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INFORMATION MEDICAL TECHNOLOGIES AND COMPLEMENTARY REHABILITATION IN TOP-LEVEL SPORTS

Actuality. *The intensive training process in top-level sports is accompanied by high levels of physical and psycho-emotional stress. At the present stage of sports development, inadequate medical control and self-monitoring of the functional state of athletes' main body systems is an acute issue.*

Among the problems leading to a decrease in functional reserves are insufficient recovery after training and competitions, limited use of pharmacological agents, frequent seasonal illnesses due to weakened immunity, and chronic bacterial and viral infections.

These factors significantly impact sports performance, making it crucial to explore the latest methods for optimizing the recovery of athletes' psychophysical state, maintaining their health, and ensuring high performance.

The use of modern quantum technologies and advancements in information medicine devices open new prospects for enhancing medical support for athletes. These technologies can partially replace labor-intensive and expensive physical methods through innovative mechanisms for controlling and self-monitoring biological processes in the body.

Aim of the study. *The study aims to scientifically substantiate the feasibility of using information medicine and complementary rehabilitation methods to optimize the training process of top-level athletes.*

Materials and methods. *To achieve this goal, general scientific and theoretical methods were applied, including system analysis, modeling, and generalization. The research was based on scientific literature covering the role of electromagnetic processes in the human body, as well as modern developments in quantum medicine. The analysis focused on the effectiveness of information medicine methods in identifying, monitoring, and correcting the functional state of athletes.*

Research results. *The obtained results demonstrate the high efficiency of information medicine methods in maintaining athletes' health and sports performance, making them a valuable element of modern sports medicine.*

The application of information medicine and complementary rehabilitation technologies enables specialists to conduct objective instrumental assessments of bodily functions based on frequency characteristics, perform quantum correction of functional states at the preclinical stage, and ensure dynamic monitoring with timely modifications of training programs.

The study results confirm the feasibility of integrating information medicine technologies and complementary rehabilitation into the training system of elite athletes.

Conclusions. *Innovative technologies of information medicine and complementary rehabilitation open up wide opportunities for improving the quality of medical support for athletes and provide: objective instrumental preclinical assessment of the functional state of the body by their frequency indicators; fast and effective recovery after training and competitions without the use of pharmacological agents; maintenance of high performance and prevention of injuries and diseases; provide prompt dynamic monitoring and timely modification of training and exercise.*

Thus, the proposed methods can become a promising area for further research in the field of sports medicine and rehabilitation, contributing to the achievement of new heights in sports.

Key words: *innovative rehabilitation technologies, information medicine, rehabilitation, health monitoring, health optimization technologies, functional state of the body, neurophysiology in sports.*

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ІНФОРМАЦІЙНІ МЕДИЧНІ ТЕХНОЛОГІЇ ТА КОМПЛЕМЕНТАРНА РЕАБІЛІТАЦІЯ У СПОРТІ ВИЩИХ ДОСЯГНЕНЬ

Актуальність. *Інтенсивний тренувальний процес у спорті вищих досягнень супроводжується високим рівнем фізичного та психоемоційного навантаження. На сучасному етапі розвитку спорту гостро постає питання неадекватного медичного контролю та самоконтролю функціонального стану основних систем організму спортсменів.*

Серед проблем, що впливають на зниження функціональних резервів організму, є недостатнє відновлення після тренувань і змагань, обмежені можливості застосування фармакологічних засобів, часті сезонні захворювання на фоні ослабленого імунітету, а також хронічні бактеріальні та вірусні інфекції.

Ці фактори значною мірою впливають на зниження спортивних результатів, що робить актуальним пошук новітніх методів для оптимізації процесів відновлення психофізичного стану спортсменів, підтримки їх здоров'я та високої працездатності.

Застосування сучасних квантових технологій і розробка пристроїв для інформаційної медицини відкривають нові перспективи для покращення медичного супроводу спортсменів, даючи змогу частково замінити трудомісткі й дорогі фізичні методи на основі інноваційних механізмів контролю та самоконтролю за біологічними процесами в організмі.

***Метою дослідження** є наукове обґрунтування доцільності застосування методів інформаційної медицини та комплементарної реабілітації для оптимізації навчально-тренувального процесу спортсменів вищих розрядів.*

***Матеріали та методи.** Для досягнення мети були використані загальнонаукові та теоретичні методи, зокрема системний аналіз, моделювання й узагальнення. Джерельною базою дослідження стали наукові праці, що висвітлюють роль електромагнітних процесів в організмі людини, а також сучасні розробки в галузі квантової медицини. Аналіз було проведено з акцентом на ефективність методів інформаційної медицини у виявленні, моніторингу та корекції функціонального стану спортсменів.*

***Результати дослідження.** Отримані результати свідчать про високу ефективність методів інформаційної медицини в забезпеченні утримання адекватного рівня здоров'я та спортивної працездатності спортсменів, що робить їх важливим елементом сучасної спортивної медицини.*

Використання технологій інформаційної медицини та комплементарної реабілітації дає змогу спеціалістам проводити об'єктивну інструментальну оцінку функціонального стану організму за частотними характеристиками; здійснювати квантову корекцію функціонального стану органів і систем на доклінічному етапі; забезпечувати динамічний моніторинг і своєчасну модифікацію навчально-тренувальних програм.

Результати дослідження підтверджують доцільність інтеграції технологій інформаційної медицини та комплементарної реабілітації у систему підготовки спортсменів вищих розрядів.

***Висновки.** Інноваційні технології інформаційної медицини та комплементарної реабілітації відкривають широкі можливості для підвищення якості медичного супроводу спортсменів і забезпечують: об'єктивну інструментальну доклінічну оцінку функціонального стану організму за їх частотними показниками; швидке й ефективне відновлення після тренувань і змагань без застосування фармакологічних засобів; підтримку високої працездатності та профілактику травм і захворювань; забезпечують оперативний динамічний моніторинг і своєчасну модифікацію навчально-тренувальних програм спортсменів на будь-якому етапі підготовки.*

Таким чином, запропоновані методи можуть стати перспективним напрямом подальших наукових досліджень у галузі спортивної медицини та реабілітації, сприяючи досягненню нових висот у спорті.

***Ключові слова:** інноваційні реабілітаційні технології, інформаційна медицина, реабілітація, моніторинг стану здоров'я, технології оптимізації здоров'я, функціональний стан організму, нейрофізіологія в спорті.*

Introduction. There are many arguments and factors that emphasise the importance and feasibility of using innovative technologies in the sports sector. The general idea is that these technologies help athletes achieve better results by reducing the risk of injury, facilitating more efficient recovery from intense stress during training and competition. They help coaches to build a more scientifically oriented and safe training process, improving the overall psychophysical state of athletes and increasing their chances of success.

This makes it crucial to find effective methods that can normalise and optimise metabolic processes at the tissue level in athletes to maintain their health and high performance. One of the most promising and effective areas of therapeutic correction of the psychophysical state of athletes is information medicine and complementary rehabilitation.

Scientific interest in the methods of information therapy is growing every day, as at the present stage there is a significant scientific breakthrough in understanding the role of electromagnetic processes in ensuring the phenomenon of vital activity, metabolism in the cells of living organisms. There is a gradual transition to the magneto-electrochemical paradigm of metabolism (Boyko, 2022; Gulyar, 2022; Kolbun, 2022; Mincer, 2023; Nevoyt, 2023).

Information medicine is the result of a combination of molecular medicine, neuroscience, engineering and computer science, along with the development of modern health monitoring devices. As a result of the current understanding of the mechanisms of neural control of biological processes that make up the pathogenesis of diseases, scientists have been able to develop special devices and techniques for modulating neural circuits (Datta-Chaudhuri, 2021; Ganzer, 2021; Olofsson, 2018, 2022; Shevchenko, 2022).

The realisation by scientists that any substance has an electromagnetic structure has fundamentally changed the scientific view of living biological systems. This fundamental knowledge is scientifically substantiated and recognised, and opens up new horizons for science to study and understand the structure and functioning of the human body. They should be decisively integrated into sports medicine.

Complementary rehabilitation (complementary – additional, adjacent, alternative) is a set of methods and means

of early detection (diagnosis), correction (recovery without medication and invasion), monitoring and comprehensive rehabilitation. Examples of such technologies for improving human health include manual therapy, osteopathy, occupational therapy, kinesiology, craniofacial therapy, quantum and information navigation, and other methods of improving health and quality of life (Hloba, 2021).

High-quality quantum information navigation of human health is a discipline at the intersection of genetics, neuropsychology, information and graphic design, and engineering. It is a technology that allows a living organism to return to its origins, to the original natural electromagnetic environment where its life once originated, to a state of harmony with the world around it (Hloba, 2022).

The purpose of this study was to substantiate the system of scientific views on the use of information medicine and complementary rehabilitation methods in the training process of top-level athletes.

Materials and methods of the research. To achieve this goal, general scientific and theoretical methods were used, including system analysis, modelling and generalisation. The research was based on scientific papers covering the role of electromagnetic processes in the human body, as well as modern developments in the field of quantum medicine. The analysis was carried out with a focus on the effectiveness of information medicine methods in identifying, monitoring and correcting the functional state of athletes.

Research results. A systematic analysis and generalisation of modern views on the substantiation of the possibilities of using information technologies of medicine and complementary rehabilitation in sports of higher achievements was carried out. The author's conclusion on the principles of diagnostic and therapeutic capabilities of information medicine and methods of complementary rehabilitation is made. These technologies are based on the principles of the structural structure of matter at the subatomic and atomic levels, the frequency-wave model of the human body and the presence of specific frequency characteristics for each type of molecules, cells, tissues, organs and organ systems.

According to modern scientific views, the human body has the structure of an electromagnetic field. Therefore, the human body can be viewed as a form of organised energy (Mincer, 2023; Nevoit, 2023).

Each type of atom or substance is characterised by its own specific constant frequency of rotation – the precession of the atomic nucleus. This principle has made it possible to scientifically establish the frequency characteristics of most microorganisms, chemicals, tissues and processes of human body organs (Voroniuk, 2024).

Thus, substances, cells and tissues, metabolic processes in the human body can be determined by the frequency component of their own processes using special diagnostic equipment that allows recording these frequencies (Koutcher, Burt, 1984; Mincer, 2021; Potiazhenko, Nevoyt, 2019).

Each healthy cell, tissue and organ has a characteristic set of its own frequencies of normal functioning, which are part of the intercellular information signal and electromagnetic communication. In the event of pathological conditions, a deviation from the frequency spectrum is recorded, which can be detected using information and therapeutic equipment at the preclinical stage (Sylver, 2011; Vértesi, 2024).

It has been proven (Ursell, 2012; Rackaityte, Lynch, 2020) that the composition of the microbiome determines key processes of human life (digestion and assimilation of food, complex immune reactions, and the impact on higher nervous activity). The presence of chronic bacterial and viral infections, intracellular parasites, and changes in the composition of the fungal flora can increase the overall load on the athlete's body, reduce his or her performance and stress resistance.

Thanks to the databases of frequency characteristics of microorganisms (The Consolidated Annotated Frequency List – CAFL, The Non-Consolidated Frequency List – NCFL, The All-Frequencies CAFL (AFCAFL, etc.) can determine the pathogenetic components of the microbiome with the available means of information medicine (Sylver, 2011; Vértesi, 2024) and adequate frequency-wave correction of the psychophysical state of the athlete (Brugemann, 1993; Dörfler, 2002; Kirsever, 2022; Wild, 2009).

Modern information technologies and databases of markers (frequency characteristics) allow to diagnose the quality of nutrition of athletes, identify deficiencies of vitamins, amino acids, minerals, develop an individual nutrition programme that will increase the effectiveness of the training process.

The frequency-wave method of diagnostics allows to detect pathological processes at the preclinical stage, which makes it possible to carry out frequency-wave correction of the psychophysical state of the athlete's body (Brugemann, 1993; Dörfler, 2002; Kirsever, 2022; Malmivuo, Plonsey, 1995; Sylver, 2024; Wild, 2003). Such correction can be carried out by passive (the signal received from the body is converted and returned to the body with the help of devices) and active (corrective frequency is fed into the body with the help of information therapy devices) methods of therapy.

It is known that low-frequency electric current stimulation with a frequency of about 2 Hz causes natural

peristalsis and smooth muscle contraction of venous and lymphatic vessels, improves venous and lymphatic outflow, and cellular metabolism, stimulates arterial blood circulation, promotes the removal of excess fluid from tissues due to intercellular drainage, reduces muscle-tonic syndrome, improves microcirculation and reduces stagnation in tissues, has anti-inflammatory effect, stimulates reparative processes (Dörfler, 2002; Kirsever, 2022; Will, 2003).

The developed by us information-analytical system of control (self-control) over the functional state of the main systems of the human body 'VV' ('Vim Vitae' – Latin life force) is based on the use of energy quanta, i.e. small doses of electromagnetic oscillations, for testing (diagnosis), correction (treatment) and monitoring (prevention) of many disorders of information electromagnetic exchange (communication, interaction) between cells, tissues, organs, organ systems with subsequent restoration of human health and improvement of the quality of life (Globa, 2023).

'VV' is designed for screening-integral rapid assessment of the functional state of the human body. 'VV' uses passive registration of bioelectrical information with the help of proprietary devices. Thanks to innovative solutions, stable operation with dynamic signals is achieved, which allows analysing the volumetric characteristics of these signals and ensuring a high level of analysis accuracy and validity. The non-invasive VV method of application ensures that the consumer and the provider of correctional and rehabilitation services are comfortable with the research.

The author's hardware and software systems and the methodology for their application have been experimentally tested in medical and rehabilitation institutions of Ukraine, used during long-term training of athletes of various sports and levels of training (biathlon, rugby, beach soccer, swimming, invasive sports), and have the appropriate permits.

Discussion of research results. According to many scientists and researchers, the development of information technology is actively changing existing ideas in the medical field (Mincer, 2021; Olofsson, Tracey, 2017). The emergence of new fundamental knowledge about the organisation and functioning of matter has aroused considerable interest among doctors and rehabilitation therapists (Mincer, 2021; Boyko, Krasnoholovets, 2004; Boyko, 2022; Kolbun, 2022; Gulyar, 2022).

According to a number of scientists, the correction of the functioning of organs and body systems using various types of electromagnetic energy with appropriate frequency and wave properties can effectively complement existing therapeutic and preventive methods in sports medicine. The process of electromagnetic activation of molecules ensures their biochemical activity and the structural integrity of the interaction of body cells (Mincer, 2021; Nevoit, 2023).

The foregoing gives an understanding that the human body is a form of information organisation of biological matter, which is controlled by electromagnetic energy. Therefore, external electromagnetic influence on the human body has an adequate therapeutic effect.

Our body is a computer, a complex machine. By changing and improving its individual parts, we improve it as a whole. In the near future, humanity will be able to completely rebuild itself with the help of genetic engineering, nanotechnology, neurointerfaces, and implants.

In our opinion, the introduction of innovative technologies in the educational and training process ensures the maintenance of a high level of endurance and performance of athletes at different stages of training, as well as the implementation of effective actions on: diagnostics, prevention and correction of the psychophysical state of the athlete's body; increasing the level of energy supply and energy saving; ensuring effective recovery of the body; strengthening the immune function of the body; medical, psychological and pedagogical control of the educational and training process; development of an individually adapted regime of physical activity, nutrition, selection of vitamins, microelements, and lifestyle; ensuring the stability of results.

The use of the highest achievements of information medicine and complementary rehabilitation technologies in sports provides:

– individual approach to the construction of the training process;
– constant monitoring of the athlete's health;
– rehabilitation efficiency;
– optimisation of the training process;
– accessibility and mobility;
– increasing competitiveness and economic attractiveness.

Conclusions

1. The scientific and theoretical substantiation of the effectiveness of the use of information medicine methods and complementary rehabilitation technologies does not contradict the existing scientific knowledge of medical science, but complements the existing paradigms.

2. The theoretical basis for the substantiation of the use of information and medical methods and technologies of complementary rehabilitation in sport is modern fundamental knowledge about the structure of human tissues, their structural organisation, electromagnetic theory of metabolism, frequency-wave

model of the human body structure, the presence of individual frequency characteristics in molecules, cells, tissues, organs and systems.

3. Innovative technologies of information medicine in sports allow for an objective instrumental assessment of such body parameters as: the functional state of organs, tissues and organ systems by their frequency indicators; the presence of pathological agents and processes with the determination of their approximate localisation in organs, tissues, systems or parts of the body; the adequacy of the individual nutrition of the athlete with the determination of the list of nutrients necessary for him/her; peculiarities of the psycho-emotional state of the athlete at the preclinical stage.

4. Innovative technologies of information medicine in sports allow for: quantum correction of the functional state of organs and systems at the preclinical stage; protection of the body from pathological agents; optimisation of the functioning of immune mechanisms, lymphatic drainage and restoration of connective tissue in the muscular and osteoarticular systems; optimisation of the process of correction of the psycho-emotional state of athletes.

5. Innovative technologies of information medicine in sport provide for operational dynamic monitoring and timely modification of training programmes of athletes at any stage of training, maintaining a high level of endurance and performance of athletes.

6. The use of methods of information medicine and technologies of complementary rehabilitation in the educational and training process of athletes of the highest ranks allows to significantly increase the efficiency of their activities, reduce the risk of injury, increase the level of psychophysical condition and quality of life, ensure comfort and safety during training and competitions.

Prospects for further research. Introduction into the health care system (including sports medicine) of biological feedback technologies, modern software and diagnostic information systems and devices, quantum-nonlinear methods of assessing homeostasis, as well as biomedical devices and devices for functional diagnostics, screening and remote monitoring of health I will allow in the future to implement the idea of preliminary diagnosis of diseases in practice. This revolution will take place during the change of one generation, so it makes no sense to postpone this work, but to implement the best technologies of the quantum century, which replace classical analogues already today.

BIBLIOGRAPHY

Вплив використання принципу спектрально-динамічного аналізу напруженості електретного поля електронного комплексу Vim Vitae на живий організм / О. Глоба та ін. *Фізична реабілітація та рекреаційно-оздоровчі технології.* 2023. № 8 (2). С. 105–116. https://doi.org/10.15391/prrht.2023-8(2).04.

Вплив малих доз електромагнітних коливань на особливості розмноження коронавірусу / О. Глоба та ін. *Acta Balneologica*. № 3 (164). С. 210–215. URL: https://actabalneologica.eu/wp-content/uploads/library/ActaBalneol2021i3.pdf.

Kuettel A., Larsen C.H. Фактори ризику та захисту психічного здоров'я елітних спортсменів: огляд масштабів. *Int Rev Sport Exerc Psychol*. № 2. С. 1–35.

Дарч П. К., Heimes D. Біорезонанс за Полом Шмідтом (BaPS) та його благотворний вплив на цілісність кишкового бар'єру in vitro. *Adv Bioeng Biomed Sci Res*. № 5 (3). С. 180–185.

Останні досягнення в біоелектронній хімії / Ю. Фанг та ін. *Chem Soc Rev*. № 49 (22). С. 7978–8035. DOI: 10.1039/d0cs00333f.

Мінцер О. П., Потяженко М. М. і Невойт Г. В. Магнітоелектрохімічна теорія метаболізму. Том 1. Концептуалізація : монографія. У 2 т. Київ – Полтава : Інтерсервіс, 2021. 351 с.

Мінцер О. П., Потяженко М. М. і Невойт Г. В. Оцінка біоелектромагнітного поля людини в медицині: розвиток методології та перспективи на сучасному науковому етапі / О. П. Мінцер та ін. Wiadomości Lekarskie. № 5 (II). С. 1117–1121. DOI: 10.36740/WLEK201905231.

Сучасний біофізичний погляд на електромагнітні процеси явища життєдіяльності живих біологічних систем як перспективна основа розвитку комплексної медицини: роль води / Г. Невойт та ін. *Журнал складності в науках про здоров'я.* № 2 (5). С. 45–57. Doi.org/10.21595/chs.2022.23089.

Комплементарні методи діагностики та лікування болю та больових синдромів / М. Чухраєв та ін. Міжнародні наукові інновації в житті людини. Видавництво «Когнум», Манчестер, Велика Британія. 2022. 441 с. ISBN 978-92-9472-195-2.

Психологічна безпека для психічного здоров'я в елітному спорті: теоретично обґрунтована модель / Ч. К. Уолтон та ін. *Спорт Мед*. Doi.org/10.1007/s40279-023-01912-2.

Effect of virtual reality-based rehabilitation on upper extremity function, visual perception, and mood after stroke: A randomized controlled trial / Y.J. Choi et al. *Journal of stroke and cerebrovascular diseases*, № 29 (3). P. 104591.

Augmented reality in otolaryngology: A systematic review / V. Donnabella, et al. *Journal of Clinical Medicine*, № 10 (7), P. 1466. DOI: 10.3390/jcm10071466.

Gasperini P., Espigolan R., Forni M. F. Applications of gene therapy to immune cells. *International Journal of Molecular Sciences*, № 20 (8). P. 1835. DOI: 10.3390/ijms20081835.

McArthur J., Gee B. The use of virtual and augmented reality in surgery: A systematic review. The Surgeon, № 19 (1). P. 52–63. DOI: 10.1016.

Johnson J.T., Russo M.A. Virtual reality in endodontic treatment: A systematic review. *Journal of Endodontics*, № 46 (10). P. 1331–1341. DOI: 10.1016/j.joen.2020.06.010.

Patil S., Jain S. Role of genetic engineering and biotechnology in healthcare. *Biomedical Research and Therapy*, № 3 (5). P. 673–680. DOI: 10.7603/s40681-016-0031-2.

Pratt W., Unruh K.T. The ethics of personalized medicine: Critical perspectives. Springer.

Rajkomar A., Dean J., Kohane I. Machine Learning in Medicine. *New England Journal of Medicine*, № 380 (14). P. 1347–1358. DOI: 10.1056/NEJMra1814259.

Russell S., Bennett J. Wellman Center for Photomedicine: Gene therapy clinical trials. URL: https://www.masseyeandear.org/research/centers-and-institutes/wellman-center-forphotomedicine/research/gene-therapy-clinical-trials.

Вплив імпульсних електромагнітних полів (PEMF) на м'язову активацію під час їзди на велосипеді: односліпе контрольоване пілотне дослідження / A. Trofè et al. Охорона здоров'я (Базель). № 11 (6). P. 922. DOI: 10.3390/healthcare11060922.

REFERENCES

Bar-Zeev, Y., Haile, Z. T., & Chertok, I. A. (2022). Association between prenatal smoking and gestational diabetes mellitus. Obstetrics & Gynecology, 135 (1), 91–97. https://doi.org/10.1097/aog.0000000000003602.

Chi, Y., et al. (2022). Smoking status and type 2 diabetes, and cardiovascular disease: A comprehensive analysis of shared genetic etiology and causal relationship. Frontiers in Endocrinology, 1813. https://doi.org/10.3389/fendo.2022.809445.

Edstorp, J., Lampousi, A., & Carlsson, S. (2022). Parental smoking, type 1 diabetes, and islet autoantibody positivity in the offspring: A systematic review and meta-analysis. Diabetic Medicine, 29. https://doi.org/10.1111/dme.14830.

Fawkes, L., & Sansom, G. (2022). Preliminary study of lead-contaminated drinking water in public parks – An assessment of equity and exposure risks in two Texas communities. International Journal of Environmental Research and Public Health, 18 (12), 6443. https://doi.org/10.3390/ijerph18126443.

World Health Organization. (2023). Guidelines for drinking-water quality: Fourth edition incorporating the first and second addenda. Retrieved from https://iris.who.int/bitstream/handle/10665/352532/9789240045064-eng.pdf?sequence=1.

Hama Aziz, K. H., et al. (2023). Heavy metal pollution in the aquatic environment: Efficient and low-cost removal approaches to eliminate their toxicity—A review. RSC Advances, 13 (26), 17595–17610. https://doi.org/10.1039/d3ra00723e.

Jenssen, B. P., et al. (2023). Electronic health record-embedded, behavioral science-informed system for smoking cessation for the parents of pediatric patients. Applied Clinical Informatics, 13 (2), 504. https://doi.org/10.1055/s-0042-1748148.

Lototska, O.V., & Prokopov, V.O. (2023). Hygienic problems of drinking water supply in the Western region of Ukraine: Monograph. Ternopil: TNMU.

Machate, D.J. (2023). Anthropogenic hyperactivity for natural resources increases heavy metal concentrations in the environment: Toxicity of healthy food and cancer risks estimated. Journal of Trace Elements and Minerals, 4, 100057. https://doi.org/10.1016/j.jtemin.2023.100057.

Mallol, J., et al. (2021). Prevalence and determinants of tobacco smoking among low-income urban adolescents. Pediatric Allergy, Immunology and Pulmonology, 134 (2), 60. https://doi.org/10.1089/ped.2021.0018.

Morales-Suárez-Varela, M., et al. (2022). Risk of gestational diabetes due to maternal and partner smoking. International Journal of Environmental Research and Public Health, 1419 (2), 925. https://doi.org/10.3390/ijerph19020925.

Mykyta, Kh.I., & Rohach, I.M. (2023). Monitoring of the state of pollution of the water supply network of the city of Uzhhorod and settlements of the Transcarpathian region in dynamics during 2018–2022. Hygiene of Populated Places, 73, 48–58. https://doi.org/10.32402/hygiene2023.73.048.

Onul, N.M., Antonova, O.V., & Golovkova, T.A. (2020). Lead in the environment of the city of Dnipro and its biomonitoring in the body of preschool children. World Science, 6 (24), 33–36.

Parks, J., et al. (2023). Potential challenges meeting the American Academy of Pediatrics' lead in school drinking water goal of 1 mg/L. Corrosion, 74, 914–917. https://doi.org/10.5006/2770.

Regional report on the state of the natural environment in the Dnipropetrovsk region for 2023 (2023). Dnipro. 320 p.

Regional report on the state of the natural environment in the Dnipropetrovsk region for 2022 (2022). Dnipro. 304 p.

Sia, H.K., et al. (2022). Association between smoking and glycemic control in men with newly diagnosed type 2 diabetes: A retrospective matched cohort study. Annals of Medicine, 1654 (1), 1385.

Unsal, V., Dalkiran, T., & Cicek, M. (2023). The role of natural antioxidants against reactive oxygen species produced by cadmium toxicity: A review. Advances in Pharmaceutical Bulletin, 10, 184–202. https://doi.org/10.34172/apb.2020.023.

Wu, L., et al. (2023). Smoking cessation, weight gain, and risk for type 2 diabetes: A prospective study. International Journal of Public Health, 1467. https://doi.org/10.3389/ijph.2022.1604654.

Zamora-Ledezma, et al. (2022). Heavy metal water pollution: A fresh look at hazards, novel and conventional remediation methods. Environmental Technology & Innovation, 22, 101504. https://doi.org/10.1016/j.eti.2021.101504.

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