that a variety of colors distinguishes many chromene derivatives. Chromenes are oxygen-containing heterocyclic compounds with a benzoannelated γ-pyrone ring (4*H*-chromen-4-one, 4*H*-1-benzopyran-4-one). Several medicines are known for chromene derivatives. Among the synthetic derivatives of chromene, many biologically active substances with different action profiles are also known. Given these facts, the chromene cycle is considered privileged. The rhodanine cycle is also an example of a privileged structure, as it has been found to be present in various biologically active molecules such as kinase inhibitors, antimicrobial and anti-inflammatory agents, etc. A rhodanine substituent in these compounds determines their ability to be a starting point for developing new drugs and biologically active molecules.

Materials and methods. Methods of organic synthesis, spectral methods of confirming the structure of synthesized compounds, *in silico* research, and *in vitro* highly effective screening of antimicrobial and antifungal activity.

The results. The interaction of 3-substituted rhodanines with chromene-3-carbaldehydes was investigated. Several 5-(4-oxo-4*H*-chromen-3-ylmethylene)-2-thioxothiazolidin-4-ones, previously undescribed in the literature, were obtained. The synthesized compounds were evaluated according to the drug-likeness parameters, which indicate the compliance of the characteristics of the studied substances with the druglikeness criteria. The ADME prediction of the parameters of the synthesized compounds was carried out. It is shown that they can be used as oral medicinal products. Also, these compounds will be able to penetrate the central nervous system. The synthetic accessibility of this type of compound is estimated from 3.44 to 4.33 on a ten-point scale, where one is very easy and ten is very difficult. This indicates that synthesizing analogs of a similar structure will not cause problems. It was established that the tested compounds did not show significant antibacterial and antifungal activity. Only compound 2.21b showed moderate antibacterial activity against strains of *K. pneumoniae* ATCC 700603 and *P. aeruginosa* ATCC 27853, and compound 2.21l has the same level of antifungal activity against *C. albicans* ATCC 90028 and *A. baumannii* ATCC 19606.

Conclusions. 5-(4-oxo-4*H*-chromen-3-ylmethylene)-2thioxothiazolidin – 4 - ones were synthesized as potential antimicrobial and antifungal agents.

SYNTHESIS AND PROPERTIES OF 2-THIOXOTHIAZOLIDIN-4-ONE DERIVATIVES WITH 2,3-DIHYDRO[1,4]DIOXYNO[2,3-*G*]QUINOLINE SUBSTITUENTS

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Keywords: synthesis, biological properties, thiazolidine, anticancer activity, antimicrobial activity, druglikeness.

Introduction. 1,4-Benzodioxanes and their derivatives have long been widely used to develop organic substances with various bioactivities. 1,4-Benzodioxane is a versatile scaffold used to design molecules endowed with diverse bioactivities. In recent decades, strategies in the design of drugs using 1,4-benzodioxane scaffold have been intensively developed. One of the strategies in the search for biologically active substances is the combination of two heterocyclic pharmacophore fragments in one molecule. Considering the above, synthesizing hybrids based on benzodixane, quinoline, and rhodanine and studying their biological activity is an urgent task today.

Materials and methods. Methods of organic synthesis, spectral methods of confirming the structure of synthesized compounds, and *in silico* research of druglikeness, *in vitro* highly effective screening of antimicrobial and antitumor activity.

The results. Literature data on the synthesis and biological activity of quinoline, rhodanine, and benzodioxane were processed. Several new 2-thioxothiazolidin-4-ones with 2,3-dihydro[1,4]dioxyno[2,3-*g*]quinoline substituents were synthesized. Their physical properties were studied. The structure of the obtained 2-thioxothiazolidin-4-one derivatives with 2,3-dihydro[1,4]dioxyno[2,3-*g*]quinoline substituents was reliably confirmed by NMR spectroscopy methods. In the spectra, there are signals of all protons with chemical shifts corresponding to the structure of the molecules. Calculations of the similarity parameters were carried out, according to which 2-thioxothiazolidin-4-ones were obtained from 2,3-dihydro[1,4]dioxyno[2,3-*g*] with quinoline substituents meet the criteria of drug similarity and therefore are promising for biological activity studies. The parameters of potential bioactivity of synthesized 2-thioxothiazolidin-4-one derivatives with 2,3-dihydro[1,4]dioxyno[2,3-*g*]quinoline substituents were evaluated. It was established that studying the obtained compounds as enzyme inhibitors is most suitable. Highly effective compounds 2.17a and 2.18a were found, for which the level of antibacterial activity was 4-8 μM/ml and 8-32 μM/ml, respectively. The toxicity of the tested compounds 2.17a and 2.18a was not observed for human embryonic kidney cells and human red blood cells at a concentration of 32 μM/ml. The synthesized compounds show moderate antitumor activity. Compound 2.18d showed the best cytotoxic activity among the tested compounds, particularly the central nervous system cancer line SNB-75 with GP = 47.41% and the non-small cell lung cancer line HOP-92 with GP = 57.04%.

Conclusions. We have reported an efficient method for preparing novel 2-thioxothiazolidin-4-one derivatives with 2,3-dihydro[1,4]dioxyno[2,3-*g*]quinoline substituents as potential antibacterial and antitumor agents.

THE INVESTIGATION OF NEW THIAZOLOTHIOPYRAN DERIVATIVES AS POTENTIAL ANTICANCER AGENTS

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Keywords: thiopyranothiazoles, anticancer activity, MTT assay.

Introduction. Thiopyranothiazole derivatives are biologically active condensed thiazolidinone compounds synthesized using several approaches, namely, hetero-Diels-Alder and Michael-cyclization. This heterocyclic scaffold is characterized by the "fixed" 4-thiazolidinone biophor in the "rigid" fused system would save the biological activity of their synthetic precursors – 5-ene-4-thiazolidinones – that represent a pharmacologically attractive class of bioactive compounds for modern medicinal chemistry. 5-Ene-4-thiazolidinones

and related heterocyclic-based compounds have been extensively explored as the source of anticancer, anti-inflammatory, antimicrobial, antidiabetic and antibacterial agents. In addition, 5-ene-4-thiazolidinones are important "building blocks" for achieving the chemical diversity of heterocyclic derivatives and the design of biologically active molecules. Synthesis of thiopyrano[2,3-*d*]thiazoles is one of the important directions of 5-ene-4-thiazolidinones chemical transformations for medicinal chemistry purposes. Such an approach allows for preserving synthetic precursors' biological activity and avoiding Michael acceptors' properties as possible pan assay interference compounds (PAINS). Among thiopyrano[2,3-*d*]thiazoles, anti-inflammatory, antiviral, antimicrobial, anti-trypanosomal, as well as anticancer agents have been reported.

Materials and methods. It has been analysed the corresponding research in synthesis of appropriate biologically active thiopyranothiazoles in the in the *hetero*-Diels-Alder reaction. The synthesized compounds were evaluated for anticancer activity according MTT protocol. Induction of ROS production and morphological changes in treated cells under target compound treatment was also accomplished.

Results and Discussion. Seven chromeno[4',3':4,5]thiopyrano[2,3-d]thiazole derivatives were synthesized and screened for their cytotoxic effects on different lines of mammalian leukemia, breast adenocarcinoma, glioblastoma, and pseudo-normal and normal cells. The derivative 3 demonstrated toxicity towards tumor cells of Jurkat, K562, U251, HL-60, MCF-7, and MDA-MB-231 lines. At the same time, this compound possessed low toxicity (IC50 >100 μM) towards cells, used as control, representing non-tumour, somatic cells: HaCaT, HEK293 cells as well as murine Balb/c 3T3 and J774.2 cells, mink Mv1Lu cells, and normal mitogen-activated human blood lymphocytes. This compound triggered pro-apoptotic morphological changes in Jurkat cells, namely chromatin condensation, nuclei fragmentation, and membrane blebbing. This compound induced the accumulation of endogenous reactive oxygen species (ROS), namely superoxide radicals, in human leukemia cells. Our finding indicated that compound 3 inhibited the viability of human leukemia T-cells and glioblastoma cells via induction of DNA damage and apoptosis through ROS-mediated mitochondrial pathway.

Conclusions. The preliminary results allowed to identify the active compounds with promising anticancer activity.

STUDY OF NEW ANTHRAQUINONE DERIVATIVES AS POTENTIAL BIOLOGICALLY ACTIVE COMPOUNDS

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Keywords: 9,10-anthraquinone derivatives, thiazolidinones, antimicrobial activity, anticancer activity.

Introduction: The anthracene-9,10-dione derivatives represent a class for structurally new bioactive molecules which possess antimicrobial, antiviral, anticancer, antioxidant activities. Among these types of molecules a set of potent anthracycline antitumor antibiotics such daunomycin, adriamycin and mitoxantrone have been identified. The chemical and biological activity exhibited by anthraquinone-based derivatives is affected by the different substituents in the structure such polypeptide, polynucletotide, glycoside, as well as fragments of methylene active compounds. On the other hand, the methylene active compounds have also been of considerable interest in medicinal chemistry, for instance, thiazolidinone structural-type compounds are important starting materials for the synthesis of many compounds displaying antimicrobial, antiviral, anticancer, and anti-inflammatory activities. As a result, the present work is aimed at the synthesis of 2-hydrazinoanthraquinones for further screening antimicrobial and anticancer activity.

Methods: The synthesis of new polyfunctionalized 2-hydrazinoanthraquinones for screening antimicrobial and anticancer activities was accomplished based on azo-coupling reaction. The reaction between 2-(morpholin-4-ylazo)-anthraquinone with methylene active compounds in an acetic acid medium providing series of anthraquinonehydrazone derivatives.

Results: The anthraquinone-based triazenes was coupled with different methylene active compounds to give the corresponding hydrazine derivatives. The reaction of active methylenes with studied morpholinetriazene antraquinone proceeded with amine elimination providing to arylhydrazones. As a result, the library of new polyfunctionalized anthraquinonehydrazones for search of new antimicrobial and anticancer agents have been designed and synthesized.

Discussion: Antimicrobial activity screening identified compounds with significant effects against tested microorganisms with MIC value <186.9 μM. The newly synthesized compounds were selected by the National Cancer Institute (NCI) Developmental Therapeutic Program and evaluated for antitumor activity at 10 μM concentration toward a panel of approximately 60 cancer cell lines according to the US NCI protocol. The tested compounds showed slight activity on cancer cell lines. However, the synthesized compound 2.4 was moderate active on leukemia HOP-62 (GP = 59.56%) cell

line.

Conclusions: New polyfunctionalized 2-hydrazinoanthraquinones 2.1-2.7 have been synthesized with high yields via azo-coupling reaction using 2-(morpholin-4-ylazo)-anthraquinone and methylene active compounds. The screening of anticancer activity led to identification compound 2.4 with moderate activity on HOP-62 leukemia cancer cell line. The preliminary results of antimicrobial activity allowed us to identify the active compound 2.3, which has shown the best activity against extensively drug-resistant *P.putida* N182 and *C.albicans* N139 which revealed a potential for in-depth study of the mentioned compound for the construction of novel anticancer and antimicrobial agents.

SYNTHESIS OF NEW HETEROCYCLIC HYBRID MOLECULES BASED ON INDOLE DERIVATIVES

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Keywords: synthesis, indole, 4-thiazolidinones, Knoevenagel reaction, druglikeness, biotargets.

Introduction. Today, an essential task of pharmaceutical chemistry is the creation of effective, highly selective, and low-toxic medicinal products. One of the solutions to this problem is the concept of molecular hybridization, which combines various biologically important "structural matrices" in one molecule to achieve their biosynergism. Such a molecular design strategy often leads to a new pharmacological profile, potentiation of action, and reduced toxicity of new "hybrid" molecules. Among the "biophoric" heterocycles, the indole nucleus deserves considerable attention because it is known that indole molecules have significant pharmacological potential, including anticancer, antiviral, antimicrobial, and antifungal activities.

Materials and methods. Organic synthesis, spectral analysis, *in silico* druglikeness, predict biotargets.

Results. The target 5-ylidene derivatives of 2-(2-thiazolyl)imino-4-thiazolidones were synthesized by the Knievenagel reaction of 2-(2-thiazolyl)imino-4-thiazolidones and carbonyl compounds (1H-indole-3-carbaldehyde, 3-formyl-1H -indole-2-carboxylic acid, 1H-indole-6-carbaldehyde). For 5-(1H-indol-3-ylmethylene)-2-(thiazol-2-ilimino)-thiazolidin-4-one, potential drug-likeness parameters were investigated using the SwissADME online service and the following were found: lipophilicity XLOGP3 3.52, size MW 326.40 g/mol, TPSA polarity 123.68 ?2, solubility log S -4.42, saturation (part of carbon) in sp3 hybridization 0.00, and flexibility of rotational bonds 2. Determining the potential affinity of 5-(1*H*-indol-3-

ylmethylene)-2-(thiazol-2-ilimino)-thiazolidin-4-one to various classes of biotargets was showed the potential effect on the classes of enzymes – kinases was investigated by 20.0%, G-protein-coupled receptors – 24.0%, proteases, and ligand-dependent ion channels 12% each.

Conclusions. We have reported an efficient method for the preparation of novel indole containing 2-(2-thiazolyl)imino-4-thiazolidones via Knoevenagel reaction of 2-(2-thiazolyl)imino-4-thiazolidones with different indole carbaldehydes and potential druglikeness, predictable biotargets was characterized.

SYNTHESIS AND BIOLOGICAL PROPERTIES OF *N*-QUINOXALIN-6-YLCARBOXAMIDES BASED ON 4-THIAZOLIDONE ACIDS

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Keywords: synthesis, biological properties, thiazolidine, druglikeness.

Introduction. Quinoxaline derivatives are important nitrogen-containing heterocyclic compounds with various types of biological activity. Quinoxaline is a scaffold of a wide range of pharmacologically active compounds with antibacterial and antifungal effects. Compounds with a 1,3-thiazolidin-4-one ring, particularly 1,3-thiazolidin-2,4-diones, and rhodanines (2-thioxo-1,3-thiazolidin-4-ones) have significant pharmacological value and are part of commercial pharmaceuticals. Modern studies indicate promising prospects for using 4-thiazolidone derivatives in medicinal chemistry. Therefore, valuable pharmacological properties can be expected from the combination of quinoxaline and 4-thiazolidone cycles in one molecule.

Materials and methods. Methods of organic synthesis, spectral methods of confirming the structure of synthesized compounds, and *in silico* research of druglikeness and toxicity parameters.

The results. Literary data on medicinal products and biologically active substances of compounds of the quinoxaline and rhodanine series were processed. Compounds containing quinoxaline can bind to various targets, due to which quinoxaline is an attractive nucleus in medicinal chemistry. Several new *N*-quinoxaline-6-ylcarboxamide derivatives based on 4-thiazolidone acids were synthesized, and their physical properties were studied. The methods of NMR spectroscopy and chromatography-mass spectrometry reliably confirmed the structure of the obtained derivatives of *N*-quinoxalin-6-ylcarboxamides. Calculations of druglikeness parameters were carried out, according to which the obtained derivatives of *N*-quinoxaline-6-ylcarboxamides meet the druglikeness criteria and therefore are promising for biological activity studies. The parameters of the potential bioactivity of synthesized derivatives of *N*-

quinoxalin-6-ylcarboxamides were evaluated. It was established that it is most suitable to study the obtained compounds as inhibitors of enzymes, in particular proteases and kinases. Druglikeness and toxic risks were predicted. All synthesized derivatives of *N*-quinoxaline-6-ylcarboxamides do not show an irritating effect. However, the high probability of mutagenicity, oncogenicity, and moderate effects on reproductive function should be considered for them. The acute toxicity of synthesized derivatives of *N*-quinoxaline-6-ylcarboxamides was evaluated. It was determined that all compounds belong to the 4th and 5th classes of toxicity. They are low-toxic and, as a result, promising in creating medicinal preparations.

Conclusions. We have reported an efficient method for preparing novel derivatives of *N*-quinoxalin-6-ylcarboxamides, and potential druglikeness and toxicity parameters was characterized.

SYNTHESIS AND BIOLOGICAL PROPERTIES OF 3-SUBSTITUTED DERIVATIVES OF 5-(1-METHYL-1,2,3,4-TETRAHYDROQUINOLIN-6-YLMETHYLENE)-2-THIOXO THIAZOLIDIN-4-ONE

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Keywords: synthesis, biological properties, tetrahydroquinoline, thiazolidine, antimicrobial activity

Introduction. Increased interest in tetrahydroquinoline derivatives is caused by their biological activity. Among tetrahydroquinolines there are substances that have already proven themselves as medicinal drugs, including stimulants of the central nervous system, antibiotics and antiarrhythmics. The rhodanine heterocycle is also important in medicinal chemistry. Compounds containing this pharmacophore have a wide spectrum of biological activity. With this in mind, in-depth study of the named heterocyclic systems, synthesis of hybrids based on them, study of the biological activity of the obtained compounds and establishment of the relationship between structure and action is undoubtedly of interest both from a theoretical point of view and in terms of the targeted search for potential drugs.

Materials and methods. Methods of organic synthesis, heterocyclization and condensation reactions, spectral methods of confirming the structure and synthesized compounds, in silico research and highly effective screening of antimicrobial activity.

The results. The methods of synthesis of a number of 3-substituted 2-thioxothiazolidin-4-ones and 2-(pyridyl-2-amino)thiazolin-4-ones were reproduced and optimized. The interaction of the above starting compounds with 1-methyl-1,2,3,4 -tetrahydroquinoline-6-carbaldehyde. A number of 5-(1-

methyl-1,2,3,4-tetrahydroquinolin-6-ylmethylene)-4-thiazolidinone derivatives not described in the literature were obtained. The synthesized compounds were evaluated according to drug similarity parameters. The antimicrobial activity of the synthesized compounds was investigated. It was established that most of them do not show appreciable antibacterial activity. At the same time, the investigated 2-/3-/4-hydroxy-N-(5-(1-methyl-1,2,3,4-tetrahydroquinolin-6-ylmethylene)-2-thioxothiazolidin-3-yl)benzamides exhibit antifungal activity against the fungus Cryptococcus neoformans ATCC 208821.

Conclusions. A number of 5-(1-methyl-1,2,3,4-tetrahydroquinalin-6-ylmethylene)-2-thioxothiazolidin-4-one derivatives were synthesized. 2-Hydroxy-N-[5-(1-methyl-1,2,3,4-tetrahydroquinalin-6-ylmethylene)-4-oxo-2-thioxothiazolidin-3-yl]benzamide was identified as a hit compound with values of mic 4 μg/ml.

SYNTHESIS AND BIOLOGICAL PROPERTIES OF 5-([1,3] DIOXOLO [4,5-*G*]QUINOLIN-7-YLMETHYLENE)-2-THIOXOTHIAZOLIDIN-4-ONE DERIVATIVES

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Scientific supervisor: assoc. prof. **Volodymyr Horishny**

Keywords: synthesis, biological properties, thiazolidine, antimicrobial activity, anticancer activity.

Introduction. The benzodioxole system is essential in drug design. It is part of many biologically active compounds and medicines, such as antidepressants, antivirals, and antifungals. Among the benzodioxol derivatives, there are many biologically active substances of both natural and synthetic origin. Therefore, the study of new compounds containing the benzodioxole system is an important area of research in medicinal and pharmaceutical chemistry. One of the strategies in the search for biologically active substances is the combination of several heterocyclic pharmacophore fragments in one molecule. Therefore, synthesizing hybrids based on benzodioxol, quinoline, and rhodanine and studying their biological activity is urgent.

Materials and methods. Methods of organic synthesis, spectral methods of confirming the structure synthesized compounds, *in silico* research, and *in vitro* highly effective screening of antimicrobial and anticancer activities.

The results. The methods of synthesis of rhodanine-3-carboxylic acids, 3-aryl- and 3-alkylrhodanines were reproduced and optimized. The interaction of rhodanine-3-carboxylic acids, 3-aryl- and 3-alkylrhodanines with 6-chloro-[1,3]dioxolo[4,5-g]quinoline-7-carbaldehyde and 6-oxo-5,6-dihydro-[1,3]dioxolo[4,5-*g*]quinoline-7-carbaldehyde. A series of new derivatives of 5-

([1,3]dioxolo[4,5-*g*]quinolin-7-ylmethylene)rhodanine was obtained. The structure of the synthesized derivatives of 5-([1,3]dioxolo[4,5-*g*]quinoline-7-ylmethylene)rhodanine was reliably confirmed by NMR spectroscopy. In the spectra, there are signals of all protons with chemical shifts corresponding to the structure of the molecules. The drug similarity criteria of the synthesized compounds were calculated. It has been established that they are promising potential medicinal products. The antimicrobial activity of the synthesized compounds was studied. Significant antibacterial activity of compound 2.17a against Escherichia coli strain ATCC 25922 was established, with a MIC value of 8-16 μM/ml. A study of the antitumor activity of the synthesized compounds was carried out. Compounds were found to exhibit moderate antitumor activity against the SR leukemia line.

Conclusions. Synthesized 5-([1,3]dioxolo[4,5-g]quinolin-7-ylmethylene) rhodanine derivatives as potential antimicrobial and anticancer agents.

SYNTHESIS AND INVESTIGATION OF THE RELATIONSHIP «STRUCTURE – BIOLOGICAL ACTIVITY» OF 5-QUINOXALINYLMETHYLENE-2-THIOXOTHIAZOLIDIN-4-ONE DERIVATIVES

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Scientific supervisor: assoc. prof. **Volodymyr Horishny**

Keywords: organic synthesis, biological properties, thiazolidine, antimicrobial activity.

Introduction. Nitrogen-containing heterocycles are very important, with a diverse list of therapeutic effects. A large proportion of FDA-approved drugs demonstrate this. The diazaheterocycles that are the central component of many potential drug candidates, particularly the benzodiazines: quinoxaline, quinazoline, phthalazine, and cinnoline, are well-known bioisosteres of benzothiophene, naphthalene, and quinoline, used in many drug development projects. 4-thiazolidone derivatives also occupy a unique place in medicinal chemistry due to a broad spectrum of biological activity. At today's stage of medical chemistry development, the 4-thiazolidone cycle is considered a privileged scaffold. Available synthetic methods allow widely varying substituents in the 4-thiazolidone ring in positions 2, 3, and 5, which is essential in the design of biologically active substances. This makes it possible to carry out a targeted search for new compounds with a given biological effect.

Materials and methods. Methods of organic synthesis, spectral methods of confirming the structure of synthesized compounds, *in silico* research, and *in vitro* highly effective screening of antimicrobial activity.

The results. The literature data on the synthesis and biological activity of quinoxaline derivatives were studied. Several new 5-quinoxalinylmethylene-2-thioxothiazolidin-4-ones were synthesized. Their physical properties were studied. NMR spectroscopy methods reliably confirmed the structure of the obtained derivatives of 5-quinoxalinylmethylene-2-thioxothiazolidin-4-one. Calculations of druglikeness parameters were carried out, according to which the obtained derivatives of 5-quinoxalinylmethylene-2-thioxothiazolidin-4-one meet the criteria of druglikeness and therefore are promising for studies of biological activity. It was established that it is most suitable to study the obtained compounds as inhibitors of enzymes, in particular proteases. Highly effective compounds 2.29a-c were found, for which the level of antibacterial activity was 8-16 μM/ml. Toxicity to human embryonic kidney cells (Human embryonic kidney cells) and human erythrocytes (Human red blood cells) at a concentration of 32 μM/ml was not observed.

Conclusions. Libraries of 5-quinoxalinylmethylene-2-thioxothiazolidin-4-ones were synthesized, and their physicochemical properties, spectral characteristics, parameters of druglikeness, and antimicrobial properties were studied.

THIAZOLIDINONE-4 AND PYRAZOLONE-5 DERIVATIVES IN THE DESIGN OF BIOLOGICALLY ACTIVE MOLECULES

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Keywords: synthesis, pyrazolone, 4-thiazolidinones, thiadiazoles, Knoevenagel condensation, anticancer activity.

Introduction. Pyrazolone-thiazolidines are well-known and promising research objects in modern medicinal and pharmaceutical chemistry as potential drug candidates. Eating these heterocyclic systems allows you to realize and potentiate antitumor, antimicrobial, antifungal, and anti-inflammatory activity. In addition, recent studies in the field of molecular biology and biochemistry allow us to characterize the pharmacological profiles of pyrazoline-thiazolidines by experimentally established antagonism against the epidermal growth factor receptor EGF (HER2 and EGFR, VEGFR-2, and BRAFV600E), tumor necrosis factor TNF-α, dihydrofolate reductase DHFR and agonism for PPAR-γ receptors.

Materials and methods. Organic synthesis, spectral analysis, *in vitro* anticancer activity.

Results. New (*Z*)-5-((5-methyl-3-oxo-2-phenyl-2,3-pyrazolo (dihydropyrazol)-4-yl)methyl)- 2-thioxo-4-thiazolidinones were synthesized based on the Knoevenagel reaction with pyrazoline- containing aldehydes. A new dimethylammonium 5-methyl-4-((4-oxo-2-thioxo-1,3-thiazolidin-5-ylidene)methyl)-3-oxo-2-phenyl-2,3-dihydropyrazol-1-ide. 1,5-dimethyl-2-phenyl-4-[(5-sulfanyl- 1,3,4-thiadiazol-2-yl)amino]pyrazol-3-one was effectively used to obtain 5-[5-(1, 5-Dimethyl-3- oxo-2-phenyl-2,3-dihydro-1*H*-pyrazol-4-ylamino)-[1,3,4]thiadiazol-2-ylsulfanyl]-3-methyl-1- phenyl-1*H*-pyrazole-4-carbaldehyde For the synthesized 5-(4-chlorobenzylidene)-2-[5-(4-dimethylaminophenyl)-3-methyl-4,5-dihydropyrazol-1-yl]-thiazol-4-one, in in vitro screening of antitumor activity based on the Institute of Molecular and Translational Medicine of Palatskyi University (Olomouc, Czech Republic). The anticancer activity of 5-[5-(1,5-Dimethyl-3-oxo-2- phenyl-2,3-dihydro-1H-pyrazol-4-ylamino)-[1,3,4]thiadiazol-2-ylsulfanil has been established]-3-methyl-1-phenyl-1H-pyrazole-4-carbaldehyde, which showed indirect antiproliferative activity against CCRF-CEM T-lymphoblastic leukemia cells (IC_{50} = 32.99±1.30 μM), but showed a low cytotoxic effect against pseudonormal cells human BJ (IC_{50} = >50) and MRC-5 (IC_{50} = >50) For (Z)-5-((5-chloro-3-methyl-1-phenylpyrazol-4-yl)methylidene)-2-thioxo-4-thiazolidinone's cytotoxic activity was investigated by the US National Cancer Institute Developmental Therapeutic Program (DTP NCI). Melanoma cancer cell lines were the most sensitive to the effects of the synthesized compound.

Conclusions. Purposeful synthesis of new library of pyrazole-thiazolidinone was performed. Antitumor activity of of 5-[5-(1,5-Dimethyl-3-oxo-2-phenyl-2,3-dihydro-1H-pyrazol-4-ylamino)- [1,3,4]thiadiazol-2-ylsulfanil and (Z)-5-((5-chloro-3-methyl-1-phenylpyrazol-4-yl)methylidene)-2-thioxo-4-thiazolidinone was studied and potential druglikeness was characterized.

MOLECULAR DESIGN OF COMBINATORIAL LIBRARIES OF *N*-(5-ARYLIDENE-4-OXO-2-THIOXOTHIAZOLIDIN-3-YL) NICOTINAMIDE AND ISONICOTINAMIDE AND SCREENING OF BIOLOGICAL PROPERTIES OF THE OBTAINED DERIVATIVES

Yana Skobalo
Scientific supervisor: assoc. prof. **Volodymyr Horishny**

Keywords: synthesis, biological properties, nicotinamides, isonicotinamides, thiazolidine, antimicrobial activity.

Introduction. 2-Thionthiazolidone-4 (rhodanine) is a privileged scaffold in drug discovery. Functionalization and appropriate modifications of rhodanine derivatives led to compounds endowed with various types of

biological activity. Rhodanine derivatives have many pharmacological indications, such as fungal protein mannosyltransferase inhibitors, HIV-1 integrase inhibitors, aldose reductase inhibitors, β-lactamase inhibitors, antimalarial drugs, and antidiabetic drugs. Another bioactive class of compounds is pyridine derivatives. In nature, pyridine is a component of many biologically active compounds, such as nucleic acids, caffeine, and vitamin B_3 (niacin). In addition, many drugs contain a pyridine fragment in their structure, for example, antidepressants, antihistamines, antibiotics, antiviral drugs, and others. Therefore, combining a 4-thiazolidone fragment with a pyridine fragment in one molecule is promising for drug design.

Materials and methods. Methods of organic synthesis, heterocyclization and condensation reactions, spectral methods of confirming the structure and synthesized compounds, in silico research and highly effective screening of antimicrobial activity.

The results. The interaction of *N*-(4-oxo-2-thioxothiazolidin-3-yl)nicotinamide and isonicotinamide with aldehydes of the heterocyclic series was investigated. Several *N*-(5-arylidene-4-oxo-2-thioxothiazolidin-3-yl)nicotinamides and isonicotinamides not described in the literature were obtained. The synthesized compounds were evaluated according to drug similarity and bioactivity parameters. The antimicrobial activity of the synthesized compounds was studied. It was established that most of them show moderate activity against the studied spectrum of microorganisms. *N*-(4-oxo-5-quinolin-4-ylmethylene-2-thioxothiazolidin-3-yl)-isonicotinamide was identified as a hit compound with high antimicrobial activity against Escherichia coli ATCC 25922 with a MIC value of 4 μg/ml.

Conclusions. Combinatorial libraries of *N*-(5-arylidene-4-oxo-2-thioxothiazolidin-3-yl)nicotinamide and isonicotinamide were synthesized, and their physicochemical properties, spectral characteristics, parameters of drug-likeness and toxicity, and antimicrobial properties were studied.

DEPARTMENT OF FARMACOGNOSY AND BOTANY

(Head of the department – assoc. prof. **Natiliya Shapovalova**)

CURRENT STATE AND PROSPECTS FOR MEDICINAL USES OF PLANTS OF MALVACEAE FAMILY

Andriana Dolgosh
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Keywords: plants of the Malvaceae family, common hollyhock, marshmallow.

Introduction. Medicinal plants, belonging to the Malvaceae family, which have long been used in official and folk medicine of Ukraine as anti-inflammatory, expectorant and emmolient agents, are of particular interest. The most widely known medicinal plant of the Malvaceae family is marshmallow (*Althaea officinalis*), an expectorant and anti-inflammatory component of numerous preparations. Therefore, taking into account the availability of raw materials of other species of mallow family that grow in Ukraine, their wide spectrum of pharmacological action, in order to expand the raw material base, we consider the pharmacognostic study of plants of the Malvaceae family to be relevant and promising.

Materials and research methods. The goal of our work was to conduct a pharmacognostic study of representatives of the Malvaceae family, growing in Ukraine.

Results. Recent data of literature review sources regarding the botanical characteristics, chemical composition and medicinal uses of plants of the Malvaceae family are analyzed and summarized in the master project.

Morphological and anatomical studies of the leaves and flowers of common hollyhock (*Alcea rosea*) and marshmallow were carried out, their microscopic diagnostic features were established, as well as common and distinctive features of the leaves and flowers of both species, that will be used to improve the methods of identification of medicinal plant materials by external and microscopic features. In terms of phytochemical analysis, flavonoids and polysaccharides were detected in the leaves and flowers of common hollyhock and marshmallow by means of qualitative reactions.

The quantitative content of the flavonoids' totality was determined, which is statistically higher in the leaves of marshmallow than in the leaves of common hollyhock (1.41 ± 0.21% and 1.25 ± 0.21%, respectively); however, the content of total flavonoids in the flowers of common hollyhock was higher than the content of the flavonoids in the flowers of marshmallow (1.34 ± 0.27% and 0.83 ± 0.55, respectively).

Quantitative content of total polysaccharides was determined, which is higher in leaves of marshmallow than in leaves of common hollyhock (6.83 ± 0.44% and 4.28 ± 0.35%, respectively); however, the content of total polysaccharides in the flowers of common hollyhock was higher than the

content of the polysaccharides in the flowers of marshmallow (6.81 ± 0.44% and 5.21 ± 0.39%, respectively).

Conclusions. Therefore, the conducted studies indicate the promising use of common hollyhock flowers as a new source of biologically active substances.

PHARMACOGNOSTIC STUDY OF *PHYSOCARPUS OPULIFOLIUS* (L.) MAXIM

Antonina Pasku
Scientific supervisor: prof. **Nataliya Vorobets**, PhD

Keywords:*Physocarpus opulifolius*(L.) Maxim, pharmacognostic analysis.

Introduction.*Physocarpus opulifolius*(L.) Maxim. isa North American species which an introduced or listed in various regions of Europe and grows in forest parks, forest strips, forest crops, roadsides, including in Ukraine. The chemical composition of the organs of *P. opulifolius*and its biological activity remain poorly studied. Therefore, the species needs more thorough pharmacognostic research with a view to further use.

Materials and methods. The object of research was leaves of *Physocarpus opulifolius* (L.) Maxim. of the Red Baron variety harvested in the vicinity of Lviv. There were used methods of harvesting, drying, and grinding of plant material; macroscopic and microscopic examination; spectrophotometry, titrimetry, phytochemical and antimicrobial analysis.

Results. A complex pharmacognostic investigation of *Physocarpus opulifolius* (L.) Maxim. was carried out. Using qualitative methods, it was established that the leaves of *Physocarpus opulifolius* (L.) Maxim. contain polyphenolics, flavonoids, tannins, coumarins, anthracene derivatives, as well as alkaloids. The content of phenolic compounds, flavonoids and hydroxycinnamic acids in the studied plant material is 7.2-7.8 mg/g of dry weight (DW) in terms of quercetin and 45.8-56.7% in terms of chlorogenic acid, respectively. The content of tannins and proanthocyanidins is 1.406±0.024% based on tannin and 0.70±0.12 mg/g of DW, respectively. The content of organic acids and ascorbic acid is 536.0±12.0 mg/100g and 0.345±0.010 μg/g, respectively. The content of chlorophylls a and b is 1516±14.60 and 570.2±9.80 μg/g of DW, and carotenoids are 818.56±34.97 μg/g of DW. *Bacillus subtilis* is moderately sensitive to the aqueous extract obtained from the leaves of *P. opulifolius*. Water-ethanol extracts prepared with 20%-, 60%- and 96% water ethanol showed moderate and high antimicrobial activity against *Pseudomonas fluorescens, Bacillus subtilis, Micrococcus luteus, Candida tenuis*.

Conclusion. The leaves of *Physocarpus opulifolius* (L.) Maxim. of the Red Baron variety contain a wide range of biologically active substances. Our studies have shown that ethanolic extracts have antibacterial and anti-candidiasis activity against *Pseudomonas fluorescens*, *Bacillus subtilis*, *Micrococcus luteus*, *Candida tenuis* and are obviously promising for their further investigation as antimicrobials. Since leaves of *P. opulifolius* have a high content of antioxidants (polyphenols, flavonoids, hydroxycinnamic acids, proanthocyanidins, ascorbic acid, chlorophylls and carotenoids), which are known to have a significant effect on human metabolism, it is reasonable, in our opinion, to continue their research.

THE CURRENT STATE AND PROSPECTS OF THE USE OF PHYTOREMEDIES BASED ON THE SPECIES OF THE CALAMINTHA MILL GENUS

Anastasiia Bozhok
Scientific supervisor: prof. **Nataliya Vorobets**, PhD, ScD.

Keywords: Calamintha menthifolia Mill., pharmacognostic analysis

Introduction. Genus *Calamintha* Mill. has the synonymous name *Clinopodium* L. (family Lamiaceae), represented by 165 species that are common in the temperate and tropical climates of North and South America, Africa and Eurasia. There is still no comprehensive information on the content of biologically active substances and the pharmacological activity of extracts and isolated substances in the most of them. One of the least studied species of this genus is *Calamintha menthifolia*, which is occasionally found in the Right Bank forest-steppe of the right bank of the Dnieper, and is also introduced in botanical gardens of Ukraine. Therefore, the aim of our work was to study the species *C. menthifolia* biologically active substances composition and antimicrobial activity of their extracts.

Materials and methods. The object of research was upground part (herb) *C. menthifolia* harvested during flowering in Kherson region of Ukraine. There were used methods of harvesting, drying, and grinding of plant material; macroscopic and microscopic examination; spectrophotometry, titrimetry, phytochemical as well as anticandidal and antibacterial analysis.

Results. The identification of *Calamintha menthifolia* can be carried out by a combination of anatomical and morphological features, as well as chemo-taxonomic before conducting pharmacognostic research and use (stem trichomes of two types: with one-celled foot and one-celled foot (the vast majority) and one-celled foot and 3-5 celled foot). A wide range of BASs was detected: essential oils, phenolic compounds, flavonoids, tannins, alkaloids, chlorophylls, carotenoids, ascorbic acid, organic acids. The content of

chlorophylls a and b was 0.941±0.006 and 0.427±0.017 mg/g of dry weight (DW), respectively. The content of carotenoids is 0.361±0.010 mg/g of dry weight. The content of hydroxycinnamic acids was 9.35-7.67% (DW). The content of tannins and proanthocyanidins was 1.233±0.006 and 0.88±0.002% of DW, respectively. Both the total content of ascorbic acid was found to be high: 225.0±7.06 mg/100g of DW. High antibacterial activity of *Calamintha mentifolia* Host extracts was revealed. made with aqueous ethanol against *Escherichia coli* and *Micrococcus luteus*. *Candida parapsilosis* was found to be sensitive to the tested extracts made with aqueous ethanol.

Conclusions. The species of the genus *Calamintha* according to the modern refined nomenclature using phytochemical and molecular genetic methods belong to the genus *Clinopodium* of the family Lamiaceae, in particular, this applies to the species *C. mentifolia* Host. Results of phytochemical screening of the aerial part of *C. mentifolia* Host. indicate a high BAS content in its composition. Most of the identified BASs in it have antioxidant properties: carotenoids, chlorophylls, ascorbic and organic acids, flavonoids, tannins. These substances were discovered by other authors in other species of the genus. Therefore, the totality of antioxidants in the extracts of the aerial part of *C. mentifolia* Host. can have a therapeutic effect in the treatment of inflammatory processes, diseases of the cardiovascular system and others. We found that *Escherichia coli*, *Micrococcus luteus* and *Candida parapsilosis* are sensitive to extracts of *C. mentifolia* Host., and therefore, these and other extracts are promising for further research as antimicrobials.

PECULIARITIES OF METHODS OF STANDARDIZATION OF MEDICINAL PLANT RAW MATERIALS OF MATERIALS IN ACCORDANCE WITH THE DFU

Alina Chukhonkina
Scientific supervisor: PhD (Pharm), associate prof. **Roman Darmogray**

Keywords: pharmacopoeia, pharmacopoeial types of medicinal plant raw materials, medicinal plants, test methods.

Introduction. Reserch of the chemical composition, pharmacological activity of biologically active substances, medicinal plants, their diagnostic features, indicators of the quality of medicinal plant raw materials and the development of new phytopreparations is an urgent issue of modern medicine and pharmacy, since a significant part of modern effective pharmaco - therapeutic drugs are of plant origin**.** Mandatory conditionsf or the use of wild orcultivated medicinal plant raw materials are their corresponding quality and proven pharmaco-therapeutic activity. First of all, the quality of plant raw materials must be guaranteed due to proper collection, cultivation, drying,

primary processing and storage. The main legislative document that guarantees the quality of medicinal products in Ukraine, and in particular, medicinal plant raw materials, is the State Pharmacopoeia of Ukraine.

Materials and research methods. Methods of testing pharmacopoeial types of medicinal plant raw materials, criteria (qualitative and quantitative) of their identity and benignity, analytical methods of comparative analysis, botanical - taxonomic and chemical - systematic analysis.

Results. A comparative analysis of types of medicinal plants, medicinal plant raw materials, biologically active substances of plant origin(tinctures,essential and fatty oils) DFU 2.0-2.5. It is known that 371 monographs were entered into DFU 2.0-2.5, 276 of which were on medicinal plant raw materials, 62 were national monographs and 27 were monographs with a national part. Classification of pharmacopoeial species of medicinal plants and medicinal plant raw materials were carried out according to morphological, taxonomic and chemo-taxonomic characteristics. The peculiarities of the pharmacopoeial methods for determining the identity (identification of A, B, C) and good quality of Medicinal plant raw materials (quantitative content of active substances) have been established.

Conclusions. A comparative analysis of the nomenclature, methods of identification and quantification of pharmacopoeial species of medicinal plant raw materials based on monographs of DFU 2.0 – 2.5 was carried out. Research results can be used in the educational process when learning pharmacopoeial methods for the analysis of medicinal plant raw materials, as well as in scientific work when developing methods of standardization of new types of medicinal plants

STUDY OF RAW RESOURCES OF MEDICINAL PLANTS OF LVIV REGION, CURRENT STATE OF THEIR RATIONAL USE, PROTECTION AND REPRODUCTION

Diana Dakhovych
Scientific supervisor: Associate Prof. **Roman Darmohray**, PhD (Pharmacy)

Keywords: Medicinal plants of Lviv region, protection and reproduction, autumn crocus.

Introduction. In the conditions of the general deterioration of the health of the population, the demand for raw materials of medicinal plants, biologically active substances, which have a milder effect on the human body than drugs of a synthetic nature, is increasing. In this regard, the development of measures for the balanced use of plant resources, which include their inventory, qualitative and quantitative assessment of resource indicators, as well as the creation of new nature protection territories, is relevant. A rare plant

of the Lviv region is autumn crocus (*Colchicum autumnale*), study of its new raw materials is an actual research task.

Materials and methods. Analysis of available scientific sources, printed and electronic periodicals, web resources, databases are performed. Modern methods of phytochemical research and methods of studying the resource base of medicinal plants are applied.

Results. The study of the nomenclature, habitats, main resource characteristics of medicinal plants of Lviv region was conducted. The main places of their growth, possibilities of industrial harvesting have been worked out. In the trend of protection of reproduction and rational use of medicinal plants, the main objects of the nature reserves in Lviv region, the composition of their rare species, problematic issues of their functioning and development were analyzed. The distribution and state of raw materials of autumn crocus as one of the promising plants of Lviv region was studied, the morphological, anatomical and phytochemical study of the leaves of the plant species was carried out, and its characteristic diagnostic signs were determined. Considering the raw materials's state, the content of the main group of biologically active substances (alkaloids) and prospects for uses in medicine, the leaves of autumn crocus (*Colchicum autumnale*) are recommended as a new source of medicinal plant materials.

Conclusion. Studies of the qualitative composition of autumn crocus leaf confirmed the perspective of its further studies as a source of new biologically active substances. The characteristic morphological and anatomical features of autumn crocus leaves can be used in the standardization of the investigated material, namely, the development of criteria for the identity of whole and powdered plant materials (identification A and B).

DEVELOPMENT OF THE COMPOSITION AND ANALYSIS OF HYPOGLYCEMIC HERBAL FORMULATION

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Scientific supervisor: PhD (Pharm), Assist. Prof. **Roman Lysiuk**

Keywords: herbal medicines, diabetes mellitus, hypoglycemic effect, herbal formulation, development and analysis.

Introduction. Diabetes is an important socially significant non-infectious disease, the prevalence of which has become epidemic in recent decades. Phytotherapy can provide important support to the standard method of treatment at all stages of diabetes, and at an early stage, it can sometimes replace traditional therapy for a certain time. Patients who actively use phytotherapy need smaller doses of insulin and oral hypoglycemic agents.

Materials and methods. Informational search in scientific editions and medical databases (Pubmed, Science Direct, Researchgate, Google Scholar), the State Register of Medicines of Ukraine, monographs, fundamental works on phytotherapy, patents on hypoglycemic and related effects of official herbal substances. ABC analysis of the composition of phytotherapeutic prescriptions for the treatment of diabetes. Herb MaRS system of chemical markers when justifying the choice of analytical marker standards for quality control of the developed herbal collection. In silico research using the PassOnline web resource on biological activity types associated with the expected specific impact on the pathogenesis of diabetes mellitus; methods of analysis, systematization, comparison, generalization of information data. Other applied methods compise macroscopical, microscopical, phytochemical techniques. The anatomical structure of the elements of the collection of hypoglycemic action was studied on preparations from the surface using a light microscope. Qualitative detection of active principles was performed by pharmacopoeial techniques.

Results. The research outcomes comprise summarization of current scientific data on hyperglycemic states, their etiological factors and possible directions of diabetes therapy; classification and mechanisms of action of hypoglycemic medicines, including herbal substances. The search for material sources with hypoglycemic activity on the basis of native official herbal drugs with a sufficient material base has been carried out. The composition of a new preventive and therapeutic multicomponent herbal composition with hypoglycemic activity based on official species of medicinal plants with a sufficient raw material base is proposed: common bean, marshmallow, birch, walnut, calendula, sage. When working out the composition and standardization criteria, an ABC analysis of the composition of phytotherapeutic prescriptions was carried out, the provisions of Herb MaRS were analyzed, and an in silico study was carried out.

An experimental study of the morphological and anatomical characteristics of the hypoglycemic formulation’s components was performed. The results of the carried out phytochemical study of the developed formulation, the components of which were collected from wild and cultivated plants in Lviv and Ternopil regions, indicate the presence of flavones and flavonols, condensed tannins, alkaloids, coumarins in the analyzed materials.

Conclusions. Recommendations for the use of the developed preventive and therapeutic multicomponent herbal composition with hypoglycemic activity have been presented. The developed herbal product contributes to the normalization of carbohydrate metabolism and lowering the blood sugar level and exerts tonic, choleretic and diuretic effects

CURRENT STATE AND PROSPECTS FOR THE USE OF BEEKEEPING PRODUCTS IN MEDICINE

Halyna Kuzyk
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Keywords: beekeeping products, honey, medicinal plants.

Introduction. Ukrainians have known about the healing properties of beekeeping products since ancient times. The modern development of beekeeping as a science has proven that beekeeping products are also effective remedies of treating many ailments - atherosclerosis, bronchitis, pneumonia, tuberculosis, dysbacteriosis, myocardiodystrophy, otolaryngological diseases. The advantages of these remedies of treatment are the absence of toxic effects on the body, general availability, ease of obtainingand uses. Therefore, it is advisable to use honey and other beekeeping products in food, since it helps in the fight against diseases, strengthens immunity and increases the body's resistance. However, not only honey is used for medicinal purposes, but also other beekeeping products: wax, propolis, pollen, royal jelly, and bee venom.
The polyvalency of the pharmacological action of beekeeping products and phytoextracts, due to their stimulation of various body systems and compensation of insufficient function, makes it possible to use them optimally for the correction of diseases of various etiologies. Nowadays, the use of such herbal preparations has not lost its relevance and importance. Therefore, the development of the composition and methods of standardization of new effective herbal formulations, based on beekeeping products and extracts from medicinal plant materials, which can be used as medicines or biologically active supplements, is one of the important trends for the native pharmaceutical industry.

Research materials and methods. The purpose of our work was to conduct an informational search of recent data on the use of beekeeping products for the treatment of numerous diseases, to conduct a study of the assortment of honeys enriched with the content of medicinal plants; develop the composition of a new medicinal product, based on honey and medicinal plants, and perform its analysis.

The results. Recent data on the biological properties and application of beekeeping products were collected and summarized, and the composition of a new phytopreparation, based on honey and a polyextract from medicinal plant materials with an anti-inflammatoryand tonic effects, was developed. A phytochemical study of a new phytonutrient was conducted, which revealed such groups of biologically active substances as polysaccharides, tannins, coumarins, flavonoids, polyphenolic compounds, terpenoids; some quality

criteria of the new remedy were worked out, which can be used in the development of quality control methods for the phytopharmaceutical.

Conclusions. So, after further pharmacological research, the new remedy developed by us based on honey and polyextract of medicinal plant raw materials can be used in preventive and curative therapy as a tonic.

STUDY OF ARBUTIN-CONTAINING MEDICINAL PLANTS OF THE DOMESTIC FLORA

Kateryna Saviuk
Scientific supervisor: assoc, prof. **Roman Darmohray**, PhD

Keywords: arbutin, leaves of the common pear, cystitis.

Introduction. Expanding the range of medicinal products and the raw material base of medicinal plants for the prevention and treatment of the genitourinary system is one of the important tasks of pharmaceutical science. In modern medical practice, much attention is paid to herbal medicines and their rational use. Of particular importance is the identification of additional sources of medicinal raw materialswith diuretic action. In addition, in recent years, there has been a decline in the supply of medicinal raw materials with diuretic and antiseptic effects. An appropriate solution to this problem may be the study of medicinal plants that are typical representatives of the flora of Ukraine, widely cultivated throughout the territory and have a sufficient raw material base. Such plants include the common pear (Pyrus communis L.), family Rosaceae.

Material and methods. Theoretical substantiation and experimental confirmation of the expansion of thenomenclature of phytopreparations used to treat pathologies of the genitourinary system through pharmacognostic research and standardization of arbutin-containing drugs. Methods: an analysis of available scientific sources, printed and electronic periodicals, web resources, and search databases was carried out. Modern methods of phytochemical research and methodology of studying the resource base of medicinal plants.

Results. The phytochemical analysis of common pear leaves collected in April 2023 within the Lviv region was carried out. The presence of arbutin in pear leaves was proved by means of qualitative reactions with ferrous sulfate crystal and ammonia solution with 10% phosphorus-molybdenum solution in 10% hydrochloric acid, histochemical reaction with dilute sulfuric acid and thin-layer chromatography with a layer of silica gel. The quantitative content was investigated by spectrophotometry at 285 nm and 455 nm. Calculations were performed in terms of arbutin. Other methods for the quantitative determination of arbutin are iodatometry according to State Pharmacopoeia XI and liquid chromatography.

Conclusions. The chemical composition of more than 1000 species of

medicinal plants of official and folk medicine was analyzed for the presence of arbutin. The resource characteristics of the main arbutin- containing species of medicinal plants of the Ukrainian flora were studied. Generalized data on botanical and systematic characteristics, chemical composition, prospects for the use of raw organs of the common pear. The morphological, anatomical and phytochemical study of the leaves of the common pear as a new type of medicinal plant material was carried out. The main parameters of standardization of common pearleaves as a new type of medicinal plant material were worked out.

STUDY OF THE FLORISTIC COMPOSITION OF THE NATIONAL DENDROLOGY PARK "SOFIIVKA" OF THE NATIONAL STATE OF UKRAINE

Karina Kravchuk
Scientific supervisor: associate prof. **Roman Darmogray,** PhD

Keywords: nature reserve fund, medicinal plants of the Cherkasy region, NDP "Sofiivka" protection of medicinal plants .

Introduction. The protection of raw resources, in particular medicinal plants, combines the development and implementation of special environmental protection measures. Detailed ecological and economic calculations show that the normal functioning and self-regeneration of the biosphere is possible only if there is at least 10-15% of the area occupied by nature reserves in any region. Currently, Ukraine has a much smaller indicator, which indicates an insufficient number of protected areas.

Materials and methods. The analysis of available scientific sources, printed and electronic periodicals, web-resources, search databases is carried out. Modern methods of phytochemical research and methodology for studying the resource base of medicinal plants.

Results. An analysis of the current state of the main objects of the natural reserve fund of Ukraine was carried out, problematic issues of their development were characterized. The structure, priority tasks of the object of the natural reserve fund of the Cherkasy region, the nomenclature of the composition of their rare species were elaborated.The current state of botanical varieties of Ukraine was considered, their role in the preservation and enrichment of biological diversity, including medicinal species, was determined. The role of the NDP "Sofiivka" in the preservation of red book plant species in the Cherkasy region was characterized. The botanical and systematic characteristics, chemical composition, growing conditions and directions of use of species of the genus Pavlovnii were worked out. as new forestry and economic plants. Morphological-anatomical and diagnostic study

of raw materials of Paulownia raw materials, individual characteristic diagnostic signs of raw materials and priority species of BAR was carried out. Criteria for standardization of leaves of felted Paulownia as a new type of LRS were developed.

Conclusion. The issue of reproduction, protection and reproduction of medicinal plants of the Cherkasy region is urgent and necessary, the dendrological park "Sofiivka" plays an important role in this. The study of the qualitative composition of the main BAR of paulownia leaves confirmed the perspective of further study of the species of the paulownia genus as a source of biologically active substances based on them.

SUBSTANTIATION FOR THE SELECTION OF PLANT COMPONENTS AND ANALYSIS OF THE HERBAL MIXTURE FOR THE RELIEF OF GOUT SYMPTOMS

Kateryna Kravchuk
Scientific supervisor: PhD (Pharm), Assoc. Prof. **Nataliia Shapovalova**

Keywords: herbal medicines, purine metabolism, gout, hypouricemic, herbal collection, development, analysis.

Introduction. The incidence rate of gout among the adult population is increasing annually, ranging from 0.05 to 3.9% in different states; the ratio of morbidity in men and women in the population as a whole is 5-7:1. In the regions of Ukraine, 5-28 cases of gout per 1,000 men and 1-6 in women are recorded.

An important research task is the search and development of new remedies for prevention and treatment of gout. Natural remedies, primarily those that affect water-salt exchange and exert hypouricemic activity, are an alternative to synthetic drugs.

Materials and methods. Informational search in scientific editions and medical databases (Pubmed, Researchgate, Google Scholar), the State Register of Medicines of Ukraine, monographs, fundamental works on phytotherapy, patents on plant substances, capable of influencing purine metabolism and uric acid excretion; methods of analysis, systematization, comparison, generalization of information data. ABC-analysis of the composition of phytotherapeutic prescriptions for the treatment of gout. Other applied methods compise macroscopical, microscopical, phytochemical techniques. The anatomical structure of the elements of the developed herbal collection was studied on preparations from the surface using a light microscope. Qualitative detection of active principles was performed by pharmacopoeial techniques.

Results. The literature data on gout, etiological factors and possible trends of its treatment, including herbal medicine, mechanisms of action of

antigout drugs, as well as plants that can affect purine metabolism and uric acid excretion were analyzed and systematized.

The processing of scientific sources regarding the experience of official and folk medicine uses, chemical composition, presence of therapeutic markers and necessary types of activity, as well as the ABC analysis of phytotherapeutic prescriptions made it possible to propose the composition of a new therapeutic and preventive phytopreparation in the form of a herbal collection with an expected hypouricemic and related effects.

The components of the developed complex remedy for the elimination of gout symptoms include plant substances, obtained from medicinal plants with sufficient natural reserves or those grown in Ukraine in significant quantities: *Vaccinium vitis-idaea, Calluna vulgaris, Betula spp., Aronia melanocarpa, Salix spp, Elytrigia repens, Sambucus nigra*. A method of preparing the collection in the form of an infusion and its dosage is proposed.

A morphological and anatomical analysis was carried out and the qualitative chemical composition of the biologically active substances of the developed collection for the elimination of gout symptoms was investigated. The groups of plant compounds identified in the developed phytoremedial product are flavones and flavonols, phenolic glycosides, condensed tannins, coumarins.

The developed complex remedy, which includes official medicinal plants, that have sufficient natural resources and reserves in Ukraine, is proposed in the form of a herbal collection to be used for the prevention and treatment of gout symptoms, correction of hyperuricemia in cases of purine metabolism disorders.

PROCESSING OF COMPOSITION AND ANALYSIS OF THE PHYTOCOMPOSITION FOR THE TREATMENT OF BEDSORES AND OTHER WOUNDS

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Keywords: herbal drugs, wound healing effect, bedsores and wounds, development, analysis, phytocomposition.

Introduction. In wartime, the issue of providing patients with wound-healing, anti-inflammatory, and antibacterial agents is particularly important, as the frequency of various types of wounds and injuries increases dramatically. The prevalence of bedsores can be as high as 12% in emergency departments, 53.4% in intensive care units, and 59% in nursing homes. With proper medical and other care, most bedsores are treated within 12 months.

Herbal formulations, due to their complex composition and a wide range of activities, are considered as promising therapeutic agents for the treatment of wounds and bedsores.

Materials and methods. Informational search in scientific editions and medical databases (Researchgate, Pubmed, Google Scholar), monographs, fundamental works on phytotherapy, patents on herbal substances with wound healing effect; methods of analysis, systematization, comparison, generalization of information data. ABC-analysis of the composition of phytotherapeutic prescriptions for the treatment of bedsores and wounds. Other applied methods compise macroscopical, microscopical, phytochemical techniques. The anatomical structure of elements of the phytocomposition of wound healing action was studied on preparations from the surface using a light microscope. Qualitative detection of active principles was performed by pharmacopoeial techniques.

Results. The research outcomes comprise summarization of current scientific data on wounds, their etiological and pathogenetic factors and possible directions of therapy; prevalence, causes, risk factors, etiology, pathogenesis, ways to prevent and correct bedsores. The search for wound-healing substances on the basis of native official herbal drugs with a sufficient material base has been carried out. The study of scientific sources made it possible to propose the composition of a new multicomponent phytopharmaceutical with wound-healing activity: *Plantaginis majoris folium, Salviae officinalis folium, Calendulae flos, Serpylli herba, Millefolii herba, Matricariae flos*. The carried out phytochemical analysis of extracts of the developed herbal formulation revealed occurrence in the analyzed components of the following groups of biologically active compounds: flavones and flavonols, alkaloids, condensed tannins, coumarins.

Conclusions. The developed and analyzed phytocomposition for the treatment of bedsores and other wounds comprise official medicinal plants with the potential wound-healing activity, characterized by sufficient natural resources and supplies in Ukraine.

PHARMACOGNOSTIC STUDY OF PLANTS OF THE GENUS *EUONYMUS L*

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Keywords: Euonymus (Euonymus L.), carotenoids, flavonoids, fatty oil.

Introduction. Among the plants of the genus Euonymus there are representatives that have been used as folk medicine. Among the plants selected as objects of research, 2 species are wild, and 2 are cultivated

ornamental species. Scientific research is fragmentary on individual representatives, but there is no comparative comprehensive study of these species.

Materials and methods. The objects for the study were bark, seeds, leaves of E. europaeus L. and E. verrucosus and leaves of E. japonicas and E. fortunei. The physical, physicochemical, chemical, technological, macro- and microscopic methods were used for the study.

Results. Thin-layer chromatography showed that the extracts, although similar in composition, are not identical.

The seeds of E. europaeus and E. verrucosus were extracted alternately with petroleum ether, methanol and water. The seeds of E. europaeus and E. verrucosus were extracted alternately with petroleum ether, methanol and water. The petroleum ether extracts were separated on a silica gel column by washing it with an experimentally selected system of solvents. We obtained 4 groups of biologically active substances, which were further analyzed by TLC, qualitative reactions and quantitative determination of pharmacologically active groups of substances. The seeds of the E. verrucosus also contain a high content of fatty oil, but it differs in color and its yield from raw materials is 14.7 %, in contrast to the yield of fatty oil from the seeds of the E. europaeus of about 25%. The content of extractive substances of the bark also differs, which is 1.49% for the bark of E. europaeus and 2.1% for the bark of E. verrucosus when extracted with petroleum ether. The presence of stearic, palmitic, oleic, linolenic and other fatty acids was established. The qualitative reactions showed that both extracts contain carotenoids and tocopherols, as well as steroidal compounds. The carotynoid content of the seeds of E. europaeus is 82,19 mg/g and of the seeds of E. verrucosus - 17,48 mg/g. In water extracts of the seeds the carbons were indificated.

In the bark were identificated chlorophyll, phenolic compounds, steroids. The lectins was indificated only in the bark of the E. europaeus.

The flavonoid cjntent in the leaves of the E. europaeus, E. verrucusus, E, japonicus and E. fortunei were 4,68, 10,64, 2,07, 4,04 respectively. There were a big amount of the chlorophyl.

Microscopic examination of the leaves revealed that the stomata complex is of anomocytic type, the cells of the upper epidermis have straight, strongly thickened walls, and hairs are absent. The main morphological features are the shape and color of the stem, the color and position of the arils of the seeds and leaves epidermis and cuticul.

Conclusions. As a result of the comparative study of plants of the genus Euonymus, it was found that the most promising type of raw material for wild species is seeds containing fatty oil, which contains unsaturated fatty acids, carotenoids, tocopherols and squalene and can be used as a medicine in dermatology.

PHARMACOGNOSTIC RESEARCH OF CORYLUS COLURNA L.

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Keywords: phytochemical, microbiological research, leaves, inflorescence, bark Corylus colurna.

Introduction. Among the biologically active substances isolated from various plant organs of the genus Corylus prevail flavonoids, anthocyanins, tannins, mono- and polyunsaturated fatty acids, minerals (microelements), vitamins (vitamin E), phytosterols (mainly b-sitosterol), squalene, antioxidant phenols, which exhibit anti-inflammatory, antimicrobial, antioxidant, antisclerotic effects.

The purpose of the work is a pharmacognostic study of the leaves, inflorescences and bark of the Corylus colurna, which includes the systematic and morphological characteristics of the species, distribution, phytochemical study of the medicinal plant material: qualitative and quantitative determination of tannins, anthocyanins, flavonoids, as well as a comparative study of the antimicrobial activity of the infusion of leaves, infusion inflorescences and bark decoction.

Materials and methods. The object of the study was medicinal plant raw materials - fresh and dried leaves, inflorescences and bark of the Corylus colurna species, collected in May-June 2022 in the arboretum of the National University "Lviv Polytechnic".

Biologically active substances were studied by specific qualitative reactions for the study of medicinal plant raw materials for the content of polyphenolic compounds, in particular, the amount of oxidized phenols, the amount of flavonoids and anthocyanins. The study of antimicrobial activity was carried out by diffusion in agar.

Results. Medicinal plant raw materials - leaves, inflorescences and bark of Corylus colurna were studied according to physico-chemical quality indicators. The study of the morphological features of the structure of the leaves, inflorescence and bark of bear hazel revealed their characteristic diagnostic signs.Phytochemical research of water, water-alcohol extracts of leaves, inflorescences and bark identified biologically active substances: tannins, saponins, anthocyanins, flavonoids. The maximum content of the amount of oxidizable phenols in the inflorescence is 1.25 times higher than their content in the bark and 1.63 times higher in the leaf.

The amount of flavonoids in the inflorescence is 1.62 times higher than the amount in the leaves and 2.15 times higher than the amount in the bark. The maximum quantitative content of the amount of anthocyanins found in the leaf, in terms of cyanidin-3-O-glucoside chloride, is 159 mg%. Microbiological research established that the infusion of leaves, infusion of inflorescences and,

to a greater extent, the decoction of the bark of Corylus colurna showed an antimicrobial effect in relation to the gram-positive strain Bacillus pumilus. A microbiological study of leaf infusion, bark decoction, and, especially, of the inflorescences of Corylus colurna show a pronounced antifungal effect of Candida tropicalis

Conclusions. The investigated phytoremedies in the form of infusion of leaves, infusion of inflorescences and decoction of the bark of Corylus colurna showed a pronounced antimicrobial and antifungal effect. Therefore, medicinal plant raw materials: leaves, inflorescences and bark are promising for use as antimicrobial and antifungal phytoremedies in the treatment of both opportunistic and fungal infections.

DEVELOPMENT, PROCESSING OF STANDARDIZATION CRITERIA AND ANALYSIS OF ANTHELMINTIC POLYHERBAL FORMULATION

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Keywords: herbal medicines, helminth infections, gastrointensinal tract, herbal collection,development, analysis.

Introduction. Helminth infections are a global medical and social problem, because they are detected in 25% of people; they rank third in the structure of infectious parasitic diseases. In Ukraine, up to 30 types of helminthiasis are detected, up to 600,000 cases of the disease are recorded annually, mostly enterobiasis and ascariasis. The use of phytopreparations with anthelmintic action becomes especially relevant when they are prescribed as etiotropic agents, primarily in the presence of contraindications to the use of synthetic compounds or in the case oflow sensitivity of pathogens to synthetic drugs. Therefore, the search and study of herbal remedies affecting helminths is an important task of modern medicine.

Materials and methods. Informational search in scientific editions and medical databases (Researchgate, Pubmed, Google Scholar), the State Register of Medicines of Ukraine, monographs, fundamental works on phytotherapy, patents on anthelmintic and related properties of official herbal substances. Methods of analysis, systematization, comparison, generalization of information data. ABC-analysis of the composition of phytotherapeutic prescriptions for the treatment of helminth infections. Macroscopical, microscopical, phytochemical techniques. The anatomical structure of the elements of the collection of anthelmintic action was studied on preparations from the surface using a light microscope. Qualitative detection of active principles was performed by pharmacopoeial techniques.

Results. The analysis and generalization of data published in scientific literature on helminthiases, their classification, etiological factors and possible directions of therapy as well as classification and mechanisms of action of anthelmintic drugs, including herbal ones, were carried out. The state of research for anthelmintic herbal substances in Ukraine and the world is evaluated on the example of relevant patents as objects of intellectual property, which have significant prospects for further implementation and uses in medical practice. The composition of a new preventive and therapeutic phytopreparation of anthelmintic action, containing official species of medicinal plants with a sufficient raw material base, was substantiated and developed. The performed studies of scientific data made it possible to propose the medicinal plants *Calendula officinalis, Salvia officinalis, Tanacetum vulgares, Juglans regia, Betula pendula* as sources of components of the antihelmintic herbal collection. The morphological and anatomical characteristics of the components of the developed formulation with anthelmintic activity were studied. The results of a phytochemical studyof the phytopharmaceutical, the components of which were collected on a homestead in the city of Lutsk, Volyn region, from cultivated and wild plants, indicate the presence of flavones and flavonols, condensed tannins, alkaloids, coumarins in the analyzed raw material.

Conclusions. The developed anthelmintic polyherbal formulation comprise official medicinal plantswith sufficient natural resources and supplies in Ukraine, with the potential in the prevention and treatment of helminth infections (ascariasis, enterobiasis and other worm infections), diseases of the stomach and intestines, as well as for detoxification of the body.

THE CURRENT STATE OF MEDICINAL PLANT CULTIVATION IN UKRAINE AND PROSPECTS FOR ITS DEVELOPMENT

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Keywords: medicinal plants, medicinal plant materials, cultivation, regulations, GACP, herbaldrugs.

Introduction. The issue of the quality and safety of the MP raw materials, including phytopharmaceuticals, is extremely important, which determines the urgency of the study of the state of medicinal plant cultivation and its regulation in Ukraine, since the range of native herbal preparations is extremely wide, and in addition, Ukraine annually exports significant volumes of about 20 MPM kinds.

Materials and methods. Information search in printed and electronic scientific periodicals, scientific databases, monographs on medicinal plants and

aspects of their cultivation; methods of analysis, systematization, comparison, generalization of information data. The method of individual expert evaluation by interviewing.

Results. The analysis and summarization of the sources of scientific information regarding the raw material base of MP in Ukraine, the state of introduction of MP and phytobiotechnology, the European and domestic market of medicinal and aromatic plants and herbal drugs have been carriedout.

The current assortment and volume of cultivation of medicinal plants in specialized farms of Ukraine, the advantages and disadvantages of cultivation compared to the harvesting of wild plants have been studied.

The normative acts regulating the processes of growing MP in Ukraine (Guidelines ST-N MHU 42- 4.0:2020 and 42-4.5:2012) have been analyzed.

The expediency of the cultivation of valuable MP species in open ground conditions has been established, which can be considered as one of the ways of harmonizing the use of the resource potential of the flora of Ukraine by reducing the overexploitation of wild MP stocks.

Good Agricultural and Collection Practices (GACP) for Medicinal Plants is a guarantee of the quality of herbal substances and phytopharmaceuticals. Its implementation contributes to the development of medicinal plant cultivation industry and provides a basis for the production of safe and effective products for the needs of the population of Ukraine and foreign consumers.

Conclusions. 12 promising MP species have been determined, which are recommended to grow in the western regions of Ukraine under open ground conditions. The analysis of current aspects of medicinal plant cultivation allowed to develop recommendations and suggestions for scientists and developers and people who wish to cultivate MP on an industrial scale.

PHARMACOGNOSTIC STUDY OF HEMEROCALLIS FULVA AND HEMEROCALLIS CITRINE SPECIES

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Keywords: *Hemerocallis fulva, H. citrine*, pharmacognostic analysis

Introduction. One of the ways to expand the species composition of plants that can be used as medicinal plant raw materials is a comprehensive study of introduced species, in particular the genus *Hemerocallis* L.. *Hemerocallis fulva* L. and *Hemerocallis citrine* Baroni are widely cultivated in Ukraine, but their pharmacognostic research has not been carried out enough. The aim of our work was to study the species *Hemerocallis fulva* L. and *Hemerocallis citrine* Baroni biologically active substances composition and anticandidose activity of their extracts.

Materials and methods. The object of research was leaves and flowers of *Hemerocallis fulva* and leaves of *H. citrine*. *H. fulva* leaves and flowers harvested in Botanical garden of Danylo Halytsky Lviv National Medical University, and *H. citrine* leaves in a plot in the vicinity of Lviv. There were used methods of harvesting, drying, and grinding of plant material; macroscopic and microscopic examination; spectrophotometry, titrimetry, phytochemical and antimicrobial analysis.

Results.. It was found the species differ significantly in terms of morphological and anatomical characteristics that can be used to identify and standardize their plant material. The plant material of investigated species differs significantly in quantitative and qualitative content of chemical substances. In both the investigated species have been shown the presence of polyphenolic compounds, flavonoids, alkaloids, tannins, anthracene derivatives, saponins, coumarins. The content of chlorophylls a and b, as well as carotenoids in *H. fulva* leaves is 0.174±0.02; 0.061±0.03; 918.9±0.7 mg/g of dry weight (DW), respectively. The content of chlorophylls a and b, as well as carotenoids in *H. citrine* leaves is 1.058±0.69; 0.905±0.13; 813.7±0.77 mg/g DW, respectively. The flowers of *H. fulva* contained practically no chlorophylls, the content of carotenoids was 303.5±0.44 mg/g DW. The content of phenolic compounds in the extracts from the leaves of both studied species depended on the extragent, and was the highest in aqueous extracts compared to aqueous-ethanol extracts. In 60%- extracts of *H. fulva* flowers, the content of phenolic compounds was the highest and 988.27±20.0 μg/g DW in terms of gallic acid. The content of flavonoids in the leaves of *H. fulva* is 120-180 mg/g DW in terms of quercetin, in the leaves of *H. citrine* up to 236 mg/g DW in terms of quercetin in aqueous-ethanol extracts. In the extracts of *H. fulva* flowers, the content of flavonoids was 243.3-257.2 mg/g DW in terms of quercetin. The content of tannins in leaves of *H. fulva* and *H. citrine* is 0,32%-3,23% DW, respectively; and in the flowers of *H. fulva* 0.03-0.99% depending on the calculation. The content of tannins in leaves of *H. fulva* and *H. citrine* is 0.32%-3.23% DW, respectively; and in the flowers of *H. fulva* 0.03-0.99% depending on the calculation. The content of proanthocyanidins is 0,8 mg/g DW in *H. fulva* flowers; 2.3 and 1.4 mg/g DW in leaves of *H. fulva* and *H. citrine*, respectively. The content of ascorbic acid in the leaves of *H. fulva* and *H. citrine* is 9.505 and 9.421 mg/g DW, respectively; in the flowers of *H. citrine* – 0.879 mg/g DW. The content of organic acids in the leaves of *H. fulva* and *H. citrine* is 0.148 and 0.146% DW, respectively, and in flowers it is much higher – 0.277% DW when water is used as an extractant. Low anti-candidal activity of aqueous and aqueous-ethanol extracts of *H. fulva* and *H. citrine* against *Candida pseudotropisalis*, *C. kefyr*, *C. parapsilosis*, and *C. tenuis* yeasts was revealed.

Conclusion. The set of biologically active substances found in *Hemerocallis fulva* and *Hemerocallis citrine* show them as a promising plant raw materials for further research and use in the creation of medicinal products. The leaves of *Hemerocallis fulva* and *Hemerocallis citrine* can be considered a good source of carotenoids and phenolic compounds.

CURRENT STATE AND PROSPECTS OF THE USE OF PHYTOREMEDIES FOR THE TREATMENT OF GASTROESOPHAGEAL REFLUX DISEASE

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Keywords: gastroesophageal reflux disease, anti-inflammatory action, medicinal plants

Introduction. Over the past 20 years, the structure of benign diseases of the gastrointestinal tract has changed significantly. Gastroesophageal reflux disease currently occupies a leading position, displacing peptic ulcer disease of the stomach and duodenum to the second one. Numerous epidemiological studies have shown that the prevalence of gastroesophageal reflux disease has remained consistently high over the past decades, with a tendency to increase the number of patients. The prevalence of gastroesophageal reflux disease in the general population is within 20-40% in the USA and Europe, in Ukraine 37.7-38.9%, amongst children - from 2-4% to 8.7-49% and the indicator grows every year. Untimely diagnosis and treatment of this disease can lead to such serious complications as peptic ulcer of the esophagus and its perforation (most often in the mediastinum), acute and chronic bleeding from ulcerative lesions of the esophagus, stenosis and stricture of the esophagus, the formation of Barrett's esophagus, which significantly increases the risk of adenocarcinomas of the esophagus. Medicinal plants are the most promising source of biologically active substances with gastroprotective, anti-inflammatory, and antioxidant effects. Therefore, modern medicine increasingly turns to phytotherapy for diseases of the digestive system. This necessitates the search and introduction of new medicines, including herbal ones, and more advanced methods of prevention and treatment.

Research materials and methods. The purpose of our work was to conduct an informational search for modern literary data on the use of medicinal plants in the treatment of gastroesophageal reflux disease, to study the composition of a new herbal collection and to perform its analysis.

The results. Literature data on the uses of medicinal plants and remedies for the treatment of reflux disease are summarized; the composition of a new

herbal collection for the prevention and treatment of reflux disease was worked out; a general phytochemical study of the new herbal formulation was conducted, as a result of which such groups of biologically active substances as saponins, polysaccharides, tannins, coumarins, flavonoids, polyphenolic compounds, terpenoids were identified; some quality criteria of the new herbal collection were worked out (external, microscopic features, colour, odour, taste, identification (proposed to be carried out using qualitative reactions), the content of the totality of water-soluble extractive substances, which should be at least 18.16%), that can be used when developing quality control methods for a new herbal drug collection for the prevention and treatment of reflux disease.

Conclusions. Therefore, after further pharmacological research, the new herbal collection developed by us can be used in preventive and curative therapy as a means for the treatment and prevention of gastroesophageal reflux disease.

MEDICINAL PLANTS OF KHMELNYTSKY REGION: CURRENT STATE, RAW MATERIAL BASE, PROSPECTS OF USES

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Keywords: Phytotherapy, folk medicine, medicinal plants, protection, nature reserve fund, *Dictamnus albus*.

Introduction. Data on the current state of protection, rational use and reproduction of the main medicinal plants are becoming more distributed. In Ukraine, as in the whole world, there is considerable interest in the search for safe, environmentally friendly drugs of natural origin. Collected information about healing plants of our region needs scientific justification for further use in medical practice and industrial production. To develop measures for the balanced use of available phytotherapeutic resources, it is important, first of all, to conduct their inventory with quantitative and qualitative analysis of determining indicators, as well as the creation of nature conservation areas for unique and typical natural landscapes, preservation of biodiversity of Ukraine.

Materials and methods. An analysis of available scientific sources, printed and electronic periodicals, web resources, search databases was carried out. Modern methods of phytochemical research and methods of studying the resource base of medicinal plants, floristic analysis.

Results. Based on the experience of folk medicine, the current state of their protection, rational use and reproduction, the resource potential of medicinal plants of Khmelnytsky region was investigated. After analyzing the data on the historical aspects on the study of medicinal plants of traditional medicine, the current state of their protection and reproduction, a taxonomic analysis was carried out and the structure of the species composition of the

main natural objects was determined, as well as the protected plant fund of the region was determined. Current issues of the nature reserve fund of Ukraine, problematic aspects, and ways to solve them are elaborated. The distribution and raw material base of *Dictamnus albus* in Khmelnytsky region were studied.

Conclusion. The main aspects of the application of *Dictamnus albus* as a medicinal plant are considered, namely: distribution, chemical composition, pharmacological activity, prospects of uses.

PHARMACOGNOSTIC STUDY OF THE *STACHYS PALUSTRIS* L. SPECIES

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Keywords: *Stachys palustris* L., pharmacognostic analysis

Introduction. Species of the genus *Stachys* L. are widespread in various regions of the Earth, but there is still no comprehensive information on the content of biologically active substances and the pharmacological activity of various extracts and isolated compounds in the composition of most of them. Therefore, the aim of our work was to study the species *Stachys palustris* L. biologically active substances composition and antibacterial activity of their extracts.

Materials and methods. The object of research was upground part (herb), harvested during flowering in the vicinity of Skhidnytsia, Lviv region. There were used methods of harvesting, drying, and grinding of plant material; macroscopic and microscopic examination; spectrophotometry, titrimetry, phytochemical and antibacterial analysis.

Results. A wide range of BASs was detected: phenolic compounds, flavonoids, essential oils, tannins, carbohydrates, alkaloids, chlorophylls, carotenoids, ascorbic acid, organic acids. The content of chlorophylls a and b was 2.16±0.11 and 0.99±0.11 mg/g of dry weight, respectively. The content of carotenoids is 795.35±0.03 mg/g of dry weight. Ethanol turned out to be the best extractant of hydroxycinnamic acids compared to aqueous ethanol, and their content was 84.18±8.00% by dry weight (DW) in terms of chlorogenic acid. 70% aqueous ethanol extracted 347.81±44.3 μg/g of phenolic compounds and 2.83±0.22 mg/g of DW in terms of quercetin. The content of tannins was 1.338±0.08% of DW in tannin equivalent. Both the total content of organic acids and ascorbic acid were found to be high: 0.245±0.33% and 124.5±4.66 mg/100g of DW, respectively. *Bacillus subtilis* and *Pseudomonas*

Conclusions. The upground part (herb) of *Stachys palustris* has a high content of BAS with antioxidant properties, and can be a source of phenolic compounds, carotenoids, ascorbic acid and is promising for further research as an antibacterial raw material.

DEVELOPMENT OF THE COMPOSITION AND ANALYSIS OF THROMBOLYTIC HERBAL FORMULATION

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Keywords: thrombosis, thrombolytic, herbal medicine, herbal formulation development and analysis.

Introduction. Cardiovascular diseases are the leading cause of death worldwide, with 17.9 million deaths per year, remaining an extremely important health problem in modern civilization. Strokes and heart attacks can lead to death, often due to the formation of blood clots. The use of herbal remedies with thrombolytic action has become especially relevant in the context of the pandemic of the acute respiratory disease COVID-19, caused by the SARS-CoV-2 coronavirus, since thrombosis is quite often present in patients with COVID-19, especially those with existing vascular risk factors. Plant substances can have a beneficial effect on a number of risk factors for cardiovascular diseases, therefore, herbal drugs, possessing antiplatelet, antiaggregant, fibrinolytic, and anticoagulant effects, are actively being studied as promising agents for prevention and treatment of these nosologies.

Materials and methods. Informational search in scientific editions and medical databases (Researchgate, Pubmed, Google Scholar); methods of analysis, systematization, comparison, generalization of information data. Other applied methods compise macroscopical, microscopical, phytochemical techniques. The anatomical structure of the elements of the collection of immunomodulatory action was studied on preparations from the surface using a light microscope. Qualitative detection of active principles was performed by pharmacopoeial techniques.

Results. An analysis and generalization of the sources of scientific literature on thrombotic conditions and their role in cardiovascular diseases, pathogenetic mechanisms of thrombosis and other circulatory disorders, and the current state of antithrombotic drugs' uses have been carried out. The state of study and application of plant substances with antiplatelet, antiaggregant, fibrinolytic and anticoagulant effects as remedies for prevention and treatment of thrombosis and related states has been analyzed. Affordable official plant substances have been chosen as components for a complex herbal remedy with expected thrombolytic and related biological effects: dried chokeberry fruits, ginkgo leaves, walnut leaves, lemon balm leaves, chamomile flowers, licorice roots. A method of preparing the developed herbal formulation in the form of an infusion and its dosage has been proposed. A morphological and anatomical analysis has been carried out and the qualitative chemical composition of the biologically active substances of the thrombolytic herbal formulation has been investigated. The groups of plant compounds identified in the developed

phytopharmaceutical product are flavones and flavonols, alkaloids, coumarins, and condensed tannins.

Conclusions. The developed complex herbal remedy is proposed to be used for the prevention and treatment of cardiovascular diseases: thrombosis, especially in post-COVID patients; hemorrhoids; varicose veins; thrombophlebitis; metabolic syndrome.

PHARMACOGNOSTIC STUDY OF OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH.)

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Keywords: okra, seed oil, okra leaves

Introduction. Nowadays the study of the chemical composition and use in pharmaceutical practice of food plants, that are not traditional for our climate, is quite relevant. Such promising crops include okra (*Abelmoschus esculentus* (L.) Moench), which has recently been successfully introduced into the diet of the population of our country.

Materials and methods of research. The purpose of our work was to conduct a pharmacognostic study of okra. Phytochemical, morphological and anatomical methods of analysis were used.

Results. Recent data of literature review sources on the botanical characteristics, chemical composition, and biological properties of okra are summarized. In the conditions of the Lviv region, okra was grown, samples of raw materials (fruits, seeds, leaves) were collected. A qualitative analysis of the lipophilic fraction of its seeds was conducted, as a result of which about 14 lipophilic compounds were identified.

Okra seed oil was obtained by pressing, its yield was 9.8%. The organoleptic and some physicochemical parameters of okra oil (taste, odor, color, transparency, solubility, refractive index, iodine number, acid number) were determined, which characterize its nature and quality - the fresh oil of okra is a semi-drying one.

The qualitative and quantitative fatty acid composition of okra oil was determined by the gas chromatography method, as a result of which 16 free fatty acids were identified, among which the totality of unsaturated fatty acids prevailed (67.23%), the priority among which belongs to linoleic acid, the content of the latter was 46.83%. Okra seed oil is a valuable source of unsaturated fatty acids.

The morphological and anatomical structure of the okra leaves was studied, that can be used to establish microscopic diagnostic signs when

developing a project of quality control methods for a new kind of medicinal plant materials.

As part of the primary phytochemical analysis, the main groups of biologically active substances (BAS), namely polysaccharides, terpenoids, tannins, flavonoids, saponins, and traces of coumarins, in okra leaves were identified using qualitative reactions.

The conducted research shows the prospects of using okra as a new source of BAS, as well as the development of methods for obtaining new original medicines and studying their pharmacological properties: okra seed oil as a source of polyunsaturated fatty acids, leaves as a source of polysaccharides and flavonoids.

Conclusion. Okra is a promising medicinal and food plant for the development of new phytoremedies and dietary supplements that needs further study.

PHARMACOGNOSTIC STUDY OF *ERUCA VESICARIA* L

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Keywords: *Eruca vesicaria* L. (*E. sativa* Mill.), biologically active substances (BAS), macroscopic signs, phytochemical analysis

Introduction. Sources of vitamins, macro- and microelements and other valuable chemicals comprise various green crops, among which *Eruca vesicaria* L. (*E. sativa* Mill.)), better known as arugula, occupies a prominent place. In the flora of Ukraine, arugula is not represented, but in recent years it has been actively cultivated and the leaves of arugula are used in cooking to prepare salads and other dishes. From foreign data sources, it is known about the antibacterial, antioxidant, antimicrobial, hepatoprotective, nephroprotective, antitumor, antiulcer properties of arugula. However, no information on the research of this kind of medicinal plant material has been found in our country, therefore it is relevant to study the chemical composition of biologically active substances of the raw material of *E. sativa*, cultivated in Ukraine, with the aim of introducing it into medical practice for the further development of medicinal products.

Materials and methods. The objects of the research were fresh arugula leaves cultivated in Ukraine. Methods: information search, comparison and systematic analysis, macroscopic, phytochemical analysis.

Results. Actual data from the scientific sources on distribution, conditions of growth and cultivation, chemical composition of BAS, pharmacological properties, medicinal and nutritional value of arugula have been collected and summzrized; diagnostic macroscopic features of the raw

material have been studied; BAS of *Eruca vesicaria* leaves were identified using reactions for identification, and the quantitative content of the main groups of BAS (flavonoids, phenolic compounds, ascorbic acid, essential oil, polysaccharides, chlorophylls A and B, carotenoids) has been determined.

Conclusions. The results of quantitative determination of BAS content can be used to develop standardization criteria for the studied kind of raw material. *Eruca vesicaria* L. (*Eruca sativa* Mill.) due to its rich chemical composition of biologically active substances is a promising plant for further study with the aim of introducing it into medical practice as a promising source for obtaining medicines with potential antioxidant and antimicrobial activity.

PHARMACOGNOSTIC STUDY OF VACCINIUM CORYMBOSUM L. OF THE DUKE VARIETY

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Scientific supervisor: prof. **Nataliya Vorobets**, PhD.

Keywords: *Vaccinium corymbosum* Duke variety, pharmacognostic analysis

Introduction. In Ukraine, more than 200 varieties of highbush blueberries are grown, which differ in terms of the phases of physiological development, but most of them require pruning. Pruned shoots are practically not used, although, as the results of research in recent years show, they contain a wide range of BASs. Therefore, the aim of our work was to study the species *Vaccinium corymbosum* Duke variety biologically active substances composition and anticandidal activity of their extracts.

Materials and methods. The object of research was shoots of *Vaccinium corymbosum* Duke variety harvested in four staged of development (flowering, fruiting, after fruiting, preparation for winter dormancy). There were used methods of harvesting, drying, and grinding of plant material; macroscopic examination; spectrophotometry, titrimetric, phytochemical as well as anticandidal analysis.

Results. The conducting pharmacognostic research revealed in shoots of *V. corymbosum* variety Duke wide range of BASs: carbohydrates, phenolic compounds, flavonoids, tannins, phlobatannins, arbutin, chlorophylls, carotenoids, ascorbic acid, organic acids. The total content of phenolic compounds was the highest in the extract obtained with 96% aqueous ethanol (AE), the lowest in the aqueous extract and was 164.92±1.312 and 78.5±3.50 mg·g-1, respectively of dry weight (DW) in terms of gallic acid in the phase after fruiting. The highest amount of proanthocyanidins was contained in the aqueous extract in the stage after fruiting, the lowest - the extract obtained with 96% AE, from plant material collected during flowering and was 182.35±1.65

and 20.0±0.50 mg·g-1 DW in terms of catechin, respectively. The largest amount of tannins was found in the extract from the shoots collected after fruiting, the least - in the period of preparation for winter dormancy, it was 3.6±1.65 and 2.4±0.45% DW, respectively in terms of tannin. Extracts of *V. corymbosum* shoots of the Duke variety showed high antifungal activity against *Candida* yeasts: *C. pseudotropicalis*, *C. curvata*, *C. kefir*, *C. parapsilosis*, *C. tenuis*.

Conclusions. Extracts of *V. corymbosum* shoots of the Duke variety have a high content of BAS, especially of phenolic nature, and after a number of additional studies can be used to create drugs for the treatment of many diseases due to numerous biological properties, in particular, antimicrobial and anti-inflammatory. At the same time, new plant raw materials will be used - shoots, which are practically not used now.

DEPARTMENT OF TOXICOLOGICAL AND ANALYTICAL CHEMISTRY

(Head of the department – assoc. prof. **Iryna Halkevych**)

ASSESSMENT OF PESTICIDE CONTAMINATION IN HERBAL COLLECTIONS

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Keywords: pesticides, accumulation in plants, plant material, thin layer chromatography.

Introduction. At this stage of the development of our civilization, the main problem facing humanity and threatening its existence is the problem of environmental pollution. Chemical pollution of the environment with various compounds, including those alien to the biosphere, which are not naturally present in its circulation, is a particular danger. Many of these substances harm both individual populations and species, as well as entire ecosystems, as they disrupt the vital activity of organisms to the point of death, destroy ecosystem connections, and interfere with the processes of substance and energy metabolism. A special danger is the use of chemical means of plant protection without observing the main regulations and the use of drugs. Pesticides and other chemical means of plant protection are biologically active substances that can cause disturbances in the vital activity of warm-blooded animals, humans, and agricultural plants.

Results. The research material was herbal collections that have a choleretic effect. In particular, choleretic collection No. 2, gastric collection No. 3, phytogastrol, phytohepatol. Pesticides that are registered and included in the "List of approved for use in Ukraine" were used for the research. Determination of dual and lindane was carried out by thin-layer chromatography (TLC) and gas-liquid chromatography (GLC) methods. Sorbfil-UV 254 chromatographic plates were used, solvent system: ether-acetone (3:2). Detection was carried out with a water-acetone solution of argentum ammonia and UV light. Chlorine-containing pesticides appear as dark gray spots. Rf of dual - 0.50 ± 0.03, Rf of lindane - 0.64 ± 0.02. Identification by gas chromatography method was carried out according to the absolute retention parameters, and quantitative determination by comparing the peak areas of standard solutions and samples.

Conclusions. The results of the research showed that the studied plants included in the collection are capable of accumulating organochlorine pesticides in their biomass. Moreover, lindane was most actively accumulated by plants that are part of phytogastrol and phytohepatol. The ability of plants to actively extract residues of organochlorine pesticides from the soil was established. The concentration of dual in the collection was not detected, which indicates the possibility of not using it as a herbicide.

STUDY ON THE EFFICIENCY OF CONCENTRATION OF HEAVY METAL IONS TRACES USING DIFFERENT SORBENTS

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Keywords: heavy metals, soil, AA spectrophotometry

Introduction. Heavy metals are chemical compounds that are important for the functioning of our body. The development of the chemical industry, the growth of various enterprises, and the development of aviation and mechanical engineering, lead to an increase in heavy metal emissions into the environment, accumulation in water and soil, which subsequently leads to a negative impact on the human body.

Material and methods. Research object are solutions, soil, water. Research subject: heavy metals. Methods: literature monitoring, ion exchange and complexation solid phase extraction, AA spectrophotometry.

Results. The isolation of heavy metals from soil солей Zn^{2+}, Cu^{2+}, Cd^{2+}, Ni^{2+}, Co^{2+}, Fe^{3+}, Mn^{2+}, Pb^{2+} taken from different areas of the city of Lviv was carried out by determining the conditions of salt concentration by ion-exchange and complexation solid-phase extraction using two types of cartridges. It was found that the degree of release of heavy metal ions on «Diapak Sulfo» cartridges is 93.8 - 96.2%, and on «Diapak IDK» cartridges - 98.1-99.7%. The effectiveness of the two types of sorbents was proved and it was found that the degree of ion extraction from mixtures is about 25-50% better on «Diapack IDK» cartridges than on «Diapack Sulfo».

Conclusions. The studies conducted by the method of atomic absorption spectrophotometry showed that the total content of heavy metal ions Zn^{2+}, Cu^{2+}, Cd^{2+}, Ni^{2+}, Co^{2+}, Fe^{3+}, Mn^{2+}, Pb^{2+} in the soil in the city of Lviv is within the normal range.

CHEMICAL AND TOXICOLOGICAL RESEARCH OF ATOMOXETINE

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Keywords: psychotropic drugs, attention deficit hyperactivity disorder, chemical and toxicological research, side effects, toxicity, poisonings.

Introduction. In recent years, we have seen an increase in the prevalence of mental and depressive disorders among the population. The mental health of the population has been significantly impacted by the negative events of the Covid-19 pandemic, as well as by the military events in Ukraine. Pharmacotherapy remains the main method of control and correction of this

group of diseases, using antidepressants and psychotropic drugs. Modern drug atomoxetine holds a special place among them. In the scientific literature, there are many cases of acute poisoning by atomoxetine, side effects associated with cardiotoxicity, and its ability to cause suicidal intention, especially in adolescents. However, analytical aspects of the toxicology of atomoxetine are not developed yet. Methods for isolating atomoxetine from biological material are not described. The aim of this work was a systematic chemical-toxicological study of atomoxetine, taking into account its physicochemical properties and toxicokinetic characteristics using modern methods of analysis and sample preparation.

Materials and methods. Analysis of scientific literature, its interpretation, and modern physicochemical research methods (thin-layer chromatography, UV spectrophotometry) were used.

Results. The main mechanisms of action of atomoxetine were studied. The physical and chemical properties, pharmacokinetic parameters, biotransformation, side effects, and cases of poisoning were studied. Methods for the determination of atomoxetine in biological objects and methods of detection and quantification in extracts from biological material have been researched. A method of isolation of atomoxetine from urine has been developed. A number of chromogenic reagents have been proposed for the identification of atomoxetine isolated from biological material during systematic toxicological screening. A method of cleaning urine extracts by thin-layer chromatography is proposed. Methods of identification of atomoxetine isolated from urine by UV spectrophotometry and thin-layer chromatography are offered.

Conclusions. The results of the research can be used in screening studies of extracts from biological material for the presence of atomoxetine.

TOXICOLOGICAL ASSESSMENT OF COSMETICS USED IN SYSTEMIC SKIN DISEASES

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Scientific supervisor: assoc. prof. **Yuriy Bidnychenko**, PhD.

Keywords: smokeless tobacco, tobacco-specific nitrosamines, thin layer chromatography.

Introduction. Skin diseases constitute a significant part of the total number of diseases in the world, affecting millions of people around the world. In today's world, due to the constant presence on the Internet, the popularity of perfectly smooth skin is increasing. However, in real life there is no such thing as an ideal, as most people experience various skin conditions, even minor ones such as comedones (a type of acne) or postacne. In order to solve these

problems, we spend a lot of money on buying cosmetics that promise to achieve a wonderful effect. The problem of frequent occurrence of comedones, acne, hyperpigmentation and other systemic skin diseases stimulates the dermatocosmetics market. The shelves of pharmacies, in cosmetology offices, on the screen of our phones are saturated with various advertisements for therapeutic and preventive care cosmetics. In the assortment we can find creams, lotions, masks, as well as means for spot application. Although cosmetic products are intended to improve the health and appearance of the skin, some of them may contain toxic and dangerous components that can trigger allergic reactions and have carcinogenic effects.

Materials and methods. The objects of research are care cosmetics from different manufacturers for quantification of colloid silver in it. Methods: information monitoring, photometry.

Results. A study of the composition of cosmetic products for skin care, which contain active components for the treatment of systemic skin diseases, was conducted. Modern regulatory and technical documentation related to quality control of prophylactic and therapeutic cosmetics familiarized with. The domestic and foreign specialized literature was studied in order to find out the availability of research methods for preventive and curative cosmetic products. Domestic and foreign specialized literature was studied for the availability of research methods for components used in the creation of care cosmetics. Methods of determining colloidal silver in cosmetics were analysed.

Conclusions. A toxicological study of different care cosmetics was conducted. The composition of selected cosmetic products containing silver was studied and the silver content in these products was determined.

CHEMICAL AND TOXICOLOGICAL ANALYSIS OF COLCHICINE ALKALOIDS OF AUTUMN CROCUS (COLHICUM AUTUMNALE)

Anastasiia Shavalo
Scientific supervisor: assoc. prof. **Iryna Halkevych**, PhD.

Keywords: colchicine, colchamine, SPE, thin-layer chromatography (TLC) GC/MS, plasma, liver tissue.

Introduction. Preparation AUTUMN CROCUS - Colchicum autumnale Pleniflorum (L.) (family: Colchicaceae) - have analgesic effect, are used in the treatment of rheumatic pain, gout, neuralgia, cataracts, pericarditis, gastroenteritis, etc. The main active ingredient in these drugs is the alkaloid colchicine. In traditional medicine, colchicine is used to treat gout and has anti-inflammatory, antimitotic and anticancer activity, and is effective in the treatment of Mediterranean fever. Recently, interest in autumn crocus has increased, as colchicine has been found to block cell nucleation. This property

is widely used in genetic and breeding research to produce polyploid plants, artificial mutations, etc. Along with its therapeutic effect, colchicine is characterized by high toxicity, which often causes poisoning. Therefore, the development of modern methods for the study of colchicine, which can be used in pharmaceutical analysis and in the practice of forensic chemical analysis, is relevant.

Materials and methods. The objects of the study were colchicine alkaloid, Colchicine Lirka tablets, and alcoholic tincture of autumn crocus corms. The alkaloids were separated by thin-layer chromatography (TLC) and GC/MS. Plasma and liver tissue samples were prepared for analysis using three types of sorbents for solid-phase extraction.

Results. The composition of 5 solvent systems for the identification and separation of alkaloids by TLC on Sorbfil plates has been proposed. The method of gas chromatographic determination of colchicine on a capillary column RTX 5 MS was developed. The conditions for the preparation of plasma and liver tissue samples for colchicine content testing using cartridges with a hydrophobic sorbent (Sep-Pak Vac C18), a cation exchange sorbent (Oasis MCX) and a hydrophilic-lipophilic sorbent (Oasis HLB) have been developed.

Conclusions. Over the past decade, alkaloids of autumn crocus have been attracting attention because they are characterized by a wide range of pharmacological effects; they are used to produce drugs with antitumor and antiviral effects, bioinsecticides, and plant breeding. The development of analytical methods for the analysis of colchicine in medicines, plant extracts, physiological fluids and tissues of biological material is still relevant. For the rapid screening, the composition of 5 solvent systems was studied, in which colchicine can be identified in the presence of 4 other colchicine alkaloids. The conditions for the identification and quantification of colchicine by GC/MS on an RTX 5 MS capillary column have been developed. The linearity of the calibration graph is observed in the range of 100-1100 ng/ml ($r = 0.999$). The conditions for the extraction of colchicine from plasma and acidic liver tissue extracts using three types of sorbents were developed. The optimal eluents were selected. It was found that the smallest amount of endogenous components of the biological matrix is contained in samples purified on Sep-Pak Vac C18 cartridges. At the same time, up to 98 % of colchicine was isolated from plasma and up to 79 % from liver tissue.

TOXICOLOGICAL ASSESSMENT OF MEDICINAL PRODUCTS CONTAINING BARBITURATES

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Keywords: analysis, phenobarbital, biological fluids, immunochromatography.

Introduction. In general, barbiturates are taken by patients to improve falling asleep, for relaxation, as a hypnotic and sedative drug. Poisoning can occur with the accidental use of a large amount of medication: and this is not uncommon, since barbiturates cause gradual habituation of the body, a person begins to take larger and larger doses. The most common cause of death is the development of respiratory and liver failure, shock and cardiac arrest. Most often, barbiturate poisoning is recorded in the following people: those who take barbiturates as prescribed by a doctor, but for a long time; in those who combine the intake of barbiturates with the use of alcohol; in those who independently take such medications, randomly and in arbitrary doses; in those who use barbiturates off-label (for example, to obtain a euphoric state).

Results. Was used as the studied components Corvaltab LLC "Pharma Start", Ukraine (1 tablet contains phenobarbital - 7.5 mg); Barboval JSC "Farmak", Ukraine (1 ml of solution contains 17 mg of phenobarbital); Corvalcaps JSC "Kyiv Vitamin Plant", Ukraine (1 capsule contains 18.26 mg of phenobarbital), Corvalol (1 ml of solution contains 18.26 mg of phenobarbital).

The research group consisted of 10 people aged 18 to 45 who use one of the medicines. Material for research (urine) was collected on the day of admission before the start of active therapy (control study) and five days after the use of drugs. Informed consent for the study was obtained from the group participants. "SNIPER" tests from "Alfa Scientific Design Inc., USA", Atlas Linc, Inc (USA) were used for rapid immunochromatographic analysis. To identify phenobarbital, as well as to purify it from compounds of biological origin, we used the chromatography method in a thin layer of sorbent.

For analysis, "Sorbfil" plates and solvent systems were used: methanol; ethyl acetate-methanol-25% ammonia solution (85:10:5), chloroform-acetone (80:20), chloroform-methanol (90:10). Detection was carried out with a 5% solution of $Hg(NO_3)_2$ and a 0.1% chloroform solution of diphenylcarbazone (sequentially). In the presence of barbiturates, blue-violet or red-violet colored spots appear. Color reactions with Lieberman reagents (red-orange color), Kopani-Zwicker (purple), mercury nitrate (black color) were used as confirmatory tests. We found that the proposed reactions make it possible to identify phenobarbital isolated from biological objects of research.

Conclusions. An express analysis was carried out for the detection of phenobarbital in urine using the immunochromatographic method, using test

systems. To confirm the results and identify phenobarbital isolated from urine, chromatography in a thin layer of sorbent and color reactions were performed. It was established that they can be used for express analysis of the studied drug in extracts.

STUDY OF THE COMPOSITION SAFETY OF COMBINED ANTI-COLD DRUGS

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Keywords: combined anti-cold drugs (CAD), toxicity, TLC, HPLC/UV, blood.

Introduction: When treating mild to moderate acute respiratory infections (ARI), over-the-counter drugs are commonly used to alleviate symptoms. Combined anti-cold drugs (CAD) are popular for treating ARI because they can address multiple symptoms at once. However, despite their perceived safety, overdoses of CAD can lead to hospitalization and even fatalities. Therefore, it is crucial to study the composition and safety of CAD and develop reliable methods for detecting and quantifying their active pharmaceutical ingredients (APIs) for clinical and chemical-toxicological analysis.

Materials and Methods: A literature search was conducted to gather information on the composition and safety of CAD. TLC was used for rapid screening of APIs present in CAD, while liquid extraction was employed to isolate dextromethorphan and chlorpheniramine from blood. HPLC/UV was used for identification and quantification of these APIs.

Results: Analyzing the composition of the CPs registered in Ukraine, it was found that they contain a component with anti-inflammatory, analgesic, antipyretic effect - non-narcotic analgesic-antipyretic paracetamol or non-steroidal anti-inflammatory API - ibuprofen, decongestant phenylephrine or phenylpropanolamine and blocker of histamine H1 receptors pheniramine, chlorpheniramine, levocetirizine or cetirizine. In the case of a cold with a cough, you can use drugs that contain dextromethorphan or guaifenesin, and some drugs contain ascorbic acid and caffeine.

It has been established that due to the risk of overdose, it is impossible to use different CPPs simultaneously, as well as in combination with paracetamol, since the hepatotoxicity of paracetamol is dose-dependent. It should be ensured that drugs containing sympathomimetics are not used simultaneously orally and topically (preparations for the nose, ears and eyes) in order to avoid overdoses.

For the purpose of express screening of paracetamol, dextromethorphan, chlorpheniramine and phenylephrine, two systems are proposed, which are used

in toxicology departments of domestic forensic medical examination bureaus, and two individual systems are also proposed. The conditions for identifying and quantitatively determining dextromethorphan and chlorpheniramine by the HPLC/UV method have been developed. The relative error of quantitative determination of chlorpheniramine maleate in the range of 1 - 150 мg/ml is 0.51%, for dextromethorphan, in the range of concentrations of 2-500 мg/ml - 0.77%. The studied compounds were isolated from blood using a 30% solution of trichloroacetic acid, with a recovery rate of 67-68%.

Conclusions: the composition and safety of using CAD were thoroughly examined, and the conditions for TLC and HPLC/UV analysis of the APIs present in CAD were developed to be suitable for both forensic chemical analysis and clinical laboratory research purposes.

DETECTION OF ANTIBACTERIAL DRUGS IN FOOD PRODUCTS

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Keywords: antibiotics, gentamicin, food, dairy products.

Introduction. Antibiotics are considered the most outstanding discovery in medicine of the 20th century and a universal weapon against most pathogenic microorganisms. However, to date, antibiotic resistance of the main pathogens of infectious diseases is, without exaggeration, one of the biggest problems of modern humane and veterinary medicine. The speed with which the resistance of microorganisms to antibacterial drugs is formed and spread is amazing. Medicines, which were effective a few years ago, are losing their positions today and their use is necessarily limited. One of the reasons for the total spread of this threatening phenomenon was the excessive and irrational use of antibiotics in animal husbandry. Farms practice the use of these drugs for therapeutic and preventive purposes. In addition to bacteriostatic and bactericidal effects, antibiotics can stimulate certain biochemical processes in the body of animals, which leads to the improvement of their general condition, acceleration of growth and increase in productivity. The threat is posed by the use of livestock products contaminated with residual amounts of antibiotics, which can be the cause of allergic diseases in people, as well as the development of antibiotic-resistant microorganisms, as a result of which, in the case of prescribing antibacterial drugs for humans, they turn out to be ineffective. The specified problem makes it necessary to control products of animal origin for the content of residual amounts of antibiotics.

Materials and methods. Research object is dairy products. Research subject: gentamicin. Methods: literature monitoring, toxicological assessment, physical-chemical, and thin-layer chromatography.

Results. The pharmacological properties of aminoglycoside antibiotics and methods of their use in animal husbandry were studied. The toxicological properties of gentamicin were studied Developed modern regulatory and technical documentation on the use of gentamicin in animal husbandry.

Evaluation of modern methods of food quality control was carried out.

Modern methods of determining residual amounts of antibiotics in food products are analyzed. Some types of dairy products have been tested for gentamicin content.

Conclusions. Our tests showed the presence of gentamicin in dry and condensed milk and traces of gentamicin in sour cream, which indicates antibiotic contamination of the milk from which this product was made.

CHEMICAL AND TOXICOLOGICAL RESEARCH OF SMOKELESS TOBACCO (SNUS)

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Scientific supervisor: assoc. prof. **Yuriy Bidnychenko**, PhD.

Keywords: smokeless tobacco, tobacco-specific nitrosamines, thin layer chromatography.

Introduction. Snus is a tobacco product derived from a type of dry snuff that was invented in Sweden in the early 18th century. It is placed between the upper lip and the gums for a long time in the form of a form for sublabial administration. Snus is considered an alternative to smoking, vaping, chewing, dissolvable and snuff tobacco products. Snus usually contains nicotine, which leads to nicotine addiction. The most dangerous components of snus are N-nitrosamines, which are formed in the tobacco leaf during its storage and processing into the finished product. Snus is not banned in Ukraine, so its use poses a danger to the health of consumers.

Materials and methods. The objects of research are snus from different manufacturers for detection of carcinogenic tobacco-specific nitrosamines in it. The subject of research is modern methods of assessing the safety of snus. Methods: information monitoring, toxicological assessment, ionometry, thin layer chromatography.

Results. Various types of snus – tobacco-containing, nicotine-containing and nicotine-free – were studied for the presence of tobacco-specific nitrosamines in them. The pH of water extracts from snus samples was determined. Samples of snus containing tobacco are more alkaline than snus with synthetic nicotine or nicotine-free. Snus with the highest nicotine content has the highest pH value. With the help of thin-layer chromatography, various types of snus were investigated for the presence of tobacco-specific

nitrosamines. N-nitrosamines were detected in samples containing tobacco. No nitrosamines were detected in samples of nicotine-free snus.

Conclusions. A toxicological study of different types of snus was conducted; dangerous tobacco-specific N-nitrosamines were found.

ANTI-INFLAMMATORY PROPERTIES OF NATURAL COMPOUNDS IN THE COVID–19 THERAPY AND METHODS OF THEIR ANALYSIS

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Keywords: quercetin , Covid-19

Introduction: The second decade of the 21st century will be remembered in human history for the beginning of an unprecedented epidemic caused by the emergence of a new strain of human beta-coronavirus, the genome of which was first isolated and identified in China in early 2020. The etiological agent of coronavirus disease 19 (COVID-19) was named SARS-CoV-2 (Severe Acute Respiratory Syndrome Corona Virus-2). As a result of a number of conducted studies, it was established that SARS-CoV-2 is characterized by a high degree of danger. In a number of cases, therapy for this disease has not been effective, so clinicians continue to search for effective drugs, and in particular, among natural compounds that could be prescribed for COVID-19 in order to speed up recovery. Literature sources provide data on the effectiveness of a number of natural compounds that in one way or another affect the course of this disease. In particular, the effectiveness of quercetin in the treatment of complications of COVID-19 was clinically proven.

Materials and methods: fluorimetry, high performance liquid chromatography, solid phase extraction.

Results: According to the literature, in the last 3-4 years, a large number of works have been devoted to the search for biologically active compounds of natural origin, which are characterized by antiviral activity against SARS-CoV-2. Such substances include C-terpinene, isothymol, limonene, P-cymene, thymol, kurkmin; flavonoids; acids - cinnamic, benzoic, gallic, chlorogenic; 3,5,7,30,40,50-Hexahydroxyflavanone-3-O-β-D-glucopyranoside, baicalin, oils – laurel, soybean, linseed, olive; amaranthine; baicalin, etc. Among the flavonoids, quercetin, apigenin hesperidin, catechin, kaempferol, quercetin luteolin were found to have antiviral activity. Medicinal products with quercetin were among the first in Ukraine to be approved for use in pneumonia caused by the COVID-19 coronavirus infection. Based on clinical studies, quercetin is recommended for complex treatment of atypical pneumonia, as this compound has endothelium-protective and antioxidant effects.

Conclusions: The conditions for identification and quantitative determination of complexes of quercetin with aluminum nitrate in methanolic solutions have been developed.

Developed conditions for the identification and quantitative determination of quercetin in methanolic solutions by the HPLC method.

A technique for solid-phase extraction of quercetin from plasma on cartridges with H-form clinoptilolite was developed. The optimal eluent for desorption of quercetin from the sorbent was selected. It was established that almost the same amount of quercetin in parallel samples was determined by the methods of spectrofluorimetry and EPC in the eluates.

TOXICOLOGICAL ASSESSMENT AND FEATURES OF SIBUTRAMINE DETECTION IN BIOLOGICAL MATERIAL

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Scientific supervisor: assist. prof. **Sofiia Ihlitska**, PhD

Keywords: subutramine, toxicity, screening, TLC-chromatography, UV-spectrophotometry.

Introduction. Sibutramine has been withdrawn from the US market due to association with adverse cardiovascular outcomes, especially in patients with pre-existing heart disease. However, the persistent presence of sibutramine in herbal preparations is a public safety concern. It has been found that one of the most likely impurities in the weight loss agents is sibutramine, a substance which can provoke cardiovascular side effects, including sudden cardiac death syndrome, serotonin syndrome, amnesia, psychosis, and manic episodes.

Materials and methods. Research object is chemical-toxicological analysis of sibutramine. To solve the tasks, the method of literature search as well as thin-layer chromatography and UV spectrophotometry were used after isolation and purification of sibutramnium by liquid extraction.

Results. The detection and analysis of sibutramine in biological samples such as blood, urine, and hair is important for toxicological and chemical purposes. Various solvents such as dichloromethane, ethyl acetate, and hexane can be used for liquid extraction of sibutramine, and solid-phase extraction using cartridges filled with a stationary phase can be used for simultaneous purification and concentration. Chemical screening tests, including TLC screening, can also be used to detect sibutramine. To detect sibutramine on TLC plates, the following developers can be used: UV absorption at 254 nm, ninhydrin (purple spots), 2,4-dinitrophenylhydrazine (orange spots), Dragendorff and Folin-Chocalteu reagents (solution of phosphoric molybdic acid and phosphoric tungstic acid (blue spots), potassium permanganate (brown or black spots), and potassium iodoplatinate (yellow spots), fluorescein (view

under ultraviolet light to obtain a bright - green spot), iodine vapor (brown spots), iron chloride (purple spots). Additionally, UV spectrophotometry, gas chromatography–tandem mass spectrometry, and ultra high performance liquid chromatography (UHPLC) are powerful methods for detection and quantification of sibutramine in biological samples. It is important to note that unchanged sibutramine may not be detected in urine, but metabolites of sibutramine can be determined after enzymatic hydrolysis, preconcentration, and derivatization of urine samples. Multiple methods and tests should be used in combination with other analytical methods to obtain more accurate and reliable results.

Conclusions. The scheme of toxicological screening of sibutramine in biological material was developed, which may be useful to clinicians and toxicologists in the diagnosis and treatment of sibutramine poisoning. TLC screening, UV spectrophotometry, gas chromatography–tandem mass spectrometry, and ultra high performance liquid chromatography (UHPLC) are some of the methods used to detect and quantify sibutramine in biological samples. The choice of method depends on factors such as sensitivity, specificity, and the nature of the sample.

CHEMICO-TOXICOLOGICAL ANALYSIS OF TIZANIDINE

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Scientific supervisor: sen. lec. **Serhiy Kramarenko**, PhD.

Keywords: Tizanidine, alpha-2 adrenergic agonist medicines, chemical analysis, intoxycations, isolation, extraction, thin layer chromatography, spectrophotometry.

Introduction. Tizanidine is a muscle relaxer and an antispasmodic agent. Tizanidine is used to treat muscle symptoms; such as spasm, pain and stiffness; caused by multiple sclerosis, spinal cord injuries, or other spinal cord disorders. It is given intrathecally (directly into the spinal cord) or orally (by mouth). A lot of reports can be found in the literature about lethal intoxications with Tizanidine, with combined intoxications, Tizanidine misuse and suicide poisoning. Takin this into consideration, chemico-toxicological investigation of Tizanidine is actual problem.

Materials and methods. Research object is Tizanidine and biological samples poisoned this drug. Research subject: element of chemical development of Tizanidine for identification, quatification and isolation of this substance. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The UV-spectrophometry and thin layer chromatography methods were developed for identification of Tizanidine in pharmaceutical

formulations and samples from biological liquids. The spectrum of Tizanidine in acid solution is characterised by two maximums of absorption. Four eluent system, which recommended for systematic analysis in forensic toxicology, for determination of Tizanidine in biological samples: chloroform-acetone (4:1), ethyl acetate, chloroform-methanol (9:1) and ethyl acetate-methanol-25% solution of ammonia (17:2:1) were used. Determination was developing on "Sorbfil" plates. Tizanidine identification can be achieved with such reagents: 5% ningidrine solution in 10% acetate acid, Dragendorf and Bushard reagents.

The spectrophotometric method was used for Baclofen quantification. It based on reaction between Tizanidine and 3% vanilinesolution in alkaline environment. Limit of Tizanidine detection is 5 μg/ml. Linearity of calibration curve is in concentration range 5-40 μg/ml. The proposed method was successfully applied to biological samples for Tizanidine analysis. Relation between pH and Tizanidine extraction amount was investigated. This substance was extracted in high quantities from light base solutions with pH 8.0-8.5. The WHO recommended techniques were used for Tizanidine isolation from blood and urea samples.

Conclusions. The techniques for identification, quatification and isolation of Tizanidine were developed and demonstrated good results for Tizanidine determination in biological samples.

CHEMICAL AND TOXICOLOGICAL RESEARCH OF ALPRAZOLAM

Ihor Rura
Scientific supervisor: assist. prof. **N. M. Darmohrai**

Keywords: psychotropic drugs, anxiety disorder, alprazolam, chemical and toxicological research, side effects, toxicity, poisonings.

Introduction. According to a number of international organizations, including the WHO, anxiety disorders remain one of the most common psychopathological conditions in patients with somatic pathology (cardiological, dermatological, oncological, gastrointestinal). Anxiety disorders are considered as an independent risk factor for the development, adverse course and consequences of cardiovascular diseases, as well as mortality. Long-term persistence of anxiety symptoms significantly increases the risk of suicide. The basis of therapy for this group of diseases is pharmacotherapy, the gold standard of which is the use of tranquilizers from the group of 1,4-benzdiazepine derivatives, such as modern drug alprazolam. Under certain conditions, this drug can have side effects associated with cardiotoxicity and its ability to lead to suicidal intention, especially in adolescents. Cases of chronic overdose, as well as acute and fatal poisoning by alprazolam have been reported worldwide. Systematic chemical and toxicological study of alprazolam

is relevant, taking into account its physico-chemical properties and toxicokinetic characteristics using modern methods of analysis and sample preparation, which are implemented in domestic practice of toxicological research.

Materials and methods. Analysis of scientific literature and its interpretation, modern physico-chemical research methods (TLC, UV spectrophotometry, GS-MS) were used.

Results. The general characteristic of tranquilizers and their classification is developed. The peculiarities of the pharmacological action of alprazolam were studied. The physico-chemical and pharmacokinetic properties, peculiarities of its biotransformation were studied. The features of chemical and toxicological study of alprazolam, isolation from biological objects, methods of detection and quantification in extracts from biological material have been studied. A method of isolation of alprazolam from urine has been developed. A method of cleaning urine extracts by thin layer chromatography is proposed. Methods of identification of alprazolam isolated from urine by chromogenic reactions, UV spectrophotometry, thin layer chromatography and by gas chromatography-mass spectrometry are offered. **Conclusions.** The results of research can be used in screening studies of extracts from biological material for the presence of alprazolam.

TOXICOLOGICAL ANALYSIS OF ANTISPASMODIC MEDICATIONS

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Scientific supervisor: assoc. prof. **L. Kostyshyn,** PhD.

Keywords: antispasmodics, drotaverine, spectrofluorometric determination.

Introduction. Antispasmodics are the most common class of drugs, most of which are available over the counter and can be used without a doctor's prescription. Due to their wide availability in our country, there are frequent cases of acute poisoning with these drugs with suicidal intent. So, over the past 5 years, more than 20 cases of intoxication with drotaverine in combination with other drugs, which led to a fatal outcome, have been recorded. The drug in large doses disrupts atrioventricular conduction, reduces the excitability of the heart muscle, can cause cardiac arrest and paralysis of the respiratory center. In medicine, drotaverine hydrochloride is widely used in combination with many drugs, which leads to acute and fatal cases. In particular, in combination with mefenamic acid, drotaverine is used to relieve severe pain during childbirth, with paracetamol, with nifuroxazide for enterocolitis of various etiologies; complex treatment of intestinal dysbiosis; with proton pump inhibitors in the treatment of dyspepsia, peptic ulcer, gastroesophageal reflux disease, etc.

Therefore, there is an urgent need to develop a method for the simultaneous evaluation of drotaverine hydrochloride with other drugs suitable for chemical-toxicological analysis.

Results. Drotaverine hydrochloride (Drotaverin-Darnytsia solution d/in. 20 mg/ml per 2 ml No. 5 in ampoules) was used as the studied components in a mixture with papaverine hydrochloride (Papaverin-Darnytsia solution d/in. 2% 2 ml No. 10 in ampoules) and paracetamol B. Brown 10 mg/ml. For the identification of drotaverine hydrochloride when used in combination with other drugs, it was used TLC screening. Chloroform extracts from biological objects (blood, urine) were obtained according to general methods of isolation of medicinal poisons. Cleaning was carried out by the method of liquid extraction. Thin-layer chromatography was performed on "Silufol" UV-254 plates. The most optimal value of Rf is observed in the solvent system of ethyl acetate-methanol-25% ammonia (17:2:1). This allows the method to be used for the identification and separation of drotaverine in mixtures with papaverine and paracetamol in extracts from biological material.

Conclusions. We proposed a TLC screening for the identification and separation of drotaverine hydrochloride in a mixture with paracetamol and papaverine hydrochloride. For separation and quantification, a method of UV-spectrometry of the studied drug in a mixture with papaverine and paracetamol was developed.

PERFORMANCE EVALUATION OF HOUSEHOLD FILTERS FOR WATER TREATMENT

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Keywords: tape water quality, charcoil, shungite, silicon.

Introduction. Water plays a crucial role in human life. According to the WHO, most human diseases are caused by the consumption of poor-quality water. Doubts of the population about the quality of drinking water supplied by the local water supply cause an increase in demand for various household water filters. The purpose of the work is to study the quality of the filtration of the ox with the most popular filter materials for household filters.

Materials and methods. The object of the study is water from a city water supply for the purpose of determining physical and chemical parameters after the use of filter materials.

Methods: literature monitoring, pH-metry, titrimetry, spectrophotometry.

Results. During the 7-day period of infusing the water samples, activated carbon does not affect the acidity of the water, shungite makes the water more acidic, and silicon makes the water more alkaline.

Activated carbon does not affect the hardness of water during the period of water infusion recommended by the manufacturer. Shungite and silicon increase the overall hardness of water. The use of shungite and silicon for water softening is undesirable.

Within 7 days, chlorine completely evaporates from the water, regardless of the presence of activated carbon or shungite in it. The presence of silicon does not contribute to the free weathering of chlorine from the studied water samples; therefore its use for the purpose of removing chlorine from water is impractical.

Silicon is partially soluble in water, so its use for "improvement" or "activation" of water is questionable. Activated carbon and shungite do not change the concentration of silicon in water..

Conclusions. The assessment of the quality of tap water purification by the most common household filters according to the advertised indicators was carried out.

COMPARISON OF TOXICOLOGICAL PROPERTIES AND ANALYSIS METHODS OF NEW TETRACYCLINES: TIGECYCLINE, OMADACYCLINE, SARECYCLINE AND ERAVACYCLINE

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Keywords: tigecycline, omadacycline, sarecycline and eravacycline, toxicity, screening, TLC-chromatography, UV-spectrophotometry, UPLC.

Introduction. Tigecycline and omadacycline are known to cause liver damage and gastrointestinal side effects such as nausea and diarrhea. Sarecycline is specifically designed to treat acne and have few side effects. Eravacycline has a low risk of hepatotoxicity and gastrointestinal side effects but can cause photosensitivity, increasing the risk of sunburn and skin damage from sunlight. The development of analytical methods to monitor drug levels in patients is important for administering the drugs at the appropriate dose and frequency.

Materials and methods. Thin-layer chromatography, UV spectrophotometry, HPLC. The analysis of the obtained results was carried out using the integrated system of statistical analysis and processing of biomedical data Statistica 6.1.

Results. After extraction, the filtrate was evaporated to dryness in a water bath and the residue was used for detection by chemical reactions, thin-layer chromatography and UV spectrophotometry.Ninhydrin can react with the amino group in tigecycline to produce a purple color, but it is not specific to tigecycline and may yield false positive results in the presence of other amino

group-containing compounds. The Griess reagent can detect tigecycline's nitro group by forming a red-violet color, but the sensitivity and specificity of the test may be limited by other compounds in the sample. Thus, confirming the presence of tigecycline with more specific analytical methods such as HPLC or LC-MS/MS is recommended. The article describes the development and validation of a UPLC-PDA method for the quantitative determination of tigecycline concentration in human blood plasma. The method involves the use of a tigecycline standard solution, which is then measured against a reagent blank in the UV range. The accuracy of the method was evaluated by applying it to the analysis of known quantities of a reference substance added to serum samples containing 5 μg/ml of tigecycline. The LOD and LOQ values were 0.33 and 1.00 μg/mL, respectively. Chromatographic separation was performed using HPLC, and the calibration curve was linear up to 6 μg/ml. The method was found to be suitable for therapeutic monitoring of tigecycline concentrations in patients treated with the drug.

Conclusions. The analysis of tigecycline, omadacycline, sarecycline, and eravacycline poisoning through instrumental methods was discussed. A toxicological screening method for tigecycline using thin-layer chromatography was developed. Based on this research, a scheme for conducting a toxicological study of biological material for the presence of new tetracyclines, using tigecycline as an example, was developed.

ASSESMENT OF THE TOXICITY OF SEDATIVE MEDICATIONS INCLUDING DOXYLAMINE

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Keywords: doxylamine, sedative drugs, sleep disorders, side effects, toxicity, poisonings, assessment of the toxicity.

Introduction. Insomnia is the most common sleep disorder and occurs in 15-30 % of patients. Insomnia can also serve as an additional pathological condition of other diseases, such as depression, anxiety, mental disorders and others. Doxylamine is recommended as a first-line drug in the treatment of chronic or newly diagnosed insomnia. The number of cases of poisonings by this drug is increasing every year. Both accidental deaths as a result of overdose and suicides have been registered. Many polyvalent poisonings with doxylamine have been recorded when it is used in combination with drugs from the benzodiazepine group, with diphenhydramine, and barbiturates, or in combination with alcohol. Despite this, doxylamine is not researched enough in chemical and toxicological analysis. The aim of this work was development methods of doxylamine isolation from biological material, methods of him

identification and quantification in extracts using modern physico-chemical methods of analysis.

Materials and methods. Analysis of scientific literature and its interpretation were used. Modern physico-chemical methods of analysis were used, such as thin-layer chromatography, gas chromatography-mass spectrometry.

Results. The classification of insomnia, the etiology of their occurrence and its pharmacotherapy were studied. It was also studied physico-chemical, pharmacokinetic properties of doxylamine, its biotransformation in the body, side effects and cases of poisonings. A comparative assessment of the extraction efficiency of doxylamine from liver tissues by classical methods of isolation was carried out. A technique of doxylamine isolation from liver tissues by chloroform was developed. A method of purification of extracts by thin-layer chromatography was proposed. A method of sample preparation of biological fluids by treatment with deproteinizing agents followed by liquid-liquid extraction with organic solvents or by treatment with amphiphilic solvents with subsequent separation of the organic layer was proposed. A technique of doxylamine extraction from urine has been developed. Conditions for identification of doxylamine isolated from biological material using chromogenic reactions and gas chromatography-mass spectrometrywere proposed.

Conclusions. The toxicological safety of doxylamine needs to be studied more closely. Development of reliable and rapid methods for its determination in samples of biological material is recommended.

RESEARCH ON THE COMPOSITION OF VAPING LIQUIDS

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Keywords: vaping liquids, chemical tests, thin-layer chromatography

Introduction. Recently, the new trend of vaping has been spreading. Among young people and, even, among more mature people the use of new generation of electronic cigarettes is rise to a whole subculture. Electronic cigarettes are often used as a popular alternative to smoking cigarettes. Vaping is believed to be less harmful than smoking. But e-cigarette vapor contains small amounts of other harmful substances that are not present in cigarette smoke. There is a fair amount of skepticism about whether e-cigarettes really are a healthier alternative and whether they can help people quit smoking.

Material and methods. The object of research is liquids for vaping. Methods: literature review, chemical tests, thin-layer chromatography.

Results. The mechanisms of pharmacological and toxicological activity of natural and synthetic nicotine have been studied. Method of nicotine isolation from liquids for e-cigarettes has been reviewed. Chemical and physicochemical methods of nicotine detection and identification in e-liquids are described: qualitative reactions and thin layer chromatography. A comparison of the nicotine content in various samples of e-liquids, both nicotine-containing and nicotine-free was made.

Conclusions. With the help of qualitative reactions and thin-layer chromatography, nicotine was detected in 6 samples of liquids for electronic cigarettes. An unidentified substance was detected in two samples of liquid for electronic cigarettes. These liquids contain nicotine salts, so it is likely that this substance is a special technological additive that the manufacturers did not indicate on the label of their products.

CHEMICAL AND TOXICOLOGICAL STUDY OF BENZIMIDAZOLE DERIVATIVES HAVING ANTHELMINTIC ACTIVITY

Mariia Hira
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Keywords: albendazole, mebendazole, UV spectrophotometry, TLC, SPE, plasma.

Introduction: Mebendazole and albendazole, which are benzimidazole derivatives, have the broadest range of anthelmintic activity among drugs used for this purpose. Due to their episodic use, they are relatively safe and have few side effects. However, the increasing prevalence of self-medication via the Internet has put people at risk of poisoning from albendazole intended for animals, as severe poisonings have been reported. Fatal cases of pancytopenia have also occurred during albendazole treatment. Hence, there is a pressing need for a chemical-toxicological study of benzimidazole derivatives with anthelmintic properties.

Materials and methods: The study involved a literature search, followed by the analysis and interpretation of the collected data on the chemical-toxicological analysis of albendazole and mebendazole. The TLC method was used for rapid screening of albendazole, while UV spectrophotometry was utilized for identifying and quantifying albendazole isolated from blood plasma.

Results: The study revealed that albendazole and mebendazole are lipophilic, making them poorly absorbed by the digestive tract after internal use. The main product of mebendazole biotransformation is 2-amino-5-benzoyl benzimidazole, which lacks anthelmintic activity. In contrast, the main biotransformation product of albendazole is albendazole sulfoxide, which

retains half of the original compound's pharmacological activity. It has been established that even a single use of albendazole or mebendazole can cause acute liver toxicity. Furthermore, the combined use of mebendazole and metronidazole in doses exceeding 500 mg is prohibited due to severe and potentially fatal side effects.

To enable the rapid detection of albendazole in biological fluids, a TLC method was developed. Detection is recommended using UV light (л = 254 nm), and the detection limit of albendazole by the TLC method is 25 мg/ml. Additionally, the UV spectrum of albendazole in 96% ethanol was analyzed. The light absorption of albendazole in ethanol solutions followed the law of Bouguer-Lambert-Bere, ranging from concentrations of 2.0 мg/ml to 15 мg/ml. The detection limit was determined to be 1 мg/ml. For quantitative determination, the specific absorption index of albendazole in 96% ethanol at л = 296 nm was calculated, with a relative error of 1.30%. Furthermore, it was established that up to 89% of the drug is released when albendazole is isolated from plasma using Oasis HLB cartridges (30 mg).

Conclusions: The physicochemical properties, mechanism of action, and pharmacokinetic features of mebendazole and albendazole were thoroughly examined. Furthermore, the potential side effects and toxic effects of these compounds were established. Modern scientific literature was analyzed to obtain information on the methods used to determine mebendazole and albendazole in substances, medicinal products, and biological samples. The study selected the conditions required for an express screening of albendazole using the TLC method. A technique for isolating albendazole from blood plasma was also proposed. Additionally, the study developed conditions for albendazole identification and determination using the UV spectrophotometry method. These findings could prove useful in forensic chemistry or clinical toxicology.

CLINICAL AND PHARMACOLOGICAL PROPERTIES AND METHODS OF ANALYSIS OF THE STATIN DRUG CLASS

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Keywords: statins, pharmacokinetics, toxic effect, plasma, urine, UV-spectrophotometry, fluorimetry, HPLC/UV, HPLC/MS/MS, LC-MS/MS, SPE.

Introduction. Statins are the first-line drugs for lipid-lowering therapy. The results of numerous clinical trials indicate that the use of statins as primary and secondary prevention agents has a pronounced favorable effect on prognosis. It provides a significant reduction in morbidity and mortality from cardiovascular diseases. However, despite their widespread use, there are cases

of forced discontinuation of treatment due to side effects from the musculoskeletal system, hepatotoxicity, and the development of diabetes mellitus. The literature describes cases of fatal outcomes from the use of statins in combination with antihypertensive drugs for suicide. Therefore, studying the clinical and pharmacological properties of statins, methods of their analysis in substances, pharmaceutical dosage forms, and biological fluids, as well as developing new methods for isolating and determining drugs of this group, is an urgent task.

Materials and methods: literature search, analysis and interpretation of collected information regarding the clinical and pharmacological properties of statins, methods of their analysis in substances, pharmacutical dosage forms and biological fluids; SPE for isolation of atorvastatin from blood plasma, UV spectrophotometry - for determination of atorvastatin extracted from plasma.

Results. Despite the same general mechanism of action, statin drugs differ in their chemical structure and pharmacokinetic profiles. The chemical structure of statins determines their water solubility, which, in turn, affects their absorption, distribution, metabolism, and excretion. The analysis of scientific sources has shown that for the identification and quantification of atorvastatin, rosuvastatin, simvastatin and pitavastatin in substances, monocomponent and combined pharmaceuticals, spectrophotometric methods in the UV and visible spectral range are used, fluorimetry, RP-HPLC-UV, and for the determination in biological fluids, mainly chromatographic methods of analysis are used, in particular, HPLC-MS/MS, LC-MS, HPLC-MS, HPLC-UV. It has been established that the UV spectrum of atorvastatin in methanol solution is characterized by two absorption bands - at 210 nm and 246 nm. The light absorption of atorvastatin in methanolic solutions obeys the Beer-Lambert law in the concentration range from 5 μg/ml to 30 μg/ml. The limit of detection is 4 μg/mL. To isolate atorvastatin from blood plasma, it is proposed to use the SPE method. When using the proposed SPE scheme, up to 79% of the drug can be isolated.

Conclusions. The clinical and pharmacological properties of statins have been studied. The methods of identification and quantitative determination of statins in substances, ready-made medicinal forms and biological fluids available in modern scientific literary sources were analyzed. The conditions for isolation of atorvastatin from plasma by the SPE method on Oasis HLB cartridges are proposed. A technique for the identification and quantitative determination of atorvastatin by UV spectrophotometry was developed, which is suitable for its determination in plasma.

REVIEW OF PROPERTIES AND DEVELOPMENT OF METHODS FOR DETECTING POTENTIALLY HARMFUL COMPONENTS OF WHITENING COSMETICS

Mariia Pavelko
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Keywords: fairness creams, toxicity, hydroquinone, TLC, UV-spectrophotometry.

Introduction. The effectiveness and safety of bleaching agents depends on how deeply the acid penetrates the skin and what chemical agents are used. A number of dermatological complications have been reported from the use of skin lightening creams. Some bleaching creams against age spots contain mercury, due to which the whitening of the face ends in mercury vapor poisoning.

Materials and methods. Methods of literature search, thin-layer chromatography and UV spectrophotometry were used to solve the tasks.

Results. The main side effects of hydroquinone include erythema, contact and allergic dermatitis, depigmentation, ochronosis. Phenol can cause prolonged erythema and hypopigmentation. Glycolic and salicylic acid has an irritating effect, so it should be used with caution on sensitive skin. Resorcinol can cause thyroid dysfunction after long-term exposure. Retinoids, as well as azelaic and kojic acids, can cause skin irritation, erythema, dermatitis, and increased pigmentation. The consequences of mercury poisoning can be serious damage to the psyche, nervous system, kidney function, but pregnant women are in particular danger, as it can lead to fetal development pathology.

The optimal solvent systems for the detection of hydroquinone are n-hexane/acetone (3:2) and benzene-dioxane-acetic acid (85:15:1). Visualization was performed under UV light irradiation and spraying with 0.2% ethanolic dichlorofluorescein or ferric chloride solution. Quantification of hydroquinone was carried out at 290 nm, the graph maintained linearity in the range of 10-40 μg/ml, and the limit of quantification was 7.8 μg/ml.

Conclusions. The peculiarities of the toxic effect of bleaching components on the human body were studied using the Medline, Toxline, and Toxnet databases. Extraction conditions and cleaning methods necessary for conducting physicochemical methods of analysis have been studied. TLC and UV spectrophotometry conditions for detecting potentially dangerous ingredients in whitening creams are proposed.

CHEMICAL AND TOXICOLOGICAL RESEARCH OF ANTIPLATELET AGENTS OF THE THIENOPYRIDINE GROUP

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Scientific supervisor: assist. prof. **N. M. Darmohrai**

Keywords: antiplatelet agents, clopidogrel, thienopyridine, chemical and toxicological analysis, side effects, toxicity, poisonings.

Introduction. Cardiovascular diseases are the leading cause of death in most countries of the world, especially from atherothrombosis and myocardial infarction. Antiplatelet pharmacotherapy is an integral part of the treatment of cardiovascular pathology. Antiplatelet agents of the thienopyridine group occupy a leading role among these drugs, especially clopidogrel. Today, there are known cases of mono- and polyvalent poisonings after the use of clopidogrel, some of them are fatal. Despite this, methods of chemical and toxicological research of clopidogrel have not been developed yet. It is necessary to develop effective isolation methods and sensitive methods of identification and quantitative determination, which are suitable for the purposes of chemical and toxicological analysis in establishing the cause of fatal poisonings and diagnosing of acute intoxication with this drug in combined poisonings.

Materials and methods. Analysis of scientific literature and its interpretation were used. Modern physico-chemical methods for determination of clopidogrel in biological material by thin-layer chromatography and UV-spectrophotometry were used.

Results. Clinical and pharmaceutical approaches to the use of clopidogrel in the pathology of the cardiovascular system have been studied. The physical and chemical properties of clopidogrel, the peculiarities of its pharmacological action, the pathways of its metabolism were studied. Toxic effects, cases of overdose and poisoning by clopidogrel was evaluated. A technique for clopidogrel isolating from liver tissue with acetonitrile has been developed. A technique for clopidogrel isolation from urine has been developed. Conditions for the identification of clopidogrel isolated from biological material using chromogenic reactions and thin-layer chromatography have been researched. Method for the identification and quantification of clopidogrel isolated from biological material using UV-spectrophotometry have been developed.

Conclusions. The toxicological safety of clopidogrel needs to be studied more closely. The development of modern reliable and rapid methods for its determination in samples of biological material is very important for the forensic medicine.

DEVELOPMENT OF METHODS FOR DETERMINING MODAFINIL AND ARMODAFINIL IN BIOLOGICAL FLUIDS

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Keywords: modafinil, toxicity, screening, TLC-chromatography, UV-spectrophotometry.

Introduction. Modafinil and armodafinil are amphetamine analogues used as psychostimulants to promote wakefulness. Both drugs have potential for abuse and addiction and are classified as "non-specific stimulants" by the World Anti-Doping Agency. While modafinil gained popularity as a cognitive enhancer and productivity booster, armodafinil is being studied for the treatment of attention deficit hyperactivity disorder (ADHD), bipolar depression, and fatigue associated with multiple sclerosis and cancer.

Materials and methods. Solid-phase extraction cartridges, gas chromatography system, chemical reagents, silica gel plates, TLC developing chamber, GC-MS instrument.

Results. The methods for the isolation and quantification of modafinil from biological fluids for therapeutic, forensic, and diagnostic purposes were discussed. It was found that a combination of liquid-liquid extraction and solid-phase extraction can be used to extract modafinil and armodafinil from urine samples.

A suggested scheme for the detection of modafinil and armodafinil in biological fluids includes detection by using chemical tests and TLC-screening in ethyl acetate-methanol-water (100:10:10) and ethyl acetate-methanol (9:1). These solvent systems were found to provide good separation of modafinil from other components of the sample, with R_f values in the range of 0.40-0.45.

The UV absorption spectrum of modafinil was characterized by an absorption band in the range of 250-260 nm. The linear regression equation for the calibration curve between concentration and absorbance was found to be $Y = 0.0048 x + 0.0237$ with a correlation coefficient of $R2 = 0.9993$ in the range of 5-30 μg/ml. The LOQ and LOD for modafinil were 1.30 μg/mL and 3.93 μg/mL, respectively.

We also utilized GC/MS method for detecting modafinil in urine samples using an Agilent 6890 N chromatograph with an RTX-5 column from Restek, USA. The mass detector was an Agilent 5978 BMSD with a stationary phase of 5% phenylmethylpolysiloxane, and helium was used as a carrier gas with a mobile phase rate of 1 ml/min. The study used m/z 288, 104, 167, 165, and 152 with a retention time of 7.29 ± 0.07 min as the main signals for identification. Quality control samples were prepared in six replicates at four concentrations 100 ng/mL, 250 ng/mL, 500 ng/mL, and 1000 ng/mL for GC-MS analysis.

Conclusions. In conclusion, the study examined the use and potential risks associated with modafinil and armodafinil. The study also highlighted various methods for extracting and quantifying modafinil and its metabolites in biological fluids, which can aid in the diagnosis of poisoning and forensic investigations. Finally, the study outlined a scheme for detecting modafinil and armodafinil in biological matrices, which could be useful in identifying athletes who use these substances to enhance their performance.

COMPARATIVE EVALUATION OF THE METHODS FOR SPECTROPHOTOMETRIC AND CHROMATOGRAPHIC DETERMINATOIN OF NAFTIFINE IN DOSAGE FORMS.

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Scientific supervisor: assoc. prof. **Iryna Halkevych**, PhD

Keywords: naftifine, fungus, SPE, TLC, UV spectrophotometry.

Introduction: According to the World Health Organization (WHO), about 20% of the world's population is susceptible to fungal infection, and the issue of effective therapy of this infection is becoming more urgent. The increase in the number of fungal diseases is due to both changes in the ecology of the environment and the uncontrolled use of antibacterial drugs, antibiotics, corticosteroids and cytostatics. Among mycoses, fungal diseases of the feet (epidermophythia), nails (onychomycosis), as well as dermatomycoses are most common. For the treatment of fungal infections, drugs that are characterized by a wide spectrum of action are preferred. One of such means is naftifine hydrogenchloride which is effectively applied at fungal lesions caused by various representatives of fungi. In this regard, the development of methods for quality control of dosage forms with naphthyphine is relevant.

Materials and methods: UV spectrophotometry, GC/MS, TLC, solid phase extraction.

Results: The analysis of drugs and substances with naftifine hydrogenchloride, which are available in the domestic pharmaceutical market and are used for local treatment of fungal skin lesions, was carried out. It was established that in dosage forms (skin solutions, sprays, creams and gels) the amount of naftifine hydrogenchloride is determined by UV spectrophotometrically or CLA. The quantitative determination is carried out by comparing the measured parameter with the naftifine hydrogenchloride substance parameter. The GC/MS method for naftifine was not used. The conditions for the identification and quantification of naftifine hydrogenchloride by UV spectrophotometry and GC/MS on the capillary column RTX 5 MS have been developed. The methods of sample preparation for the quantitative determination of naftifine in two skin solutions of different

manufacturers and Exic cream were worked out. It was found that under the conditions of GC/MS analysis, two isomeric forms of naftifine hydrogen chloride (E and Z isomers) can be separated.

Conclusions: Based on the results obtained, it can be concluded that when analyzing solutions of naftifine and cream by UV spectrophotometry and GC/MS, the total content of naftifine hydrogenchloride in 1 ml or 1 g of the dosage form is practically the same. At the same time, using the GC/MS method, it is possible to separate the isomeric forms of this drug and conclude on the effectiveness of this substance used to make the dosage form.

ASSESSMENT OF THE TOXICITY OF ANTITUSSIVE DRUGS

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Keywords: antitussive, toxicity, cough, dextromethorphan, poisonings, toxicological studies, UV-spectrophotometry, TLC.

Introduction: Cough is one of the most common symptoms of various respiratory diseases. Antitussive drugs are used to treat cough, however, like any other drug, antitussive drugs can have side effects and negative effects on a person's health. Dextromethorphan is a modern antitussive drug that is often prescribed for the purpose of pharmacotherapy of various respiratory tract diseases. Under certain conditions, this drug may exhibit toxic properties in overdose or in combination with other drugs or alcohol. Studying the toxicity of antitussive drugs, in particular dextromethorphan, is important when conducting research to establish the cause of poisoning with drugs of this group. In addition, an important aspect in the evaluation of toxicity is taking into account the interaction of the drug with other drugs, which can increase its toxicity or reduce its effectiveness. The development of methods for the isolation, identification and determination of dextromethorphan in biological objects usingmodern physicochemical methods of analysis is an urgent task of clinical toxicology and is necessary for the work of domestic forensic medical examination.

Materials and methods: Analysis of scientific literature, physico-chemical research methods (TLC, UV spectrophotometry) were used.

Results: The general characteristics of antitussive drugs, their classification, mechanism of action and types of cough were studied. The assortment of antitussive drugs on the pharmaceutical market of Ukraine was studied, in particular those containing dextromethorphan. The toxicity of antitussive drugs and the toxicity of drug interactions wereanalyzed. It has been established that the toxicity of antitussive drugs depends on the dose, duration of therapy, and characteristics of the patient’s body. A toxicological study of

dextromethorphan was carried out, including methods of isolation, determination and identification of dextromethorphan in biological materials. The method of identification of dextromethorphan by UV spectrophotometry and the conditions of identification of dextromethorphan using color reactions have been developed.

Conclusions: The results of the study can be used for scientific studies of dextromethorphan, extracted from biological objects.

TOXICOLOGICAL CHARACTERISTICS AND CHEMICO-TOXICOLOGICAL ANALYSIS OF GIDAZEPAM

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Scientific supervisor: sen. lec. **Serhiy Kramarenko**, PhD.

Keywords: Gidazepam, benzodiazepine derivative, chemical analysis, intoxycations, isolation, extraction, thin layer chromatography, spectrophotometry.

Introduction. Gidazepam is a drug which is an atypical benzodiazepine derivative. It is a selectively anxiolytic benzodiazepine. It also has therapeutic value in the management of certain cardiovascular disorders. Gidazepam is used as an antianxiety drug. Its anxiolytic effects can take several hours to manifest after dosing however, as it is the active metabolite which primarily gives the anxiolytic effects, and Gidazepam's half-life is among the longest of all GABA-ergic agonists. Takin this into consideration, chemico-toxicological investigation of Gidazepam is actual problem.

Materials and methods. Research object is Gidazepam and biological samples poisoned this drug. Research subject: element of chemical development of Gidazepam for identification, quatification and isolation of this substance. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The UV-spectrophometry and thin layer chromatography methods were developed for identification of Gidazepam in pharmaceutical formulations and samples from biological liquids. The spectrum of Gidazepam in acid solution is characterised by three absorbtion maximums at wavelengthes 237, 273 and 360 nm. Four eluent system, which recommended for systematic analysis in forensic toxicology, for determination of Gidazepam in biological samples: chloroform-acetone (4:1), ethyl acetate, chloroform-methanol (9:1) and ethyl acetate-methanol-25% solution of ammonia (17:2:1) were used. Determination was developing on “Sorbfil” plates. Gidazepam identification can be achieved with such reagents: Marquis, Dragendorf, Mandelin, potassium permanganate in 0.1 M sulfate acid and 1% ninhydrine solution. The visible spectrophotometric method was used for Gidazepam quantification. Limit of

Gidazepam detection is 50 μg/ml. Linearity of calibration curve is in concentration range 50-400 μg/ml. The proposed method was successfully applied to biological samples for Gidazepam analysis. Relation between pH and Gidazepam extraction amount was investigated. This substance was extracted in high quantities from alkaly solutions. The WHO recommended techniques were used for Gidazepam isolation from blood and urea samples.

Conclusions. The techniques for identification, quatification and isolation of Gidazepam were developed and demonstrated good results for Gidazepam determination in biological samples.

TOXICOLOGICAL PROPERTIES OF THE TRIPTAN DRUG CLASS AND COMPARATIVE EVALUATION OF METHODS FOR THEIR DETERMINATION IN BIOLOGICAL FLUIDS

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Keywords: triptans, toxic effect, plasma, blood, urine, fluorimetry, HPLC/MS, HPLC/UV, UHPLC/MS/MS, LC-MS/MS.

Introduction. Triptans are currently the first-line emergency therapy for patients experiencing moderate to severe migraine attacks. Clinical trials have shown that they are generally well-tolerated. However, there are contraindications for their simultaneous use with drugs from certain pharmacological groups, and non-compliance with these precautions can pose risks to the patient's health. Additionally, cases of suicide and fatal overdose have been reported with triptan use. Therefore, there is an urgent need to study the toxic effects of triptans, compare methods for their detection in biological fluids, and develop suitable isolation methods for chemical and toxicological analysis.

Materials and methods: The study involves conducting a literature search, analyzing and interpreting the collected information on the toxicity of triptans, as well as the methods used for their detection in biological fluids. Solid phase extraction (SPE) and fluorimetry techniques were used for the isolation and identification of sumatriptan in blood.

Results. The mechanism of action, pharmacokinetics, and metabolism of triptans have been extensively studied. It has been established that a general contraindication for all triptans is their simultaneous use with derivatives of ergots, monoamine oxidase inhibitors, and selective serotonin reuptake inhibitors due to possible interactions. To determine triptans in biological fluids, liquid extraction is the most commonly used isolation method for plasma and urine samples, with quantitative determination, performed using chromatographic analysis. For the identification and quantitative determination

of sumatriptan, a fluorescence spectroscopy method was developed, which measures the fluorescence intensity of sumatriptan solutions at лех/лем = 290 nm / 350 nm. Grading graphs for the quantitative determination of sumatriptan in methanol acidified with 0.05 M H_2SO_4 (9:1) demonstrate linearity in the range of 0.1 - 3.0 мg/ml with a relative error of quantification of 1.54 %. Furthermore, we propose optimal conditions for isolating sumatriptan from blood using the SPE method and Oasis HLB cartridges (30 mg), under which 48-50 % of the drug can be isolated.

Conclusions. The toxic effects and contraindications of triptans, which can have negative consequences for patient health, have been extensively studied. This study provides a comparative assessment of the various methods for isolating, identifying, and quantitatively determining triptans in biological fluids, as documented in scientific sources. We proposed optimal conditions for isolating sumatriptan from blood using the SPE method. Furthermore, we developed a technique for the identification and quantitative determination of sumatriptan using the fluorimetric method. This method is suitable for accurately detecting and measuring sumatriptan in blood samples during chemical and toxicological analyses.

TOXICOLOGICAL ASSESSMENT OF MODERN ANTIHISTAMINES AND METHODS OF THEIR CHEMICAL AND TOXICOLOGICAL ANALYSIS

Tetiana Yatsenko
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Introduction. Allergies are nowadays called a disease of civilization. According to the World Health Organization (WHO), allergy ranks third among other nosologies in terms of incidence. According to statistics, 20 to 40 % of the world's population, i.e. at least one in five people, suffer from various forms of allergic diseases. The number of patients with allergic diseases doubles every ten years.

According to official data, about 1.5% of the population in Ukraine is diagnosed with allergies. However, the real figures are much higher - up to 25% (about 10 million people). Currently, the prevalence of various forms of allergic diseases is reaching pandemic proportions. Therefore, there is widespread use of anti-allergic drugs, which creates preconditions for cases of their irrational use. As a result, the frequency and severity of side effects caused by anti-allergic drugs is increasing, which in some cases can lead to death.

Materials and methods. Methods of scientific cognition and generalization, physical and chemical methods of analysis (TLC, HPLC); methods of precipitation and concentration (liquid and solid-phase extraction)

Results. It has been established that cetirizine can be identified by HPLC on a Prontosil 120-5-C18 AQ column in the mobile phase methanol - 0.1% trifluoroacetic acid solution in a mixture with diphenhydramine and promethazine. For the quantitative determination of cetirizine, the limits of linearity of the calibration graph in the concentration range of 400-1400 ng/ml were established. The developed method for the quantitative determination of cetirizine in solutions is correct, the accuracy does not exceed 3.29 % and this method can be used for the quantitative determination of cetirizine in biological fluids in forensic chemical research.

Conclusions. The paper describes the main classifications of antihistamines, their toxicity in case of overdose and concomitant use with drugs of other pharmacotherapeutic groups. It has been established that antihistamines, which also have a cholinergic effect, are characterized by the highest toxicity. The most frequent fatal poisoning cases are caused by diphenhydramine, promethazine and cyclizine (first-generation drugs) and cetirizine and loratidine (second-generation drugs). For the preliminary screening of cetirizine in a mixture with diphenhydramine (Dimedrol) and promethazine (Pipolfen), solvent systems can be used that allow the separation of organic compounds with acidic and basic properties: methanol-25% ammonia solution (100:1.5); cyclohexane-toluene-diethylamine (75:15:10); chloroform-methanol (90:10); chloroform-acetone (4:1); ethyl acetate-methanol-25% ammonia. A scheme of two-stage purification of urine samples for the quantitative determination of cetirizine by HPLC was developed. Using liquid and solid-phase extraction, the degree of isolation of cetirizine from urine is 77-79 %.

REVIEW OF METHODS FOR DETECTION AND QUANTIFICATION OF NEW SYNTHETIC OPIOIDS IN BIOLOGICAL MATERIAL

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Keywords: forensic toxicology; new synthetic opioids; biological samples; toxicity; analysis.

Introduction. Synthetic opioids that are increasingly being abused and responsible for a growing number of overdose deaths. Therefore, the accurate determination of these compounds in biological samples is critical for forensic and clinical purposes.

Materials and methods. A bibliographic search was performed on the PubMed database using the following key words: "new synthetic opioid", "newest synthetic opioid", "new psychoactive substances" in combination with logical operators, as well as NSO names. In addition, official reports published

by the Centers for Disease Control and Prevention, the Drug Enforcement Administration, the United Nations Office on Drugs and Crime, the European Monitoring Center on Drugs and Addiction (EMCDDA), and the World Health Service were examined. Only articles written in English were considered.

Results. Fentanyl derivatives exhibit high solubility in organic solvents and their potency can be attributed to the ability of the non-ionized, lipid-soluble portion in the bloodstream to easily cross the blood-brain barrier. Classical sample pretreatment methods used for the determination of HCO in biological samples include protein precipitation with acetonitrile, dilution, liquid-liquid extraction, solid-phase extraction, and the QuEChERS method.

In fatal overdose cases, the concentration of fentanyl in blood and urine is typically between 3.0 and 4.0 ng/mL. Enzyme immunoassays typically have a cutoff of 0.5 ng/mL for fentanyl, while the toxicological effects of fentanyl analogs can be observed at blood concentrations of up to 0.1 ng/mL. Although native NSOs can be readily detected using GC-MS, their dealkylated and deacetylated metabolites, such as norfentanil and despropionylfentanil, require derivatization using reagents like acetic anhydride, heptafluorobutyric anhydride, or pentafluoropropionic anhydride (PFPA). The limit of detection for these methods is approximately 0.1 ng/mL for urine, serum, or blood samples.

UPLC/MS/MS can be used to analyze NSOs, including fentanyl derivatives and their nor-metabolites, with a total runtime of 4.0 minutes. Separation can be achieved using an silica column, with a 5 μL sample injection and a mobile phase consisting of 10 mM ammonium formate and 0.1% formic acid in a mixture of water and methanol. The gradient feeding mode of the mobile phase is recommended with the flow rate 0.6 mL/min.

Conclusions. Approaches and recent trends available in laboratories for detection and determination of new synthetic opioids in biological samples are reviewed. The general scheme of biological material screening includes an immunoassay for opiates, and in the case of a positive result, NSO extraction by the LE or SPE method and subsequent UHPLC-MS/MS.

We have systematized methods for quantitative determination of analogs and metabolites of fentanyl in whole blood, urine, and human hair for clinical and forensic use. The proposed scheme allows to automate and quickly test biological samples for the purpose of diagnosing NSO poisoning.

CHEMICO-TOXICOLOGICAL ANALYSIS OF CYCLODOL (TRIHEXYPHENIDYL).

Viktoriia Kaliuzhniak
Scientific supervisor: sen. lec. **Serhiy Kramarenko**, PhD.

Keywords: Trihexyphenidyl, alpha-2 adrenergic agonist medicines, chemical analysis, intoxycations, isolation, extraction, thin layer chromatography, spectrophotometry.

Introduction. Trihexyphenidyl works as an anticholinergic and is used for the treatment of tremors, spasms, stiffness, and weak muscle control seen in patients with Parkinson disease.. A lot of reports can be found in the literature about lethal intoxications with Trihexyphenidyl, with combined intoxications, Trihexyphenidyl misuse and suicide poisoning.

Takin this into consideration, chemico-toxicological investigation of Trihexyphenidyl is actual problem.

Materials and methods. Research object is Trihexyphenidyl and biological samples poisoned this drug. Research subject: element of chemical development of Trihexyphenidyl for identification, quatification and isolation of this substance. Methods: literature monitoring, physical, physical-chemical, and mathematical.

Results. The UV-spectrophometry and thin layer chromatography methods were developed for identification of Trihexyphenidyl in pharmaceutical formulations and samples from biological liquids.

The spectrum of Trihexyphenidyl in acid solution is characterised characterised by lack of maximum absorption.

Four eluent system, which recommended for systematic analysis in forensic toxicology, for determination of Trihexyphenidyl in biological samples: chloroform-acetone (4:1), ethyl acetate, chloroform-methanol (9:1) and ethyl acetate-methanol-25% solution of ammonia (17:2:1) were used. Determination was developing on “Sorbfil” plates. Trihexyphenidyl identification can be achieved with such reagents: 5% ningidrine solution in 10% acetate acid, Dragendorf and Bushard reagents.

The spectrophotometric method was used for Trihexyphenidyl quantification. It based on reaction between Trihexyphenidyl and 2% ninhydrine. Limit of Trihexyphenidyl detection is 5 μg/ml. Linearity of calibration curve is in concentration range 5-40 μg/ml. The proposed method was successfully applied to biological samples for Trihexyphenidyl analysis.

Relation between pH and Trihexyphenidyl extraction amount was investigated. This substance was extracted in high quantities from light base solutions with pH 8.0-8.5.

The WHO recommended techniques were used for Trihexyphenidyl isolation from blood and urea samples.

Conclusions. The techniques for identification, quatification and isolation of Trihexyphenidyl were developed and demonstrated good results for Trihexyphenidyl determination in biological samples.

GENERAL CHARACTERISTICS AND TOXICITY ASSESSMENT OF DRUGS FOR THE TREATMENT OF ACNE

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Keywords: medicines for the treatment of acne, toxicity, UV spectrophotometry, blood.

Introduction: The use of acne drugs is popular among young people, and many over-the-counter local remedies can be purchased without a prescription. Patients often self-treat milder forms of acne, sometimes using multiple drugs simultaneously without considering potential interactions. Therefore, assessing the toxicity of these drugs is important. Isotretinoin, a systemic retinoid, can cause serious neuropsychiatric side effects, including depression, suicide, mania, mood swings, and aggression, making it crucial to determine its presence and quantity in the blood.

Materials and Methods: A literary search was conducted to collect information on acne medicines. UV spectrophotometry was used to isolate and identify isotretinoin from blood samples.

Results: The pharmacological properties, mechanism of action, and side effects of active pharmaceutical ingredients (APIs) that are part of topical acne treatment drugs were studied, including sulfur, trithenoin, adapalene, benzoyl peroxide, clindamycin, erythromycin, zinc hyaluronate, azelaic acid, and systemic retinoid isotretinoin.

It has been established that topical acne treatments have a favorable safety profile. The most commonly reported side effects are local skin irritations, which are usually mild to moderate in intensity and occur early in treatment. These side effects rarely lead to discontinuation of therapy.

However, the systemic retinoid isotretinoin can cause neuropsychiatric disorders, including suicidality, mania, aggression, and psychosis. Some of these effects can persist after discontinuation of the drug and sometimes last for 2 to 18 months after treatment.

During pregnancy, the topical retinoid tretinoin cannot be used, as there are cases of birth defects when using the drug in the first trimester. The systemic retinoid isotretinoin is a strong human teratogen and is contraindicated for all women of reproductive age who do not follow the "Pregnancy Prevention Program."

A method for identifying and quantifying isotretinoin using UV spectrophotometry was developed. It was established that the UV spectrum of isotretinoin in methanol is characterized by an absorption maximum at 345 nm. The light absorption of isotretinoin in methanolic solutions follows the Bouguer-Lambert-Beer law in the concentration range of 1 мg/ml to 8 мg/ml. The detection limit is 0.5 мg/ml.

Isolation of isotretinoin from blood was carried out using a mixture of acetonitrile with 70% perchloric acid (10:1) as an extractant and hexane (pH=4). When using the developed technique, up to 79% of the drug can be isolated.

Conclusions: The toxicity of acne drugs, particularly isotretinoin, was evaluated based on their pharmacological properties, mechanism of action, and side effects. The UV spectrophotometry method developed for the quantitative determination of isotretinoin in the blood is suitable for clinical laboratory tests and forensic toxicological analysis.

AUTHOR INDEX

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