

ABSTRACT&REFERENCES

DOI: 10.15587/2519-4852.2019.177612

STUDY OF THE ANTIULCER ACTIVITY OF DRY EXTRACT OF GARDEN CABBAGE ON A MODEL OF SUBCHRONIC GASTRIC ULCER

p. 4-9

Mirzachan Mirzaliyev, Postgraduate Student, Department of Pathological Physiology, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: patology@nuph.edu.ua

Nadiia Kononenko, MD, Professor, Head of Department, Department of Pathological Physiology, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: kononenkonn76@gmail.com

ORCID: <http://orcid.org/0000-0002-3850-6942>

Valentina Chikitkina, PhD, Associate Professor, Department of Pathological Physiology, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: valentina.chikitkina@gmail.com

ORCID: <http://orcid.org/0000-0002-8277-0388>

Aim – to study the gastroprotective properties of dry cabbage garden extract on the model of experimental lesions of the gastric mucosa with acetylsalicylic acid.

Materials and methods. Subchronic ulcerative lesions of the gastric mucosa of rats were simulated by intragastric administration of acetylsalicylic acid at a dose of 150 mg/kg for 3 days. Dry cabbage extract in a conditional therapeutic dose of 50 mg/kg and the comparison drugs omeprazole and altan were administered daily during the reproduction of the pathology and for another 2 days. The percentage of animals with ulcers in the group, the condition of the gastric mucosa were evaluated, the ulcer index and anti-ulcer activity were calculated. Histologically, the capacity of mucoid secretion by mucus-forming cells of the pathogenic epithelium outside the destruction zones by the severity of the PAS-reaction was investigated.

Results. It was established that the dry extract of cabbage at a dose of 50 mg/kg leveled the ulcerogenic effect of acetylsalicylic acid at the level of omeprazole, which was reflected by a decrease in the ulcer index by 3,3 times, its antiulcer activity was 83 %. The maximum anti-ulcer effect was shown by the combination of dry cabbage extract with omeprazole, which significantly reduced the risk of developing damage to the gastric mucosa, ulcer index exceeded monotherapy with dry cabbage extract, omeprazole and altan, anti-ulcer activity was at the level of 94 %. The cabbage extract stabilized the processes of mucoid synthesis; when combined with omeprazole, the PAS-intensity of the gastric superficial-foveolar epithelium of the mucous membrane did not differ from the intact control in all the studied areas. The obtained data allow us to consider the dry extract of garden cabbage as a gastroprotector of acetylsalicylic ulcerogenesis.

Conclusions. On the model of rats' gastric lesion with acetylsalicylic acid, a dry cabbage extract showed an anti-ul-

cer effect, by the severity of which it was not inferior to the comparator drug with the proton pump inhibitor omeprazole and significantly exceeded the phytopreparation of altan tablets. The combined use of cabbage extract and omeprazole showed a high prophylactic effect on the negative effect of nonsteroidal anti-inflammatory drugs on the gastric mucosa. One of the mechanisms of the gastroprotective effect of dry cabbage extract is its ability to enhance the formation of mucus by the cells of the integumentary-patchy epithelium of the stomach. The results indicate the promise of further research on the anti-ulcer properties of dry cabbage extract for the purpose of its use in the treatment of peptic ulcer disease and the prevention of gastropathy caused by nonsteroidal anti-inflammatory drugs.

Keywords: peptic ulcer, acetylsalicylic ulcer, dry cabbage extract, anti-ulcer activity

References

1. Kharchenko, N. V., Babak, O. Ya. (Eds.) (2017). *Hastroenterolohiia*. Vol. 2. Kirovohrad: Polium, 432.
2. Borovkova, N. Iu., Buianova, M. V., Bakka, T. E., Borovkov, N. N., Ivanchenko, E. Iu. (2018). Porazheniia zheludochno-kishechnogo trakta pri dlitelnom prieme acetylsalicylovoi kisloty u bolnykh so stabilnoi ishemicheskoi boleznii serdca i vozmozhnosti ikh korrektsii. *Kardiologiia Terapiia*, 8 (152), 25–29.
3. Svitsitskiy, A. S. (2010). NPZP-hastropatii: suchasnyi stan problemy. *Krymskiy terapevtichnyi zhurnal*, 2 (2), 280–286.
4. Khimion, L. V., Yashchenko, O. B., Danyliuk, S. V., Sytiuk, T. O. (2018). Suchasni pidkhody do diahnostyky ta vedennia khvorykh na vyrazkovu khvorobu shlunka ta dvadnatsiatypaloi kyshky na pervynnomu rivni medychnoi dopomohy. *Semeinaia medytsyna*, 1 (75), 6–11.
5. Hladkykh, F. V., Stepaniuk, N. H. (2014). Suchasni pidkhody do poslablennia ultserohennosti nesteroidnykh protyzapalnykh zasobiv: dosiahnennia, nevyrisheni pytannia ta shliakhy optymizatsii. *Zaporozhskiy medytsynskiy zhurnal*, 2 (83), 82–86.
6. Bi, W., Hu, L., Man, M.-Q. (2017). Anti-Ulcerogenic Efficacy and Mechanisms of Edible and Natural Ingredients in Nsaid-Induced Animal Models. *African Journal of Traditional, Complementary and Alternative Medicines*, 14 (4), 221–238. doi: <http://doi.org/10.21010/ajtcam.v14i4.25>
7. Bi, W., Man, H., Man, M. (2014). Efficacy and safety of herbal medicines in treating gastric ulcer: A review. *World Journal of Gastroenterology*, 20 (45), 17020–17028. doi: <http://doi.org/10.3748/wjg.v20.i45.17020>
8. Morales-López, J., Centeno-Álvarez, M., Nieto-Camacho, A., López, M. G., Pérez-Hernández, E., Pérez-Hernández, N., Fernández-Martínez, E. (2016). Evaluation of antioxidant and hepatoprotective effects of white cabbage essential oil. *Pharmaceutical Biology*, 55 (1), 233–241. doi: <http://doi.org/10.1080/13880209.2016.1258424>
9. Kim, H., Lee, Y., Kim, S., Yang, B., Lim, C., Kim, J.-H., Cho, S. (2018). Anti-inflammatory effects of Brassica oleracea Var. capitata L. (Cabbage) methanol extract

in mice with contact dermatitis. *Pharmacognosy Magazine*, 14 (54), 174–179. doi: http://doi.org/10.4103/pm.pm_152_17

10. Lemos, M., Santin, J. R., Júnior, L. C. K., Nie-ro, R., Andrade, S. F. de. (2011). Gastroprotective activity of hydroalcoholic extract obtained from the leaves of *Bras-sica oleracea* var. *acephala* DC in different animal mod-els. *Journal of Ethnopharmacology*, 138 (2), 503–507. doi: <http://doi.org/10.1016/j.jep.2011.09.046>

11. Kononenko, N. M., Mirzaliiev, M. T. (2018). Eksperymentalne vyvchennia protyvyrazkovoï aktivnosti ekstraktu kapusty horodnoi na modeli spyrtovo-prednizolo-novoi vyrazky shlunka v shchuriv. *Advances of science. Kar-lovy Vary, Kyiv*, 1693–1696.

12. Kononenko, N. M., Mirzaliiev, M. T., Ostapets, M. O. (2018). The effect of the *Brassica oleracea* extract on the structural components of mucous cells of the stomach in its ulcerative damage. *News of Pharmacy*, 1 (93), 54–57. doi: <http://doi.org/10.24959/nphj.18.2201>

13. Yakovlieva, L. V., Obolentseva, H. V., Briuzghi-nova, L. P.; Stefanov, O. V. (Ed.) (2001). Eksperymentalne vyvchennia novykh protyvyrazkovykh preparativ. *Dok-linichni doslidzhennia likarskykh zasobiv*. Kyiv: Avitsen-na, 321–333.

14. Rybolovlev, Iu. R., Rybolovlev, R. S. (1979). Dozirovanie veschestv dlia mlekopitaiuschikh po konstan-tam biologicheskoi aktivnosti. *Doklady AN SSSR*, 247 (6), 1513–1516.

15. Merkulov, G. A. (1969). *Kurs patologogistolog-icheskoi tekhniki*. Moscow: Medicina, Leningr. otd-nie, 424.

16. Pirs, E. (1962). *Gistokhimiia teoreticheskaiia i prikladnaia*. Moscow: Izd-vo inostran. lit., 962.

17. Salimov, R. M. (2000). Osnovnye metody statis-ticheskoi obrabotki rezultatov farmakologicheskikh eksper-imentov. *Rukovodstvo po eksperimentalnomu (dokliniches-komu) izucheniiu novykh farmakologicheskikh veschestv*. Moscow: Remedium, 349–454.

18. Rebrova, O. Iu. (2006). *Statisticheskii analiz medicinskikh dannykh. Primenenie paketa prikladnykh pro-gramm STATISTICA*. Moscow: MediaSfera, 312.

19. Moskal, O. M., Lohai, I. V., Turok, Yu. Yu. et. al. (2019). Osoblyvosti proiaviv, likuvannia ta profilaktyky NPZP – indukovanoi hastroduodenopatii u khvorykh vid-dilen riznoho profilii. *Visnyk Kharkivskoho natsionalno-ho universytetu imeni V. N. Karazina. Seriiia «Medytsyna»*, 37, 41–47.

20. Cavallini, M. E., Andreollo, N. A., Metze, K., Araújo, M. R. (2006). Omeprazole and misoprostol for pre-venting gastric mucosa effects caused by indomethacin and celecoxib in rats. *Acta Cirurgica Brasileira*, 21 (3), 168–176. doi: <http://doi.org/10.1590/s0102-86502006000300009>

21. Kim, J. H., Park, S.-H., Cho, C.-S., Lee, S. T., Yoo, W.-H., Kim, S. K. et. al. (2014). Preventive Efficacy and Safety of Rebamipide in Nonsteroidal Anti-Inflamma-tory Drug-Induced Mucosal Toxicity. *Gut and Liver*, 8 (4), 371–379. doi: <http://doi.org/10.5009/gnl.2014.8.4.371>

22. Pittayanon, R., Martel, M., Barkun, A. (2018). Role of mucoprotective agents in endoscopic submucosal dissection-derived ulcers: A systematic review. *Journal of Gastroenterology and Hepatology*, 33 (12), 1948–1955. doi: <http://doi.org/10.1111/jgh.14305>

23. Sharaeva, E. N. (2006). Morfofunkcionalnoe sostoianie zheludka belykh krysh pri eksperimentalnykh iaz-vakh. *Ulan-Ude*, 26.

DOI: 10.15587/2519-4852.2019.177193

ANALYSIS OF THE DYNAMICS OF EXPENDITURES ON PHARMACEUTICAL SUPPORT OF POPULATION IN UKRAINE, BELARUS REPUBLIC AND IN EUROPEAN UNION

p. 10-14

Lyubov Tereshchenko, PhD, Associate Professor, Depart-ment of Social Pharmacy, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: lyubov.ter2017@gmail.com

ORCID: <http://orcid.org/0000-0001-6066-1925>

Irina Zhirova, PhD, Associate Professor, Department of So-cial Pharmacy, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: irina.v.zhirova@gmail.com

ORCID: <http://orcid.org/0000-0002-7770-6808>

Aim: comparative analysis the dynamics of changes in the indices of expenditures (%) on pharmaceutical provision of population from total health expenditure at the macroeco-nomic level in Ukraine, the Republic of Belarus (RB) and the countries of the European Union (EU).

Materials and methods. The studies used data from the World Health Organization and its Regional Office for Eu-rope, as well as data from the legislative and regulatory framework regulating medical and pharmaceutical activities in Ukraine, the Republic of Belarus and the EU. Historical, analytical-comparative, systemic, logical, graphic, mathe-matical-statistical methods of scientific search and knowl-edge were used.

Results. It has been established that in the group of reference countries, the expenditures indicator (%) for the pharmaceu-tical provision of the population from the total spending on health during the period of 1990–2015 fluctuated in a wide range of values. The largest range of values was typical for Belarus (from 3.2 % in 1992 to 29.8 % in 2015), and the smallest for the EU countries (from 16.7 % in 2011 to 18.8 % according to 2003 data). Analyzing the dynamics of changes in this indicator, it was established that there was a tenden-cy towards its decline across the EU and Ukraine, while in Belarus, on the contrary, it was increasing. Thus, in 2015, this indicator increased by 2.5 times, compared with the base data in the 1990 analysis. By the average value in order of magnitude of the indicator that was analyzed, the reference countries were located as follows: Ukraine (10.82 %); RB (14.87 %); EU countries (17.88 %).

Conclusions. A significant fluctuation in the values of ex-penditures (%) allocated for pharmaceutical provision of the population in total health expenditures in the group of countries that were studied was established. In addition, the unstable nature of changes in the indicator that was ana-

lyzed in Belarus indicates the need for further research in this direction

Keywords: health care; health care spending; spending for pharmaceutical provision of population; the system of pharmaceutical provision of the population; pharmaceutical aid

References

1. U prohrami «Dostupni liky» bere uchast blyzko 3 tys. aptek – Derzhkaznacheistvo (2019). Apteka, 2 (1173). Available at: <https://www.apteka.ua/article/486357>
2. Nalichnye vyplaty semei na zdravookhranenie, v % ot obschikh zatrat na zdravookhranenie. VOZ. Evropeiskoe regionalnoe biuro. Available at: https://gateway.euro.who.int/ru/indicators/hfa_584-6860-private-households-out-of-pocket-payments-on-health-as-of-total-health-expenditure/visualizations/#id=19679
3. Orhanizatsiia ekonomichnogo spivrobitnytstva ta rozvytku (OESR). Ministerstvo infrastruktury Ukrainy. Available at: <https://mtu.gov.ua/content/organizaciya-ekonomichnogo-spivrobitnictva-ta-rozvytku-oesr.html>
4. Podpruzhnikov, Iu. V., Ishmukhametov, A. A., Nemchenko, A. S. et. al.; Ishmukhametov, A. A. (Ed.) (2015). Khrestomatiia farmacevticheskogo kachestva. Moscow: OOO «Gruppa Remedium», 432.
5. Pharmacy workforce predicted to grow year on year in new report (2018). Press FIP – International Pharmaceutical Federation. Available at: <https://www.fip.org/press-releases?press=item&press-item=42>
6. Pharmacy Workforce Intelligence: Global Trends Report (2018). International Pharmaceutical Federation (FIP). Available at: https://fip.org/files/fip/PharmacyEducation/Workforce_Report_2018.pdf
7. Fedina, E. A. (2015). Farmaceuticheskaia pomoshch kak aktualnoe nauchno-prakticheskoe napravlenie farmacii. Innovacionnaia nauka, 12 (2), 303–305.
8. Fidler, A., Msisha, W. (2008). Governance in the pharmaceutical sector. Eurohealth, 14 (1), 25–29. Available at: <http://www.lse.ac.uk/LSEHealthAndSocialCare/pdf/eurohealth/VOL14No1/FidlerMsisha.pdf>
9. Thompson, D. F. (2009). The Challenge of Conflict of Interest in Medicine. Zeitschrift Für Evidenz, Fortbildung Und Qualität Im Gesundheitswesen, 103 (3), 136–140. doi: <http://doi.org/10.1016/j.zefq.2009.02.021>
10. Assessment of patient payment policies and projection of their efficiency, equity and quality effects: the case of Central and Eastern Europe (2007). ASSPRO CEE 2007. European Commission. Available at: <https://cordis.europa.eu/project/rcn/88429/factsheet/en> Last accessed: 01.01.2018
11. Sommersguter-Reichmann, M., Wild, C., Stepan, A., Reichmann, G., Fried, A. (2018). Individual and Institutional Corruption in European and US Healthcare: Overview and Link of Various Corruption Typologies. Applied Health Economics and Health Policy, 16 (3), 289–302. doi: <http://doi.org/10.1007/s40258-018-0386-6>
12. Gagnon, M.-A. (2013). Corruption of Pharmaceutical Markets: Addressing the Misalignment of Financial Incentives and Public Health. The Journal of Law, Medicine & Ethics, 41 (3), 571–580. doi: <http://doi.org/10.1111/jlme.12066>
13. Evaluation of the Good Governance for Medicines programme (2004–2012): brief summary of findings (2013). World Health Organization. Available at: http://www.who.int/medicines/areas/policy/goodgovernance/1426EMP_GoodGovernanceMedicinesreport.pdf?ua=1
14. Lui, E., Ha, R., Truong, C. (2017). Applying the pharmaceutical care model to assess pharmacist services in a primary care setting. Canadian Pharmacists Journal / Revue Des Pharmaciens Du Canada, 150 (2), 90–93. doi: <http://doi.org/10.1177/1715163517690538>
15. O registracii cen na LS (2018). Ukaz Prezidenta RB No. 345. 22.08 2018. Available at: <http://president.gov.by/uploads/documents/2018/345uk.pdf>

DOI: 10.15587/2519-4852.2019.178131

SOCIOMETRY AS A METHOD FOR ASSESSING THE SOCIO-PSYCHOLOGICAL CLIMATE IN PHARMACIES

p. 15-21

Natalia Andrienko, Postgraduate Student, Department Processes and Apparatuses of Chemical and Pharmaceutical Industries, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: paft@nuph.edu.ua

Rita Sahaidak-Nikitiuk, Doctor of Pharmaceutical Sciences, Head of Department, Department of Processes and Apparatuses of Chemical and Pharmaceutical Industries, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: sahaidak_rita@ukr.net

ORCID: <http://orcid.org/0000-0002-9337-7741>

Natalia Demchenko, PhD, Associate Professor, Department of Management and Administration, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: demchenata@ukr.net

ORCID: <http://orcid.org/0000-0001-5915-0087>

Natalia Alekhina, PhD, Associate Professor, Department of Pedagogy and Psychology, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: alexinanata76@gmail.com

Aim. The aim of the study is to adapt the sociometric method of assessment of socio-psychological climate in the pharmacy due to questionnaire design, the construction of sociometric matrix and development of sociogram.

Materials and methods. The study used methods of generalization, analysis and synthesis, content analysis. A sociological survey was used to determine the level of the socio-psychological climate in a pharmacy institution. The survey involved all team members who work in an institution. The study covered all regions of Ukraine. The total number of pharmacies that participated in the sociological survey is 92 pharmacies. There were 51 valid questionnaires. Some pharmacy experts chose incorrect answers – “I choose everyone”

or “with everyone”. Such answers are explained by the indifference and amorphousness of the relationships within the team or by providing deliberately incorrect answers.

Results. Theoretical bases of estimation of social-psychological climate are investigated. The relevance of the study of interpersonal relationships and conflict situations that have developed in the team is substantiated. The expediency of using the sociometric method for estimating the socio-psychological climate in the pharmacy institution has been proved. An algorithm for conducting a sociometric study in a pharmacy institution is proposed. A sociometric card has been developed that can be used to evaluate the socio-psychological climate of a pharmacy institution. The form of the final socio-matrix and the target sociogram are given. It is suggested to determine the magnitude of sociometric status and emotional expansiveness of pharmacy specialists.

Conclusions. The study allowed to conclude that it is advisable to use sociometric method adapted to the conditions of pharmacy to evaluate the socio-psychological climate in the pharmacy

Keywords: socio-psychological climate, pharmacy, sociometry, evaluation, pharmacy specialist

References

1. Popov, D. G. (2009). Moral-psychological status of officials and social-psychological climate of work collective. *Legal psychology*, 4, 26–29.
2. Aikins, J. W., Litwack, S. D. (2011). *Prosocial skills, social competence, and Popularity*. New York: The Guilford Press, 356.
3. Aronson, E., Wilson, T. D., Akert, R. (2014). *Sozialpsychologie*. Hallbergmoos: Pearson, 201.
4. Bossaert, G., Colpin, H., Pijl, S. J., Petry, K. (2013). Truly included? A literature study focusing on the social dimension of inclusion in education. *International Journal of Inclusive Education*, 17 (1), 60–79. doi: <http://doi.org/10.1080/13603116.2011.580464>
5. Berkowitz, L. (2008). On the consideration of automatic as well as controlled psychological processes in aggression. *Aggressive Behavior*, 34 (2), 117–129. doi: <http://doi.org/10.1002/ab.20244>
6. Scott, J. (2013). *Social Network Analysis*. Los Angeles, 51.
7. Cillessen, A. H. N. (2011). *Toward a Theory of Popularity*. New York: The Guilford Press, 426.
8. Cillessen, A. H. N., Marks, P. E. L. (2011). *Conceptualizing and Measuring Popularity*. New York, London: The Guilford Press, 183.
9. Schwartz, D., Gorman, A. H., Nakamoto, J., McKay, T. (2006). Popularity, social acceptance, and aggression in adolescent peer groups: Links with academic performance and school attendance. *Developmental Psychology*, 42 (6), 1116–1127. doi: <http://doi.org/10.1037/0012-1649.42.6.1116>
10. Dollase, R. (2013). *Soziometrie – Anfänge, historische Entwicklung und Aktualität*. Soziometrie. München: Springer VS, 15–29. doi: http://doi.org/10.1007/978-3-531-18981-9_1
11. Tolochko, V. M., Mishchenko, I. V., Artiukh, T. O. (2015). *Orhanizatsiino-psykholohichni aspekty upravlinnia robochoiu hrupoiu*. Kharkiv: NFAU, 28.

12. Maklakov, A. G. (2009). *Obschaia psikhologiya*. Saint Petersburg: Piter, 482.

13. Vasilchenko, O. P. (2011). *Socialno-psikhologicheskii klimat – diagnostika i formirovanie*. Spravochnik kadrovika, 8, 8–9.

14. Popova, G. V., Bogdan, Zh. B. (2014). *Sociometricheskoe issledovanie dinamicheskikh processov v maloi gruppe*. Warszawa: Diamond trading tour, 36.

15. Kalashnikova, A. E. (2014). *Socio-psychological climate in the workplace*. *Psychology, Sociology and Pedagogy*, 5 (32). Available at: <http://psychology.snauka.ru/2014/05/3177>

DOI: 10.15587/2519-4852.2019.178320

FATTY ACID COMPOSITION OF COMMON BUGLE HERB (*AJUGA REPTANS L.*)

p. 21-26

Andriy Grytsyk, Doctor of Pharmaceutical Sciences, Professor, Head of Department, Department of Pharmacy, Ivano-Frankivsk National Medical University, Halytska str., 2, Ivano-Frankivsk, Ukraine, 76018

E-mail: grycyk@ukr.net

Svitlana Maliuvanchuk, Assistant, Department of Pharmacy, Ivano-Frankivsk National Medical University, Halytska str., 2, Ivano-Frankivsk, Ukraine, 76018

E-mail: sv_malyv@ukr.net

ORCID: <http://orcid.org/0000-0002-6530-7834>

Aim. Identification and determination of the qualitative composition and quantitative content of fatty acids in the grass of *Ajuga reptans*.

Methods of the research. The study of *Ajuga reptans* fatty acids was carried out by gas chromatography-mass spectrometry, which is based on the formation of fatty acid methyl esters with their subsequent determination.

Results. The method of chromatography-mass spectrometry was the first to study the fatty acid composition of (*Ajuga reptans L.*). As a result of a study in the herb of *Ajuga reptans*, 22 substances were identified, of which 9 fatty acids were identified. The quantitative content was dominated by polyunsaturated fatty acids – linolenic and linoleic and saturated – palmitic. Their total content in terms of the sum of fatty acids was 56.71 % (unsaturated), 28.18 % saturated. A small amount of following substances was detected – stearic, eicosanoic, tetracosanoic, behenic acid (6.65 %).

Conclusions. Fatty acids are important biocompounds, which are involved in complex metabolic processes, are important components of lipids and cell membranes in the form of phospholipids, thereby have a large biological role.

Unsaturated fatty acids were found in significant quantities in the herb of common bugle, the amount of which was 4706.78 mg/kg, which was almost 1.4 times higher than the amount of saturated fatty acids (3380.83 mg/kg). The research results can be used in the development of quality control methods for common bugle raw materials and the preparation of biologically active substances from the studied raw materials

Keywords: *Ajuga reptans*, gas chromatography-mass spectrometry, fatty acids, saturated acids, unsaturated acids

References

1. Barbarych, A. I., Bradis, Ye. M., Visiulin, O. D.; Zorov, D. K. (Ed.) (1965). *Vyznachnyk roslyn Ukrainy*. Kyiv: Urozhai, 875.
2. Hrodzinskiy, A. M. (Ed.) (1990). *Likarski roslyny*. Kyiv: Holov. red. URE, 544.
3. Qing, X., Yan, H.-M., Ni, Z.-Y., Vavricka, C. J., Zhang, M.-L., Shi, Q.-W. et. al. (2017). Chemical and pharmacological research on the plants from genus *Ajuga*. *Heterocyclic Communications*, 23 (4), 245–268. doi: <http://doi.org/10.1515/hc-2017-0064>
4. Ványolós, A., Simon, A., Tóth, G., Polgár, L., Kelle, Z., Ilku, A. et. al. (2009). C-29 Ecdysteroids from *Ajuga reptans* var. *reptans*. *Journal of Natural Products*, 72 (5), 929–932. doi: <http://doi.org/10.1021/np800708g>
5. Sahakyan, N. Zh., Petrosyan, M. T., Volodin, V. V., Volodina, S. O., Aghajanyan, J. A., Popov, Yu. G. (2008). Isolated culture of *Ajuga genevensis* L. as a potential source of biological active substances. *New Armenian Medical Journal*, 2 (4), 65–74.
6. Makhliayuk, V. P. (1991). *Lekarstvennye rasteniia v narodnoi medicine*. Moscow: Voennoe izdatelstvo, 148–149.
7. Toiu, A., Mocan, A., Vlase, L., Pârvu, A. E., Vodnar, D. C., Gheldiu, A.-M. et. al. (2018). Phytochemical Composition, Antioxidant, Antimicrobial and in Vivo Anti-inflammatory Activity of Traditionally Used Romanian *Ajuga laxmannii* (Murray) Benth. (“Nobleman’s Beard” – Barba Împăratului). *Frontiers in Pharmacology*, 9. doi: <http://doi.org/10.3389/fphar.2018.00007>
8. Atay, I., Kirmizibekmez, H., Kaiser, M., Akaydin, G., Yesilada, E., Tasdemir, D. (2016). Evaluation of in vitro anti-protozoal activity of *Ajuga laxmannii* and its secondary metabolites. *Pharmaceutical Biology*, 54 (9), 1808–1814. doi: <http://doi.org/10.3109/13880209.2015.1129542>
9. Ramazanov, N. S. (2005). Phytoecdysteroids and Other Biologically Active Compounds from Plants of the Genus *Ajuga*. *Chemistry of Natural Compounds*, 41 (4), 361–369. doi: <http://doi.org/10.1007/s10600-005-0153-4>
10. Doneckaia, E. (2017). *Lekarstvennye rasteniia v bytu, medicine, kosmetike. Opisanie rastenii, vyraschivanie i sbor, sroki khraneniia, pokazaniia, recepty, protivopokazaniia, kosmetika*. Vol. 3. Moscow, 496.
11. Hrytsyniak, I. I., Smolianinov, K. B., Vudmaska, I. V., Yanovych, D. O., Ivaniak, V. V., Halias, H. M. (2010). Biologichna diia polinenasychenykh N-3-zhyrnykh kyslot v orhanizmi liudyny ta osnovni dzherela zabezpechenia yikh potreby. *Biologiia tvaryn*, 12 (2), 34–40.
12. Yushchyshena, O. V., Tsurkan, O. O., Korablova, O. A. (2014). Zhyrni kysloty lystia, stebel ta sutsvit viteksu sviashchenoho (*Vitex agnus-castus* L.). *Zdobutky klinichnoi i eksperymentalnoi medytsyny*, 1, 139–141.
13. Mamedova, S. O., Pavlii, O. I. (2011). Vyvchenia lipofilnykh spoluk vehetatyvnykh orhaniv sunytsi lisovoi. *Medychna khimiia*, 13 (3), 44–46.
14. Mozaffarian, D. (2005). Does alpha-linolenic acid intake reduce the risk of coronary heart disease? A review of

the evidence. *Alternative therapies in health and medicine*, 11, 24–30.

15. Frezza, C., Venditti, A., Pizzoli, F., Serafini, I., Ciccòla, A., Pitorri, M. et. al. (2018). Essential oil composition and total metabolite content of a chemotype of *Ajuga reptans* L. (Lamiaceae) collected in Central Italy. *Plant Biosystems – An International Journal Dealing with All Aspects of Plant Biology*, 153 (4), 552–558. doi: <http://doi.org/10.1080/11263504.2018.1515121>

16. Ghita, G., Cioanca, O., Gille, E., Necula, R., Zamfirache, M. M., Stanescu, U. (2011). Contributions to the phytochemical study of some samples of *Ajuga reptans* L. and *Ajuga genevensis* L. *Bulletin of the Transilvania University of Braşov. Series VI: Medical Sciences*, 4 (2 (53)), 7–14.

17. De Sousa, D. P. (2011). Analgesic-like Activity of Essential Oils Constituents. *Molecules*, 16 (3), 2233–2252. doi: <http://doi.org/10.3390/molecules16032233>

18. Lisec, J., Schauer, N., Kopka, J., Willmitzer, L., Fernie, A. R. (2006). Gas chromatography mass spectrometry-based metabolite profiling in plants. *Nature Protocols*, 1 (1), 387–396. doi: <http://doi.org/10.1038/nprot.2006.59>

19. Vahedi, H., Lari, J., Halimi, M., Nasrabadi, M., Vahedi, A. (2012). Chemical Composition of the n-Hexane Extract of *Verbascum speciosum* Growing Wild in Iran. *Journal of Essential Oil Bearing Plants*, 15 (6), 895–899. doi: <http://doi.org/10.1080/0972060x.2012.10662591>

20. Sahakyan, N. Z., Petrosyan, M. T., Popov, Y. G., Volodin, V. V., Matistov, N. V., Gruzdev, I. V., Shirshova, T. I. (2010). Content of Neutral Lipids and Fatty Acids in Callus Cultures and Leaves of Intact Plants of *Ajuga Genevensis* and *Ajuga Chia*. *Biotechnology & Biotechnological Equipment*, 24 (1), 87–90. doi: <http://doi.org/10.1080/13102818.2010.10817817>

DOI: 10.15587/2519-4852.2019.177766

DEVELOPMENT OF ORGANIZATIONAL AND ECONOMIC APPROACHES TO THE ANALYSIS OF EFFICIENCY OF ACTIVITIES OF PHARMACY AS SUBJECTS OF INSURANCE RELATIONS IN NATIONAL HEALTH CARE

p. 27-33

Hanna Panfilova, Doctor of Pharmaceutical Sciences, Professor, Department of Organization and Economics of Pharmacy, National Pharmaceutical University, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: panf-al@ukr.net

ORCID: <http://orcid.org/0000-0001-5297-0584>

Liliia Hala, PhD, Associate Professor, Department of Organization and Economics of Pharmacy, Bogomolets National Medical University, T. Shevchenko blvd., 13, Kyiv, Ukraine, 01601

E-mail: hala.liliia@gmail.com

ORCID: <http://orcid.org/0000-0002-0086-2706>

Aim: to develop a set of organizational and economic approaches to analyzing the effectiveness of pharmacy institu-

tions as important subjects of insurance relations in national health care.

Materials and methods. The study used data from the regulatory framework governing the accounting and reporting system in pharmacies, as well as data from special literature. The historical, analytical-comparative, system, logical, hypothetical-deductive, mathematical-statistical methods of scientific search and cognition are used.

Results. As a result of the conducted research, the main directions and four stages (preliminary, organizational, administrative, evaluated and effective, managerial) were justified in analyzing the effectiveness of pharmacy institutions in terms of introducing insurance relationships. An updated scorecard has been proposed, which contains 29 indicators, divided into two types depending on their content, the specifics of calculations and use in the analysis. The first type (8 indicators) were those that characterize the pharmacy insurance recipe. Use in the analysis of indicators of the second (21 indicators) types allow to evaluate the efficiency of the financial component in the insurance activities of pharmacies. When calculating the indicators can be used natural, cost and temporary accounting meters. The use of indicators describing the state of receivables of business entities in the system of pharmaceutical provision of the population in the analysis of insurance activity of pharmacies is substantiated.

Conclusions. The effective use of data from the analysis of insurance activities of pharmacies allows you to improve their social status in the system of pharmaceutical provision of the population. An important direction of prospective studies is the rationing of indicators, taking into account the specifics of pharmacy activities, depending on their form of ownership and management in the pharmaceutical market of Ukraine

Keywords: pharmacy, health insurance, insurance recipe, insurance compensation, compulsory medical insurance, voluntary medical insurance

References

- Dalton, K., Byrne, S. (2017). Role of the pharmacist in reducing healthcare costs: current insights. *Integrated Pharmacy Research and Practice*, 6, 37–46. doi: <http://doi.org/10.2147/irpr.s108047>
- Tate, M. L., Hopper, S., Bergeron, S. P. (2018). Clinical and Economic Benefits of Pharmacist Involvement in a Community Hospital-Affiliated Patient-Centered Medical Home. *Journal of Managed Care & Specialty Pharmacy*, 24 (2), 160–164. doi: <http://doi.org/10.18553/jmcp.2018.24.2.160>
- Barlas, S. (2015). Insurance Companies Struggle to Balance Medical and Pharmacy Networks. Cost and Access Are Often at Odds; Enrollees Are Caught in the Middle. *Pharmacy and Therapeutics*, 40 (1), 41–43.
- Handfield, R., Feldstein, J. (2013). Insurance companies' perspectives on the orphan drug. *Am Health Drug Benefits*, 6 (9), 589–598.
- Danylchenko, L. (2017). The study of features and prospects of the insurance medicine in Ukraine in modern conditions. *ScienceRise: Medical Science*, 3 (11), 9–15. doi: <http://doi.org/10.15587/2519-4798.2017.96222>
- Volokhova, L. F., Ostapenko, D. O. (2017). Medychno strakhuvannia ta iogo rozvitek v Ukraini. *Finansovye uslugy*, 1, 35–39. Available at: http://nbuv.gov.ua/UJRN/finu_2017_1_10
- Panfilova, H. L. (2009). Rozrobka systemy pokaznykiv, shcho kharakteryzuiut strakhovu retseptury apteky. *Visnyk farmatsii*, 3 (59), 56–59.
- Nemchenko, A. S., Panfilova, H. L., Korzh, Yu. V., Borozenets, N. I. (2010). Rozrobka efektyvnoi modeli finansovoho zabezpechennia vykonannia derzhavnykh tsilovykh program za umov vprovadzhennia oboviazkovoho medychnoho strakhuvannia. *Zaporizkyi medychnyi zhurnal*, 12 (2), 107–113.
- Krychkovska, A. M., Komar, V. S., Novikov, V. P. (2012). Medychnyi klaster yak strukturna odynitsia systemy oboviazkovoho medychnoho strakhuvannia. *Klinichna farmatsiia, farmakoterapiia ta medychna standartyzatsiia*, 1-2, 139–142.
- Khodakivska, V. P., Kotvitska, A. A., Korobova, Ye. S., Pastukhova, O. A. (2012). Istorychni aspekty rozvytku medychnoho strakhuvannia v Ukraini. *Zaporizkyi medychnyi zhurnal*, 5, 116–119.
- Bazylevych, V. D. et. al.; Bazylevych, V. D. (Ed.) (2008). *Strakhuvannia*. Kyiv: Znannia, 1019.
- Rubtsova, N. M., Chkan, I. O. (2015). Suchasnyi stan rynku medychnoho strakhuvannia v Ukraini: problemy ta perspektyvy rozvytku. *Finansovi prostir*, 4 (20), 167–172.
- Lisoval, V. P. (2009). Otsinka rezultativ diialnosti strakhovoi kompanii. *Problemy systemnoho pidkhotu v ekonomitsi*, 2 (10). Available at: <http://jrn1.nau.edu.ua/index.php/EPSAE/article/viewFile/4419/4548>
- Voronina, O. O. (2015). Naukovi pidkhody do vyznachennia sutnosti medychnoho strakhuvannia. *Naukovyi visnyk Mykolaivskoho natsionalnoho universytetu imeni V. O. Sukhomlynskoho*, 8, 733–737.
- Muzyka, O. M. (2017). Stan ta tendentsii rozvytku strakhovoho rynku Ukrainy. *Zbirnyk nauково-tekhnichnykh prats NLUU*, 246–255.
- Mishchuk, I., Vinnichuk, I. (2019). Suchasnyi stan oboviazkovoho medychnoho strakhuvannia v Ukraini ta shliakhy yoho rozvytku. *Pidpryemstvo, hospodarstvo i pravo*, 2, 110–114.
- Fedorova, N. O. (2018). Medychno strakhuvannia v systemi derzhavnogo rehuliuвання strakhovoi diialnosti. Available at: <http://repositsc.nuczu.edu.ua/bitstream/123456789/6952/1/27%20.pdf>

DOI: 10.15587/2519-4852.2019.178319

STUDY OF THE MORPHOLOGO-ANATOMIC SIGNS OF SHOOTS OF THE SALIX CAPREA L. OF UKRAINIAN FLORA

p. 34-44

Natalia Borodina, PhD, Associate Professor, Department of Pharmacognosy, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: natalijaborodina@gmail.com

ORCID: <http://orcid.org/0000-0003-1217-7420>

Volodimir Kovalyov, Doctor of Pharmaceutical Sciences, Professor, Department of Pharmacognosy, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: gnosi@nuph.edu.ua

ORCID: <http://orcid.org/0000-0001-7852-7783>

Oleh Koshovyi, Doctor of Pharmaceutical Sciences, Professor, Head of Department, Department of Pharmacognosy, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: oleh.koshovyi@gmail.com

ORCID: <http://orcid.org/0000-0001-9545-8548>

Olga Gamulya, PhD, Senior Lecturer, Department of Fundamental and Language Training, National University of Pharmacy, Pushkinska str., 53, Kharkiv, Ukraine, 61002

E-mail: olga.gamulya@gmail.com

Representatives of the Salicaceae family are valuable sources of medicinal plant material that has long been used in traditional medicine in many countries around the world. In European countries, some willow species are official plants. The bark of young branches of different willow species, including Salix purpurea L., Salix fragilis L., Salix daphnoides Vill., have been included in the edition of the European Pharmacopoeia and since 2014 to the State Pharmacopoeia of Ukraine. Expanding the raw material base of medicinal plant raw materials is an urgent problem that can be solved through the introduction into the pharmaceutical practice of systematically close autochthonous and introduced willow species widespread in Ukraine.

Aim. Determination of macro- and microscopic diagnostic features of the willow goat (*Salix caprea* L.) shoots growing in Ukraine, for the development of further regulatory documentation for medicinal plant raw materials and the use of standardized raw materials in the design of medicinal products based on willow shoots.

Methods of the research. The object of the study were dry shoots of *Salix caprea* L. Vegetable raw materials were collected in May–August 2016–2018 in Kharkiv, Zakarpattia and Kyiv region of Ukraine.

Study of the morphological and anatomical structure of goat willow shoots was performed using the methods of light and electron microscopy. The ultrastructure of the epidermal leaf tissue surface was further studied using scanning microscopy techniques.

Results of the research. An in-depth study of the morphological and anatomical structure of the shoots of *Salix caprea* L. has been carried out and the main diagnostic macro- and microscopic features of perspective medicinal raw materials have been established.

Conclusions. The obtained results significantly expand information on the anatomical structure of shoots of *Salix caprea* L. flora of Ukraine and will be used in the standardization of raw materials of species of the family Willow

Keywords: *Salix caprea* L., shoots, macroscopic features, microscopic features, SEM, surface ultrastructure

References

1. Ishchuk, L. P. (2018). Verba v etnokulturnykh tradytsiakh i zvychaiakh ukrainsiv. Etnobotanichni tradytsii

v ahronomii, farmatsii ta sadovomu dyzaini. Uman: Sochin-skyi M. M., 100–108.

2. European Pharmacopoeia. Vol. 1-2 (2010). Strasbourg: European Directorate for the Quality of Medicines & Health Care (EDQM), 3536.

3. Willow bark: British Pharmacopoeia. Vol. III (2009). London: Herbal Drugs and Herbal Drug Preparations, 3.

4. Derzhavna Farmakopeia Ukrainy. Vol. 3 (2014). Kharkiv: Derzhavne pidpriemstvo «Ukrainskyi naukovyi farmakopeinyi tsentr yakosti likarskykh zasobiv», 732.

5. Boeckler, G. A., Gershenzon, J., Unsicker, S. B. (2011). Phenolic glycosides of the Salicaceae and their role as anti-herbivore defenses. *Phytochemistry*, 72 (13), 1497–1509. doi: <http://doi.org/10.1016/j.phytochem.2011.01.038>

6. Kishore, N. R., Mangilal, T., Anjaneyulu, N., Abhinayani, G., Sravya, N. (2014). Investigation of anti-inflammatory and in vitro antioxidant activities of hydroalcoholic extract of bark of *Salix tetrasperma* Roxb. *International Journal of Pharmaceutics and Drug Analysis*, 2 (5), 506–509.

7. Fuchylo, Ya. D., Sbytina, M. V. (2009). *Vepvy Ukrainy (biolohiia, ekolohiia, vykorystannia)*. Kyiv: Lohos, 200.

8. Horelov, O. M.; Kokhn, M. A. (Ed.) (2002). *Rodyna Salicaceae Mirbel. Dendroflora Ukrainy. Dykorosli y kultyvovany dereva i kushchi. Pokrytonasynni. Chastyna I. Dovidnyk*. Kyiv: Fitosotsiotsentr, 336–379.

9. Ishchuk, L. P. (2015). Rid *Salix* L. v Ukraini. *Visti Biosferneho zapovidnyka «Askaniia-Nova»*, 17, 35–43.

10. Nedoseko, O. I. (2014). Borealnye vidy iv podrodov *Salix* i *Vetrix*: ontomorfogenez i zhiznennyye formy. *Nizhnii Novgorod: Izd-vo Nizhegorodskogo gosuniversiteta*, 426.

11. Skvortsov, A. K. (1999). *Willows of Russia and Adjacent Countries. Taxonomical and Geographical Revision*. Joensuu: University of Joensuu, 307.

12. Mola-Yudego, B., González-Olabarria, J. R. (2010). Mapping the expansion and distribution of willow plantations for bioenergy in Sweden: Lessons to be learned about the spread of energy crops. *Biomass and Bioenergy*, 34 (4), 442–448. doi: <http://doi.org/10.1016/j.biombioe.2009.12.008>

13. Lakyda, P. I., Heletukha, H. H., Vasylyshyn, R. D. et. al.; Lakyda, P. I. (Ed.) (2011). *Enerhetychnyi potentsial biomasy v Ukraini*. Kyiv: Vydavnychiy tsentr NUBiP Ukrainy, 28.

14. Lakyda, P. I. (2001). *Fitomasa lisiv Ukrainy. Ternopil: Zbruch*, 256.

15. Khiteva, O. O. (2010). Sravnitelnoe morfologo-anatomicheskoe izuchenie kory trekh vidov ivy, proizrastaiushchikh na Severnom Kavkaze. *Razrabotka, issledovanie i marketing novoi farmacevticheskoi produktsii*, 65, 139–142.

16. Derzhavna Farmakopeia Ukrainy. Vol. 1 (2015). Kharkiv: Derzhavne pidpriemstvo «Ukrainskyi naukovyi farmakopeinyi tsentr yakosti likarskykh zasobiv», 1128.

17. Kornilova, O. O., Makarova, O. Ye. (2015). Suchasni problemy standartyzatsii likarskoi roslynnoi syrovyny. *Upravlinnia yakistiu v farmatsii*. Kharkiv: Vyd-vo NFaU, 64–65.

18. Ternynko, I. I., Kyslychenko, V. S., Khvorost, O. P. (2012). Vyvchennia morfoloho-anatomichnykh oznak pahoniv ta lystia verby bilo. *Farmatsevtichnyi chasopys*, 2, 42–46.

19. Eremin, V. M., Shkuratova, N. V. (2007). *Sravnitelnaia anatomia kory ivovykh*. Brest: BrGU im. A. S. Pushkina, 196.

20. Malychenko, E. V., Lotova, L. I. (1986). Anatomia kory vidov roda *Salix* (Salicaceae) srednei polosy evropeiskoi chasti SSSR. *Botanicheskii zhurnal*, 71 (8), 106–113.
21. Ramos, P. A. B., Moreirinha, C., Santos, S. A. O., Almeida, A., Freire, C. S. R., Silva, A. M. S., Silvestre, A. J. D. (2019). Valorisation of bark lipophilic fractions from three Portuguese *Salix* species: A systematic study of the chemical composition and inhibitory activity on *Escherichia coli*. *Industrial Crops and Products*, 132, 245–252. doi: <http://doi.org/10.1016/j.indcrop.2019.02.028>
22. Willow bark *Salix* spp. Analytical, quality control and therapeutic monograph (1999). *American Herbal Pharmacopoeia and Therapeutic Compendium*. Santa Cruz, 16.
23. Kurkin, V. A., Braslavskii, V. B., Zapesochnaia, G. G. et al. (2000). Rasteniia semeistva ivovykh – perspektivnii istochnik novykh antimikrobykh, protivovospalitelnykh i toniziruiuschikh lekarstvennykh sredstv. Poisk, razrabotka i vnedrenie novykh lekarstvennykh sredstv i organizacionnykh form farmacevticheskoi deiatelnosti. Tomsk, 42–43.
24. Islam, S. M., Zahan, R., Nahar, L., Alam, B. M., Naznin, M., Sarkar, G. C. et al. (2011). Antibacterial, insecticidal and in vivo cytotoxicity activities of *Salix tetrasperma*. *International Journal of Pharmaceutical Sciences and Research*, 2 (8), 2103–2108.
25. Frolova, O. O., Kompanceva, E. V., Dementeva, T. M. (2016). Biologicheski aktivnye veschestva rastenii roda *Iva* (*Salix* L.). *Pharmacy & Pharmacology*, 4 (2 (15)), 41–59.
26. Brereton, N. J. B., Berthod, N., Laffeur, B., Pedneault, K., Pitre, F. E., Labrecque, M. (2017). Extractable phenolic yield variation in five cultivars of mature short rotation coppice willow from four plantations in Quebec. *Industrial Crops and Products*, 97, 525–535. doi: <http://doi.org/10.1016/j.indcrop.2016.12.049>
27. Sulima, P., Krauze-Baranowska, M., Przyborowski, J. A. (2017). Variations in the chemical composition and content of salicylic glycosides in the bark of *Salix purpurea* from natural locations and their significance for breeding. *Fitoterapia*, 118, 118–125. doi: <http://doi.org/10.1016/j.fitote.2017.03.005>
28. Borodina, N. V. (2016). Research of volatile compounds from *Salix cinerea* L. *Oxford Review of Education and Science*, 1 (11), 468–473.
29. Borodina, N. V., Kovalev, V. N. (2015). Sravnitel'nii analiz fenolnykh soedinenii pobegov *Salix caprea* L., *Salix purpurea* L., *Salix viminalis* L. flory Ukrainy. Fenolnye soedineniia: fundamentalnye i prikladnye aspekty. Moscow, 27–33.
30. Borodina, N. V. (2015). Izuchenie letuchikh komponentov *Salix caprea* L. *Proceedings of 4-th European Conference on Biology and Medical Sciences*. Vienna, 209–213.
31. Borodina, N. V. (2015). Khromato-mass-spektrometrycheskoe yzuchenye lystev *Salix caprea* L. Aktualni pytannia rozvytku medychnykh nauk u XXI st. Lviv: Lvivska medychna spilnota, 106–108.
32. Borodina, N., Koshovyi, O., Kovalyov, V. (2016). The chromatography-mass spectrometry study of *Salix rosmarinifolia* L. *Azerbaidzhanskii farmacevticheskii i Farmakoterapevticheskii zhurnal*, XVI (2), 15–20.
33. Borodina, N. V., Kovalyov, V. N., Koshovyi, O. N., Stremoukhov, A. A. (2018). The study of *Salix myrsinifolia* Salisb. leaves by the GC/MS method. The 9th International Conference on Pharmaceutical Sciences and Pharmacy Practice, dedicated to the 100th years anniversary of independent Lithuania's pharmacy. Kaunas: LSMU, 105.
34. Borodina, N. V., Borova, E. B. (2015). Elemental composition of *Salix caprea* L. *Topical issues of new drugs development*. Kharkiv: Publishing Office NUPh, 62.
35. Smart, L. B., Volk, T. A., Lin, J., Kopp, R. F., Phillips, I. S., Cameron, K. D., Abrahamson, L. P. (2005). Genetic improvement of shrub willow (*Salix* spp.) crops for bioenergy and environmental applications in the United States. *Unasylva*, 56 (221), 51–55.
36. Barthlott, W., Mail, M., Bhushan, B., Koch, K. (2017). Plant Surfaces: Structures and Functions for Biomimetic Innovations. *Nano-Micro Letters*, 9 (2). doi: <http://doi.org/10.1007/s40820-016-0125-1>
37. Rudall, P. J. (2007). *Anatomy of Flowering Plants*. New York: Cambridge University Press, 146. doi: <http://doi.org/10.1017/cbo9780511801709>
38. Lotova, L. I. (2000). *Morfologiya i anatomiya vysshikh rastenii*. Moscow: Editorial URSS, 528.
39. Evert, R. F. (2006). *Esau's Plant Anatomy*. New York: Wiley-Interscience, 602. doi: <http://doi.org/10.1002/0470047380>
40. Dickison, W. C. (2000). *Integrative plant anatomy*. California: Elsevier, 533. doi: <http://doi.org/10.1016/b978-0-12-215170-5.x5000-6>
41. Barthlott, W., Neithuis, C., Cytler, D., Ditsch, F., Meusel, I., Theisen, I. et al. (2008). Classification and terminology of plant epicuticular waxes. *Botanical Journal of the Linnean Society*, 126 (3), 237–260. doi: <http://doi.org/10.1006/boj.1997.0137>
42. Barthlott, W., Neinhuis, C., Cutler, D., Ditsch, F., Meusel, I., Theisen, I., Wilhelmi, H. (1998). Classification and terminology of plant epicuticular waxes. *Botanical Journal of the Linnean Society*, 126 (3), 237–260. doi: <http://doi.org/10.1111/j.1095-8339.1998.tb02529.x>
43. Borodina, N. V., Kovalov, V. M. (2018). Mineralnyi sklad deiakykh vydiv rodyny Salicaceae. *Zbirnyk naukovykh prats spivrobitnykiv NMAPO im. P. L. Shupyka*, 29, 180–187.
44. Kovalov, V. M., Marchyshyn, S. M., Khvorost, O. P. et al.; Kovalov, V. M., Marchyshyn, S. M. (Eds.) (2014). *Praktykum z identyfikatsii likarskoi roslynnoi syrovyny*. Ternopil: TDMU, 264.

DOI: 10.15587/2519-4852.2019.178951

EFFECT OF A NANODISPERSION SILICA COMPOSITE WITH POLYHEXAMETHYLENE GUANIDINE HYDROCHLORIDE ON IMMUNOLOGICAL INDICATORS AND INDICATORS OF OXIDATION AND ANTIOXIDANT HOMEOSTASIS IN RATS WITH THERMAL BURN

p. 45-52

Anna Doroshenko, Assistant, Department of Pharmacology, Bogomolets National Medical University, T. Shevchenko blvd., 13, Kyiv, Ukraine, 01601

E-mail: Annadoroshenko2015@gmail.com

ORCID: <http://orcid.org/0000-0002-6158-0964>

Nadiya Gorchakova, MD, Professor, Department of Pharmacology, Bogomolets National Medical University, T. Shevchenko blvd., 13, Kyiv, Ukraine, 01601

ORCID: <http://orcid.org/0000-0002-7240-5862>

Ganna Zaychenko, MD, Professor, Head of Department, Department of Pharmacology, Bogomolets National Medical University, T. Shevchenko blvd., 13, Kyiv, Ukraine, 01601

ORCID: <http://orcid.org/0000-0002-3506-4800>

Worldwide, nearly 6 million people annually seek medical attention for burn wounds. Today, the main method of local treatment of wounds and burns, including infected ones, is the use of medicines containing antiseptics, antibiotics, sorbents, as well as their combinations.

Purpose. To determine the effect of a nanosized silica composite with polyhexamethylene guanidine hydrochloride on the immunological parameters and oxidative-antioxidant homeostasis in the blood and in the lesion of rats with an uninfected thermal burn.

Materials and methods. The study was conducted on 72 rats, which were modeled by a thermal burn of the II degree. The animals were divided into 4 groups: intact, control, treated with chlorhexidine, treated with a composite of nanosized silica with polyhexamethylene guanidine hydrochloride. On the 7th, 14th, 21st and 28th day, the animals were removed from the experiment and the immunological parameters and the parameters of oxidative-antioxidant homeostasis in the blood and skin in the lesion were determined.

Results. Thermal injury is directly related to biochemical changes in the body. We compared the levels of anti- and pro-inflammatory cytokines, markers of free radical oxidation - diene conjugate (DC), the active products of thiobarbituric acid (TBA-AP), the activity of catalase (Cat) and superoxide dismutase (SOD). It was proved that the NDK + PHMG-GC composite showed significantly more pronounced compared with chlorhexidine, a pharmacological effect in reducing the level of pro-inflammatory cytokines IL-1 β and TNF- α and an increase in the content of IL-10 in the blood and the focus of thermal burn during the entire observation period. Also, the composite effectively affects oxidation-antioxidant homeostasis, which is manifested in the normalization of the content of DC and TBA-AP on the 14th day, restoration of Cat activity on the 14th day, SOD – already on the 7th day compared with chlorhexidine.

Conclusions. The study indicates that the NDS + PHMG composite has pronounced anti-inflammatory and wound healing properties, which allows it to be used as a combined preparation for the treatment of thermal burns

Keywords: thermal burn, nanosized silica composite with polyhexamethylene guanidine hydrochloride, cytokines, oxidation-antioxidant homeostasis

References

- Vons, B. V., Chubka, M. B., Groshoviĭ, T. A. (2018). The problem of treatment of burns' wounds and characteristic of drugs for the local treatment of burns. Current issues in pharmacy and medicine: science and practice, 11 (1 (26)), 119–125. doi: <http://doi.org/10.14739/2409-2932.2018.1.123731>
- Global action plan on antimicrobial resistance (2015). World Health Organization. Available at: <https://www.who.int/antimicrobial-resistance/global-action-plan/en/>
- Grigorev, I. A., Polienko, Iu. F., Voinov, M. A. (2009). rN-CHuvstvitelnye nitroksilnye radikaly: strukturnye trebovaniia, problemy molekuliarnogo dizaina i sinteticheskie podkhody. Khimiia aromatičeskikh, heterocikličeskikh i prirodnykh soedinenii. Novosibirsk: ZAO IPP «Ofset», 501–535.
- Walczak, M., Richert, A., Burkowska-But, A. (2014). The effect of polyhexamethylene guanidine hydrochloride (PHMG) derivatives introduced into polylactide (PLA) on the activity of bacterial enzymes. Journal of Industrial Microbiology & Biotechnology, 41 (11), 1719–1724. doi: <http://doi.org/10.1007/s10295-014-1505-5>
- Gendaszewska, D., Szuster, L., Wyrębska, Ł., Piotrowska, M. (2018). Antimicrobial Activity of Monolayer and Multilayer Films Containing Polyhexamethylene Guanidine Sulphanilate. Fibres and Textiles in Eastern Europe, 26 (2 (128)), 73–78. doi: <http://doi.org/10.5604/01.3001.0011.5742>
- Lucas, A. D. (2011). Environmental Fate of Polyhexamethylene Biguanide. Bulletin of Environmental Contamination and Toxicology, 88 (3), 322–325. doi: <http://doi.org/10.1007/s00128-011-0436-3>
- Lysytsya, A. V. (2017). Research on the impact of polyhexamethyleneguanidine on the plant component of biocenoses. Biosystems Diversity, 25 (2), 89–95. doi: <http://doi.org/10.15421/011713>
- Zhou, Z., Wei, D., Lu, Y. (2014). Polyhexamethylene guanidine hydrochloride shows bactericidal advantages over chlorhexidine digluconate against ESKAPE bacteria. Biotechnology and Applied Biochemistry, 62 (2), 268–274. doi: <http://doi.org/10.1002/bab.1255>
- Oule, M. K., Azinwi, R., Bernier, A.-M., Kablan, T., Maupertuis, A.-M., Mauler, S. et. al. (2008). Polyhexamethylene guanidine hydrochloride-based disinfectant: a novel tool to fight meticillin-resistant Staphylococcus aureus and nosocomial infections. Journal of Medical Microbiology, 57 (12), 1523–1528. doi: <http://doi.org/10.1099/jmm.0.2008/003350-0>
- Gilbert, P., Moore, L. E. (2005). Cationic antiseptics: diversity of action under a common epithet. Journal of Applied Microbiology, 99 (4), 703–715. doi: <http://doi.org/10.1111/j.1365-2672.2005.02664.x>
- Cherniakova, H. M., Minukhin, V. V., Voronin, Ye. P. (2016). Suchasnyi pohliad na mistseve likuvannia opikiv z infektsiinoiu skladovoiu. Visnyk problem biolohii i medytsyny, 1 (4), 68–72.
- Yakovlieva, L. V., Tkachova, O. V., Butko, Ya. O., Larianovska, Yu. B. (2013). Eksperymentalne vyvchennia novykh preparativ dlia mistsevoho likuvannia ran. Kharkiv: Vyd-vo NFaU, 52.
- Yevropeiska konventsiiia pro zakhyst khrebetnykh tvaryn, shcho vykorystovuiutsia dlia doslidnytskykh abo inshykh naukovykh tsilei 18.03.1986 (1986). Verkhovna Rada Ukrainy. Mizhnarodni dokumenty (Rada Yevropy). Available at: https://zakon.rada.gov.ua/laws/show/994_137
- Council Directive 86/609/EEC of 24 November 1986 on the Approximation of the Laws, Regulations and Ad-

ministrative Provisions of the Member States Regarding the Protection of Vertebrate Animals Used for Experimental and Other Scientific Purposes (1986). Official Journal of the European Communities, 358, 1–29

15. Pro zakhyst tvaryn vid zhorstokoho povodzhennia (2006). Zakon Ukrainy # 3447-IV. Vidomosti Verkhovnoi Rady Ukrainy, 27, 230.

16. Poriadok provedennia naukovykh ustanovamy doslidiv, eksperymentiv na tvarynakh (2012). Ofitsiyni visnyk Ukrainy, 24, 82.

17. Glanc, S. (1998). Mediko-biologicheskaia statistika. Moscow: Praktika, 459.

18. Lebedeva, S. N., Ochirov, O. S., Stelmakh, S. A., Grigoreva, M. N., Zhamsaranova, S. D., Mogonov, D. M. (2017). Wound healing effect of polyhexamethylene guanidine hydrochloride hydrogel at burns. *Acta Biomedica Scientifica*, 2 (4), 93–96. doi: http://doi.org/10.12737/article_59fad51d481658.42549272

19. Lebedeva, S. N., Ochirov, O. S., Stelmakh, S. A., Grigor'eva, M. N., Zhamsaranova, S. D., Mogonov, D. M. (2018). Reparative action of hydrogel polyhexamethylen-

uanidine hydrochloride. *Bulletin of Siberian Medicine*, 17 (1), 112–120. doi: <http://doi.org/10.20538/1682-0363-2018-1-112-120>

20. Beliaeva, O. A., Neshta, V. V., Prociuk, R. R., Tugushev A. S. (2007). Primenenie aplikatsionnykh sorbentov novogo pokoleniia v gnoinoi khirurgii. *Klinichna khirurgiia*, 11/12, 5–6.

21. Geraschenko, I. I. (2009). Membrantropnye svoistva nanorazmernogo kremnezema. *Poverkhnost*, 1 (16), 288–306.

22. Cherniakova, H. M., Minukhin, V. V., Voronin, Ye. P., Minukhin, D. V., Krasnoiaruzhskiy, A. H., Yefimov, D. S., Ponomarova, K. V. (2017). Obgruntuvannia antimikrobnoi efektyvnosti aplikatsiinykh bionanokompozitiv dlia likuvannia opikovoi infektsii, sprychynenoi *S. aureus* ta *P. Aeruginosa*. *Klinichna khirurgiia*, 12, 48–51.

23. Cherniakova, H. M., Minukhin, V. V., Horbach, T. V. (2017). Porivnialne doslidzhennia biokhimichnykh pokaznykiv myshei z opikovoiu *Pseudomonas*-infektsiieu pry likuvanni novykh aplikatsiinykh sorbentamy. *Eksperymentalna i klinichna medytsyna*, 4, 15–21.