



Analysis of the Integration of Medical and Sports-oriented Approaches in Physical Education



ARTICLE INFO

Article Type

Descriptive Study

Authors

Zhang Q.*¹ PhD,
Bezmylov M.M.¹ PhD

How to cite this article

Zhang Q, Bezmylov M M. Analysis of the Integration of Medical and Sports-oriented Approaches in Physical Education. Health Education and Health Promotion. 2023;11(1):37-44.

ABSTRACT

Aims This study aimed to investigate the motivational sphere of students to physical activity, as well as to analyze medical and sports-oriented approaches in physical education.

Instruments & Methods The experimental base for the study was the National University of Ukraine on Physical Education and Sport. The main research methods for this problem were the methods of analysis and synthesis, deduction, comparison, and survey.

Findings According to a survey, every three male students and every five female students experience psychological stress while studying at universities. Students have a low level of physical fitness, low motivation, lack of interest in physical education, and an unformed values-based attitude to independent physical education.

Conclusion The low level of physical activity of school graduates does not allow to ensure a sufficient level of development of the general physical proficiency of students, which leads to a decrease in health indicators to a level that does not provide sufficient effectiveness for training and future professional activity.

Keywords Physical Fitness; Adolescent; Physical Education; Chronic Disease; Physical Activity

¹Department of Innovation and Information Technologies in Physical Culture and Sports, Coach Faculty, National University of Ukraine on Physical Education and Sport, Kyiv, Ukraine

*Correspondence

Address: Department of Innovation and Information Technologies in Physical Culture and Sports, National University of Ukraine on Physical Education and Sport, Kyiv, Ukraine. Postal Code: 03150

Phone: +38044 287 0491

Fax: -

qi_zhang@ntlu-os.gb.net

Article History

Received: October 28, 2022

Accepted: February 6, 2023

ePublished: February 26, 2023

CITATION LINKS

[1] Efficacy and sensitivity ... [2] Gender-specific physical ... [3] Situation of child and ... [4] Prospects for the ... [5] The algorithm for overload ... [6] Health for ... [7] Prevalence and characteristics ... [8] The locations of anterior ... [9] Efficacy of discogel ... [10] Hop-stabilization ... [11] Physical activity ... [12] Chronic traumatic ... [13] The state of health ... [14] Bologna ... [15] Nonalcoholic fatty liver ... [16] Structurally constrained ... [17] Virtual reality based ... [18] Indicators of population ... [19] Return to sport ... [20] Rehabilitation sport ... [21] Laparoscopic approach ... [22] Are basketball players ... [23] Bilateral popliteal ... [24] Concussions in ...

Introduction

The scientists have proven that a sedentary lifestyle, together with other factors of unhealthy human behaviour (smoking, alcohol, poor diet), contributes to development of diseases and rise in mortality due to the chronic diseases, especially cardiovascular disease, type 2 diabetes, and cancer [1]. Lack of physical activity is a factor that leads to overweight and obesity in young people. Recent studies have proven that physical activity and diet are key factors for a healthy life [2]. Regular physical activity reduces the risk of cardiovascular disease, coronary heart disease, non-insulin-dependent diabetes mellitus, cancer, and other mortality factors. In addition, physical activity has a beneficial effect on blood pressure, lipids and lipoproteins, and mental health and well-being. The required level of physical activity is the key to the healthy growth of the human body, as evidenced by numerous studies [2].

According to statistical data in the CIS (Commonwealth of Independent States) countries, the health state of the population today is unsatisfactory. It is associated with a high level of overall mortality (14.6 per 1,000 population), which is steadily growing (according to the European database "Health for All", Russia, Kazakhstan, and Moldova are the only countries with standardized mortality rates, higher than in the CIS); CIS countries have a low level of life expectancy (66.12; years, only Russia, Kazakhstan and Turkmenistan have life expectancy level lower than this amount) and healthy life expectancy (59.2 years) [3]. In the European Region, natural population decline is one of the highest (-3.9 per 1,000 people in 2014); there are no signs of overcoming the epidemics of tuberculosis and HIV/AIDS [4]. The health status of the young generation as a future reserve and asset of the state is not even satisfactory [5]. Thus, according to the data of the State statistical reporting on the health status of children 0-17 years old, in 2019, in the structure of morbidity, as in previous years, diseases of the respiratory system (66.78%), skin and subcutaneous tissue (5.24%), trauma, poisoning and some other consequences of external factors (3.65%) prevailed including infectious and parasitic diseases (3.69%), diseases of the digestive system (3.65%), eyes and its adnexa (3.37%). The total share of these diseases was 86.52% [6].

Preservation of health as an important component of human capital is ranked among the factors that determine the competitiveness of the state at the international level [7]. An example is the international programme "Health 21", which defines the goal of European policy in developing each person's health

potential [8]. Health potential is determined by the ability to take care of personal health and the health of others, make decisions and control own life, as well as provide society with conditions conducive to the preservation of health by all its members [9]. Ardakani *et al.* [10] indicate the tasks to achieve this goal – improvement and protection of people's health throughout life, reducing the prevalence of disease and suffering caused by underlying diseases and injuries. Grazio and Balen [11] concluded that if a good foundation of health is laid at a young age, then a person's long life will be active, and old age will be disease-free. Šeper and Nešić [12] note the close connection between health and education: the better the health of students, the more productive the learning. The research of Cai *et al.* [2] shows that an unhealthy lifestyle acquired in youth can determine the physical condition in adulthood.

Physical education as an educational subject is quite specific and requires a special approach, especially in credit-module systems. The criteria and standards of assessment in the discipline of "physical education" have not yet been sufficiently studied since it is not entirely appropriate to reduce a student's academic performance solely to attendance at practical classes. More than 60% of university graduates, according to employers, are not ready to physically work with required intensity and dedication, which hinders scientific and technological progress in the country [13]. All these problems with the absent need of students for a healthy lifestyle negatively affect their health. So, motivation is key to exercise and sports. Therefore, the authors conducted a survey of students to determine the motives for attending physical education classes. This study aimed to investigate medical and sports-oriented approaches in physical education.

Instruments and Methods

This descriptive analytical study was conducted at the National University of Ukraine on Physical Education and Sport in the first semester of the 2020-2021 academic year.

Participants

145 eligible 1st-4th year students were selected by cluster random sampling. The survey participants were 73 males and 72 females aged 17 to 21. Informed consent was obtained from the potential study participants, with a response rate of 93.7% (n=136). The purpose of this study was orally explained by the authors, and the quick response code or hyperlink of the questionnaire was sent to all consenting students.

Instruments

Data of the study were collected using questionnaires. The questionnaire contained open and closed questions. Open questions determined the individual need for physical exercises, and closed questions determined the independent work of students in physical education. With the help of closed questions, students' interest in physical exercises for the manifestation of physical qualities was investigated: the development of flexibility, strength, speed-strength abilities, endurance, coordination abilities, and balance. Based on certain interests, participants indicated sports that met their needs.

The research was conducted using the methods of analysis, synthesis, specification, generalization, comparison, and survey. The authors conducted a theoretical analysis of the available scientific and methodological literature and statistical data on the physical condition of the population, the connection between physical activity and diseases. Students' motivation for physical education was determined by the help of a survey. The answers of males and females were compared using the method of comparison, and the conclusions of this study were systematized using the method of generalization.

Statistical analysis

The empirical data were statistically processed and graphically represented with SPSS 17.0 software and MS Excel program. After analyzing the respondents' answers, the results were calculated, and the percentage ratios were derived. To determine the differences, the Mann-Whitney test was used in independent samples, and the Pearson Chi-square test was used in the distribution frequencies of the trait. The differences in the obtained values were considered significant at $p < 0.05$. Quantitative indicators were presented as mean and Standard Deviation (SD), and qualitative indicators (frequencies, fractions) as absolute values and percentages.

Findings

The dynamics of students' motivational priorities for professional applied physical education were investigated from the 1st to the 4th year, and it was found that the critical period of decreasing students' learning motivation is the 3rd year. A decrease in the emotional background, the emergence of feelings of uncertainty in the correctness of their actions, and anxiety were noted. It was found that in the process of studying at a higher institution, students show a decrease in interest in physical education and sports in their senior years.

Studying the motivation of students with a low level of health for independent physical education, it was found that most students consciously relate to physical exercises as a way to improve their physical fitness and health and determine the health-improving orientation as a priority (88.6%), and the desire to improve their physical fitness expressed by about 97.3% of students. However, only 55.8% showed independent activity to achieve the goal (12.8% attended extracurricular activities at the university, 24.5% attended fitness clubs, and 18.5% were independently engaged). These results are associated with the disadvantages of promoting an active and healthy lifestyle.

Students in universities considered the need for physical exercises as a means of improving health (73.9%), the development of physical qualities (39.1%), and the possibility of building a beautiful body (34.8%). The fourth, fifth, and sixth places were taken by factors that can be attributed to mental activity: better mood (30.4%), a sense of satisfaction from physical exercise, and the desire for personal physical perfection (21.7% each). The last places were given by the students for passing the summative assessment of physical fitness (the 8th rank – 8.7%) and the need to get a credit in physical education (the 10th rank – 7.8%), which indicates their low importance in realizing the need to engage in sports activities.

In the current motivation of university students, the effective component prevailed. The structure of male and female students was slightly different, and the unsatisfactory state was mainly due to the uncertainty of goals that are important for current and future life.

The interest of second to fourth-year students in physical exercises was determined in terms of the manifestation of physical characteristics with gender differences. Regardless of the year of study, most of the female students indicated an interest in exercises for the development of flexibility (50% each in the 2nd-3rd year and 63.3% in the 4th year) and young men for strength (33.3% in the 2nd and 4th, 26.7% in the 3rd year) and speed-strength abilities (23.3% in all 3 years). Girls who were interested in strength exercises constituted only 3.3%, and speed-strength exercises 3.3% in the 2nd-3rd year of study, and 6.7% in the 4th year. The situation was similar with the male students, which was only 3.3% for the 2nd and 4th years of study and 10% for the 3rd year. The greatest interest in speed exercises was expressed among 2nd-year students, of whom 30% were males and much fewer females (13.3%). In the 2nd-3rd year, only 6.7% of students of both genders were

interested in speed exercises. Part of the students (20% of the 3rd-4th-year students and 13.3% of all females) expressed an interest in endurance exercises. Physical exercises for coordination abilities turned out to be interesting for a small number of students: for 6.7% of 2nd-year students, 10% of 3rd-year students of both genders, and 10% of males and 6.7% of females in the 4th year. Balance as a coordination component did not improve the situation in this physical quality. Only 3.3% of males in the 3rd-4th year, 10% of females in the 2nd, and 13.3% in the 4th year were interested in balance exercises. There was no clear influence of interest in physical exercises according to physical qualities on the interest of 2nd-4th year students of pedagogical specialties in sports. Pointing to the interest in strength exercises, only the 2nd- and 3rd-year students were interested in sports that require this very physical quality: weightlifting was of interest to 20% of the 2nd-year students, and bodybuilding was of interest to 46.7% of the 3rd-year students and 6.7% of the 4th-year students. A similar situation was demonstrated by female students. Therefore, further analysis will be carried out without referring to the previous interest. A significant number of students expressed an interest in sports games (basketball, volleyball, football) (Tables 1).

In other sports, the interest of male students was different from that of females. The results of the study are presented in Tables 2-4.

Table 1) Frequency of interest in sports games between boys and girls

Year	Male student	Female student
2nd year	50%	30%
3rd year	40%	43%
4th year	40%	23%

Table 2) Frequency of interest in aerobics and fitness among female students

Sports	2 nd year	3 rd year	4 th year
Aerobics	30%	10%	36.7%
Fitness	10%	6.7%	16.7%

Table 3) Frequency of interest in martial arts among male students

Sports	2 nd year	3 rd year	4 th year
Wrestling	3.3%	3.3%	10%
Boxing	13.3%	16.7%	6.7%
Karate	3.3%	0%	0%

Table 4) Comparison of males and females in other sports

Sports	2 nd year		3 rd year		4 th year		Mean±SD	P-value
	Boys	Girls	Boys	Girls	Boys	Girls		
Swimming	3.3%	16.7%	3.3%	23.3%	6.7%	13.3%	25.7±1.8	<0.05
Athletics	3.3%	13.3%	3.3%	3.3%	0%	0%	0.58±0.04	<0.01
Winter sports	0%	0%	0%	0%	10%	3.3%	0.31±0.02	<0.01
Tennis	3.3%	0%	0%	0%	0%	0%	0.26±0.01	<0.0001

Discussion

According to the present study, the critical period for the decrease in students' motivation for learning was the 3rd year. Those transformations that occur in the process of teaching students to lead to a decrease in the practical, theoretical, and functional proficiency of students. It is during this period that students begin to show indifference to educational activities, and their interest in sports decreases.

In the current motivation of university students, the effective component prevails. The structure of male and female students is slightly different, and the unsatisfactory state is mainly due to the uncertainty of goals that are important for current and future life (first of all, the goals must include improving and maintaining a high level of health and effective performance of professional activities) since it is goal-setting that is decisive in the effective component of motivation. Analysis of the studies of specialists in physical education and sports who work in various universities confirms the tendency that, in general, students perceive physical education rather positively, only they are not very motivated to engage in physical exercises. It has been established that the motives for physical exercises for students who live in CIS countries are fundamentally different from the motives of students who live in other countries, especially the United States [13]. It dictates the need for different approaches to stimulating youth to engage in physical activity. If American students can be attracted to systematic activities through sports because it is an integral part of the American way of life, then students from CIS countries can improve their physique, which it results in systematic physical activity and a healthy lifestyle.

To foster the motivation for physical exercises, it is proposed to expand physical education and sports work to improve its organisation at the place of residence and study. Great importance here should be given to the development of students' desire for physical self-improvement. Achieving this goal is possible only through the solution of the following intermediate tasks:

1. Raising students' steady interest in physical activity
2. Development of their skills and abilities to study independently
3. Promoting the introduction of physical exercises in the daily routine

Raising the motivation of student youth to engage in physical exercises and sports requires purposeful steps of the teacher (taking into account the motives, needs, and interests of students) and the student to

be an active participant in the educational process and to enter into a dialogue with the teacher. A large proportion of independent work is the practice of world education because after graduating from a university, a person does not complete his education but continues it, only in different conditions. Therefore, the future specialist must be ready for effective independent work.

The increase in time for independent work is the most tangible innovation in higher education, introduced by the Bologna process. The peculiarity of the credit-based modular system is that the educator must approach the organisation of student training in a different way. First of all, to manage his independent work. In the Bologna Declaration [14], lifelong education is given an important place because only the constant improvement of a person can contribute to its survival in the modern information age. It constantly emphasizes that it is necessary to ensure the continuity of the development of all educational degrees and to create an opportunity for learning and self-improvement of each person throughout his life. In the universities of the leading countries of the world and the countries of the EEC (European Economic Community), the ratio of the number of hours of classroom lessons to individual and independent work is 50% to 50%, 60% to 40% or 40% to 60%, depending on the content of the course. Independent work in the conditions of a credit-based modular system of organizing the educational process of students is the main means of assimilating educational material. Independent work of students is considered a specific cognitive activity, which, in parallel with other forms of organizing the educational process, is performed by the students themselves, according to the program proposed by the teacher, to deepen and supplement its classroom analog. According to the requirements of the credit-based modular system of organizing the educational process, a significant part of the educational material is taken out for independent study by students.

Independent work of students in a credit-based modular system is a self-sufficient part of the educational process. In the physical education of students as an academic discipline, the share of independent work has always been significant, and under new conditions, its importance increases even more. This creates new problems that need to be addressed. The conscious interest of students in physical exercises and sports is an unconditional incentive to search for attractive forms of physical activity.

The best international practices and a large number of scientific studies indicate that physical activity is a biological need of every living organism, an integral part of a healthy lifestyle, and one of the most important socio-biological factors [15-17]. But let us note that the deficit of motor activity of modern students is 60-75% of the normal level necessary to maintain health. Only 13% have the necessary, physiologically determined level of physical activity, while in the countries of the European Union, it is 40-60%, and in Japan 70-80%. According to Shavaliyev *et al.* [13], in the CIS countries, a very low level of health culture among children and students is of particular concern. Scientists note that only 6% of citizens have a sufficient level of physical activity of a health-related orientation and, which is especially saddening, only every five boys or girls of school age and every ten students (one of the lowest rates in Europe) [13]. The data shows that over the past five years, the number of people completely exempted from practical classes in physical education for health reasons in the groups of physiotherapy exercises has increased 4-5 times and in special medical groups 2 times [18]. This is because the real volume of students' motor activity does not ensure their full development and health preservation.

The results of the study by Puzzitiello *et al.* [19] also confirm that young and active patients, who were actively engaged in sports before receiving an injury, recover faster physically and have significantly decreased pain scores.

As a result of the analysis of the data obtained, it was found that the level of motor activity of students at the teacher's colleges for all years of study at the university only decreases [20]. Students do not receive a training effect from physical activity because, as noted by Piozzi *et al.* [21], an exceptionally high level of physical activity can only be provided by specially organized physical education classes, intense sports games, or health-improving classes. Many students use this component of physical activity only in the form of compulsory physical education classes, and if students are absent on that day, then there is no physical activity at all. To achieve high and above average levels of physical fitness and physical condition, it is necessary to choose an individual mode of specially organized physical activity. But in this case, the student must develop an interest and desire to independently engage in physical exercises [22]. That is, the motivation is a key for physical exercises and sporting activities.

Thus, modern conditions of the educational process in higher education institutions impose a stressful situation on students. The higher education system is

focused on equipping students with the knowledge, while health remains solely the students' concern [23]. The problem of low physical activity arises, on the one hand, due to a lack of time for this type of activity, and on the other, through the lack of motivation to engage in physical exercises. Today, the problem of the development of a person's motives and needs for a certain type of activity is one of the most urgent in motivational psychology. This has been proven by many studies. The relevance of this issue is beyond doubt since the development of motives and needs is closely related to the development of an individual as a whole. The upbringing of motivation for physical education of university students is still open and quite in demand. This is because over the past two decades, young people have been little involved in physical activity, they are passive to physical exercises and, as the statistics were given above, all this has reflected on their health, which is unacceptably low and unsatisfactory.

In many individual studies, as well as in collaboration with other scientists, the issues of increasing the effectiveness of the physical education of young students were investigated [24]. The findings suggest that it is possible to achieve real shifts in the desire to engage in physical activity only by taking into account the motivation, interests, and needs of young people. The development of a positive emotional attitude towards learning among students is considered an extremely important task of motivation. This is the skill of the teacher, the ability to instill a deep interest in the assimilation of educational material in students. The results of the study convincingly indicate that everything depends on the attitude of students towards classes of physical education, since, although the educational institution can provide the opportunity to visit sports clubs for free (swimming, volleyball, basketball, tennis, gym), most students (77%) do not visit any of them. The data obtained indicated that students know that a healthy lifestyle is crucial to improve and maintaining health, but few of them adhere to it. Most of the students note the importance of motivation for physical education – health promotion and improvement of physical fitness.

The modern concept of optimization of the educational process in a university requires a radical change in the teaching routine of physical education [20]. It is necessary to develop a sustainable interest in sporting activities to improve the health and physical fitness of students for their future professional activities. The motives for attending physical education classes are different: those who are satisfied with the classes attend them for their

physical development and health promotion, and those who are not satisfied with the classes attend them for tests and to avoid trouble due to absenteeism. The specificity of the relationship between students' motivation for physical education with the level of their physical activity and indicators of physical health has been determined. Through a questionnaire survey, the following motives for physical activity of students were found: obligation (59.31%) associated with the need to attend physical education classes, to meet the requirements of the curriculum; aesthetics (29.3%) associated with the ability to learn to move beautifully, improve posture, appearance, to be in better shape; wellness (32%) associated with the desire to improve health, reduce the occurrence of diseases, normalize body weight; social (17.67%), motivated by the desire to be with friends, communicate, cooperate with them; personal (16%), which characterizes the desire to assert themselves in their midst, gain authority, and raise their prestige; sports-oriented (6.67%), which determines the desire to achieve any significant competitive results; recreational (3.3%), which is a means of entertainment, psycho-emotional relaxation, etc.

This study suggests a new approach to the assessment of student's performance in the general, advanced, and special groups of physical education in credit-based modular systems. Thus, for students of the physical education class with a full load, the following criteria were determined:

- The degree of student activity during classes
- Participation in sports competitions held in a higher institution; in mass sporting events (for example, as part of a support group, as part of a referee panel, etc.)
- Independent work of students, which may include individual homework, theoretical training, additional preparation for exhibitions at sporting events, and the like.

When determining the score of the summative assessment of students of the general and advanced groups, the following are considerable:

- Qualifying standards for the chosen sport (physical activity)
- Theoretical tests for the chosen sport (physical activity)

For the summative assessment of students of the special group, points can be awarded for:

- Theoretical training (testing on a computer, writing a reference paper, etc.)
- preparation and demonstration of sets of physical exercises for the prevention of various diseases

It is recommended to admit students who have undergone practical training and attended at least 50% of classes in the general and advanced groups of physical education or physical rehabilitation for the summative assessment^[19]. The majority of scientists and physical education instructors at the university rate the organization of the "physical education" classes in the credit-based modular system very positively and see it as a potential for self-improvement of students.

Research limitations

One limitation of this study is that the survey was conducted with a small number of participants. Due to Covid, classes at the University were limited. Therefore, it is necessary to practically apply a new approach to assessing student performance.

Conclusion

The teaching routine of physical education in most universities is based on passing tests and meeting a qualifying standard and cannot be an incentive to achieve physical improvement in young people. The majority of students (82.8%) are dissatisfied with the organization and conduct of physical education classes, which leads to their irregular attendance and a decrease in physical activity outside the classroom. In addition, the low level of physical activity of school graduates does not allow to ensure a sufficient level of development of the general physical proficiency of students, which leads to a decrease in health indicators to a level that does not provide sufficient effectiveness of training and future professional activity.

Accordingly, it is proposed a new approach to assess the performance of students in general, advanced, and special physical education groups in credit modular systems.

Acknowledgements: Nothing reported by the authors.

Ethical Permission: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflict of Interests: The authors declare no conflict of interests.

Authors' Contribution: Zhang Q (First Author), Methodologist/Main Researcher/Discussion Writer (50%); Bezmylov MM (Second Author), Introduction Writer/Assistant Researcher/Statistical Analyst (50%)

Funding: This research did not receive any grant from funding agencies in the public, commercial, or non-profit sectors.

References

- 1- Dobrovanov OY. Efficacy and sensitivity of prenatal and postnatal ultrasound screening of congenital developmental anomalies of kidneys in Slovakia. *Wiad Lek.* 2021;74(3 cz 1):450-4.
- 2- Cai W, Chen S, Li L, Yue P, Yu X, Gao L, et al. Gender-specific physical activity-related injuries and risk factors among university students in China: A multicentre population-based cross-sectional study. *BMJ Open.* 2020;10(12):e040865.
- 3- World Health Organization. Situation of child and adolescent health in Europe [Internet]. Geneva: World Health Organization; 2018 [cited 2022 Oct 21]. Available from: <https://apps.who.int/iris/handle/10665/342237>
- 4- Ten A, Zaurenbekov B, Mikhail S, Baitasov Y, Avsievich V, Telemgenova A. Prospects for the development of physical culture and grassroots sports in the Republic of Kazakhstan. *J Physic Educat Sport.* 2022;22(9):2246-53.
- 5- Halilbašić A, Kreso A, Klepic M, Jaganjac A, Avdic D. The algorithm for overload syndrome prevention: Osgood-Schlatter's syndrome as an overload syndrome caused by early inclusion of children in sports and excessive physical activity (sports and recreation). *J Health Sci.* 2019;9(3):151-8.
- 6- Ukrainian database of medical and statistical information. Health for all [Internet]. Ukraine: medstat; 2017 [cited 2022 Oct 23]. Available from: <http://medstat.gov.ua/ukr/news.html?id=203>
- 7- Koshino Y, Samukawa M, Murata H, Osuka S, Kasahara S, Yamanaka M, et al. Prevalence and characteristics of chronic ankle instability and copers identified by the criteria for research and clinical practice in collegiate athletes. *Phys Ther Sport.* 2020;45:23-9.
- 8- Van Der List JP, Mintz DN, Difelice GS. The locations of anterior cruciate ligament tears in pediatric and adolescent patients: a magnetic resonance study. *J Pediatr Orthop.* 2019;39(9):441-8.
- 9- Latka K, Kozłowska K, Waligora M, Kolodziej W, Olbrycht T, Chowaniec J, et al. Efficacy of discogel in treatment of degenerative disc disease: A prospective 1-year observation of 67 patients. *Brain Sci.* 2021;11(11):1434.
- 10- Ardakani MK, Wikstrom EA, Minoonejad H, Rajabi R, Sharifnezhad A. Hop-stabilization training and landing biomechanics in athletes with chronic ankle instability: A randomized controlled trial. *J Athle Tral.* 2019;54(12):1296-303.
- 11- Grazio S, Balen D. Physical activity and osteoporosis. *Med.* 2019;28(2):247-55. [Croatian]
- 12- Šeper V, Nešić N. Chronic traumatic encephalopathy: Diagnostic criteria and therapeutic models. *Acta Med Croat.* 2019;73(1):69-71. [Croatian]
- 13- Shavaliev RF, Fayzullina RA, Vil'danov IK, Mal'tsev SV, Yarullina GR, et al. The state of health and adherence to

- healthy living of modern schoolchildren. *Vopr Det Dietologii*. 2018;16(1):18-25.
- 14- Bologna Declaration [Internet]. Wikipedia; 2010 [cited 2022 Oct 23]. Available from: https://en.wikipedia.org/wiki/Bologna_declaration
- 15- Tołodziecki MM, Chudański MM, Ponikowska I, Adamczyk P. Nonalcoholic fatty liver disease in obese patients. *Wiad Lek*. 2014;67(2 Pt 1):76-9. [Polish]
- 16- Crimi A, Doderio L, Sambataro F, Murino V, Sona D. Structurally constrained effective brain connectivity. *NeuroImage*. 2021;239:118288.
- 17- Latka D, Waligora M, Latka K, Miekisiak G, Adamski M, Kozłowska K, et al. Virtual reality based simulators for neurosurgeons - What we have and what we hope to have in the nearest future. *Adv Intell Syst Comput*. 2018; 720:1-10.
- 18- Indicators of population health and use of health care resources in Ukraine for 2019 [Internet]. *Ukrain: medstat*; 2020 [cited 2022 Oct 24]. Available from: <http://medstat.gov.ua/ukr/MMXIX.html>
- 19- Puzzitiello RN, Liu JN, Garcia GH, Redondo ML, Christian DR, Yanke AB, et al. Return to sport and outcomes after concomitant lateral meniscal allograft transplant and distal femoral varus osteotomy. *Arthroscopy*. 2020;36(1): 253–60.
- 20- Beck L, Sahar J. Rehabilitation sport and functional training as a vehicle for physical training for those affected by osteoporosis – basics, perspectives and limitations. *Osteologie*. 2020;29(3):227-30.
- 21- Piozzi GN, Cirelli R, Salati I, Maino MEM, Leopaldi E, Lenna G, et al. Laparoscopic approach to inguinal disruption in athletes: a retrospective 13-year analysis of 198 patients in a single-surgeon setting. *Sports Med Open*. 2019;5:25.
- 22- Cabona C, Beronio A, Martinelli I, Briani C, Lapucci C, Serrati C, et al. Are basketball players more likely to develop Hiramata disease? *J Neurol Sci*. 2019;400:142–44.
- 23- Koehler RM, Cimbak NC, Parisien RL, Nicoletta RJ, Kalish JA. Bilateral popliteal artery entrapment syndrome in a young female NCAA division-I collegiate basketball player: A case report. *JBJS Case Connect*. 2020;10(3):e1900652.
- 24- Provencher MT, Frank RM, Shubert DJ, Sanchez A, Murphy CP, Zafonte RD. Concussions in sports. *Orthopedics*. 2019;42(1):12–21.