ORIGINAL ARTICLE

The impact of the COVID-19 pandemic and martial law on the health and physical fitness of Ukrainian students

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ABSTRACT

Aim: The aim is to study the impact of prolonged quarantine related to COVID-19 and martial law on the health and physical fitness of students in Ukrainian higher educational institutions.

Materials and Methods: Research methods: literature analysis, surveys, testing of students' health and physical fitness, methods of mathematical statistics. The research was conducted in 2019-2023. The survey involved 462 (143 males and 319 females) students. Health assessments and physical fitness tests were conducted with second-year students (before quarantine (2019): males – n = 63; females – n = 78; after quarantine (2023): males – n = 51; females – n = 67).

Results: The negative attitude of the majority of students (66.4 % of men and 76.5 % of women) to distance learning in physical education was revealed. A significant deterioration of all studied indicators of students' health and physical fitness during the quarantine period related to COVID-19 and martial law in Ukraine was revealed.

Conclusions: Since the state of health and level of physical fitness of students is the main criterion for the effectiveness of physical education in higher educational institutions of Ukraine, physical education departments should focus their work on modernizing traditional and developing new forms and methods of physical education, shaping students' civic consciousness and behavior, their readiness to serve society and protect the state with dignity.

KEY WORDS: health, physical fitness, COVID-19 pandemic, students

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INTRODUCTION

Constant mental and psycho-emotional tension, information stress, insufficient material security, low motor activity, inadequate nutrition, polluted environment, etc. play an important role among the factors that negatively affect students' health [1]. The health of the entire population of Ukraine and student youth, in particular, is deteriorating as a result of prolonged quarantine restrictions related to COVID-19 and the large-scale war in Ukraine, the unstable socio-economic situation, and the growing number of families forced to change their usual way of life (temporarily emigrate to other places of residence), and insufficient funding for the health care system.

The deterioration of the health of today's youth may lead to the loss of the gene pool and the biological extinction of the nation shortly. That is why one of the leading tasks of physical education of students in higher educational institutions (HEIs) at this stage is to preserve their health and foster motivational and value-based attitudes to physical exercise, to develop healthy lifestyle skills because the health of the future generation will depend on the health of the country's modern youth [2].

Health is formed under the influence of a large number of factors i. e. social and biological, material and spiritual, which interact with each other in a complex and contradictory way. Scientists [3] include physical education among the conditions that determine the preservation of health. Several studies have shown that out of the total number of factors that influence the formation of students' health (taken as 100 %), physical exercises account for 15-30 %, sleep – 24-30 %, nutrition – 10-16 %, and 24-50 % are due to the total effect of the remaining factors [4]. That is why the system of physical education, especially in higher educational institutions, is tasked with preserving the physical, mental, and moral health of young people.

According to the WHO, one in four adults and four in five adolescents have low motor activity [5]. During the COVID-19 pandemic, when students were at home for a lot of time, the quantity and quality of daily exercise were very important [6]. COVID-19 has caused devastating global morbidity and mortality not only among the elderly but also among young people. Measures have been taken around the world to prevent the transmission of the virus from person to person and improve overall health. As a result of these actions, the level of motor activity of

the population has decreased. Daily sedentary behavior has led to a decrease in the level of health and physical fitness of students and, as a result, a decrease in the body's protective functions.

AIM

The aim is to study the impact of prolonged quarantine related to COVID-19 and martial law on the health and physical fitness of students in Ukrainian higher educational institutions.

MATERIALS AND METHODS

The research was conducted at the Ivan Franko Zhytomyr State University in 2019-2023. The survey, aimed at studying students' attitudes towards distance learning in the discipline referred to as "Physical Education," involved 462 (143 males and 319 females) students of the Faculties of Physics and Mathematics, History, Socio-Psychological, Natural Sciences, and the Institutes of Foreign Philology, Pedagogics, Philology, and Journalism. Health assessments and physical fitness tests were conducted with second-year students (before quarantine, men – n = 63; women – n = 78; after quarantine, men – n = 51; women – n = 67) who were engaged in physical exercises during the discipline referred to as "Physical Education" according to the university curriculum in September-December 2019 (before the COVID-19 quarantine) and in March-May 2023 when distance learning ended.

To achieve this aim, the following research methods were used: literature analysis, surveys, testing of students' health and physical fitness, and methods of mathematical statistics. For the research, 13 sources from the scientometric databases Index Copernicus, Scopus, PubMed, Web of Science, and others were analyzed and studied. The survey, which was conducted according to the author's questionnaire, allowed us to study students' attitudes towards distance learning in the discipline referred to as "Physical Education" and evaluate its consequences. The questionnaire contained 10 questions related to the dynamics of students' motor activity during quarantine, their physical fitness and health, mental state, level of theoretical knowledge and methodological skills in physical education, and reasons for students' absence from physical education training sessions during distance learning. The state of students' health was assessed by the method of qualitative rapid assessment of the level of somatic health by G. L. Apanasenko [7], which is based on the calculated indices of body weight, vital and strength indices, Robinson Index and Martine-Kushelevsky tests. Physical fitness was assessed by the following tests: men – 100 m run, pull-ups, standing long jump, lifting torso to the sitting position over 1 min, 4 x 9 m shuttle run, leaning torso forward; women – 100 m run, push-ups, standing long jump, lifting torso to the sitting position over 1 min, 4 x 9 m shuttle run, leaning torso forward.

Methods of mathematical statistics were used to assess the reliability of the difference between the studied indicators and to correctly process the results. The compliance of the sample with the normal law was checked using the coefficient of variation (V), which allowed the use of Student's t-test. The significance for all tests was set at $p<0.05$. This research followed the regulations of the World Medical Association Declaration of Helsinki. Informed consent was received from all students who took part in this research.

RESULTS

The introduction of the self-isolation regime in 2019 restricted motor activity on the streets and sports grounds, which means that the only place where Ukrainian students were allowed to exercise was their place of residence. Training sessions were held according to the schedule via the Zoom system. Due to the transition to distance learning, students spent most of their time at the computer, in a "sitting" position, which led to physical inactivity, eye diseases, spinal curvature, and a decrease in the level of activity of their body's functional systems. The quarantine has led to the fact that such a discipline as "Physical Education" has faced the problem of a kind of incomplete implementation, since the computer, and home conditions of quarantine restrictions cannot replace the gym, training grounds, and stadium, which were previously the usual locations for training sessions.

Currently, distance learning is one of the most common forms of education in Ukraine. The quarantine restrictions (since December 2019) and martial law (since February 2022) have forced higher educational institutions to switch to distance learning. Distance learning allowed to preserve and ensure the continuity of the educational process, which was of great social and psychological importance, especially during the war. The distance learning process made it possible to control students, provide them with psychological and moral, and sometimes material support, which united society against russian aggression. The resumption of distance learning in Ukraine during the war also slowed down the departure of students abroad and facilitated their return to study, which influenced the rise of the patriotic movement of Ukrainians to fight the enemy.

At the same time, distance education has several disadvantages in conducting practical training sessions in physical education, namely: 1) high dependence of students on the quality of the Internet network; 2) lack of opportunity to communicate with the instructor and colleagues; 3) low motor activity of practical training sessions; 4) impossibility of timely intervention of the instructor in the educational process; 5) difficulty in timely correction of student's mistakes during exercises; 6) lack of individual and differentiated approach to students; 7) no possibility to control all students and provide them with timely methodological advice, etc. Studies have shown that between 9.7 and 13.8 % of students missed distance learning training sessions in the Zoom system and continued their studies in other forms. The reasons for students' absence from training sessions during the COVID-19 epidemic and martial law in Ukraine were identified as lack of an Internet network, phone, or computer, staying in places with strangers, power outages, inability to connect to

training sessions remotely, etc. (Table 1). The reasons also include the following: lack of desire to study (12.6 % – men; 9.7 % – women); poor psychological state, anxiety (16.1 % – men; 18.5 % – women); simulation (7.7 % – men; 6.0 % – women), etc.

The questionnaire survey of students allowed us to identify their attitude towards distance learning in the discipline referred to as "Physical Education" and assess its consequences. A positive assessment of the distance learning process was given by 35.7 % of male and 23.5 % of female students. The explanation for this is that these students do not prioritize studying, or have a long distance to the educational institution, work, or lack of desire to study. Most students had a negative attitude towards the distance learning process in physical education, namely: 66.4 % of men and 76.5 % of women (Table 2).

At the same time, distance learning proved to be effective in conducting theoretical, informational, cognitive, methodological, and motivational classes. An increase in the level of theoretical knowledge in the field of physical culture was indicated by 90.2 % of men and 94.4 % of women, and the level of methodological training of students increased similarly. The situation was much worse when conducting practical physical education training sessions remotely. It was impossible to complete tasks in sports games, athletics, strength exercises, etc. Students did not comprehensively develop all physical qualities, but only partially during the period of distance learning. A decrease in the level of motor activity during the COVID-19 epidemic and russia's armed aggression against Ukraine was reported by 91.6 % of men and 91.9 % of women. Distance learning has led to a deterioration in health (96.5 % of men and 89.0 % of women) and a decrease in the level of physical fitness of students (88.8 % of men and 92.8 % of women). 93.7 % of men and 86.5 % of women showed symptoms of psychological discomfort and nervousness.

Table 1. Reasons for students' absence from physical education training sessions during distance learning (number of people / %)

Reasons	Gender	
	Males (n = 143)	Females (n = 319)
Lack of an Internet network	17 / 11.9	34 / 10.7
Lack of a phone or computer	7 / 4.9	9 / 2.8
Staying in places with strangers	8 / 5.6	17 / 5.3
Power outages	13 / 9.1	29 / 9.1
Inability to connect to the training session remotely	8 / 5.6	22 / 6.9
Air raid alarms	112 / 78.3	307 / 96.2
Simulation	11 / 7.7	19 / 6.0
Lack of desire to study	18 / 12.6	31 / 9.7
Poor psychological state, anxiety	23 / 16.1	59 / 18.5

Table 2. Assessment of distance learning in the discipline referred to as "Physical Education" by students of higher educational institutions (number of people / %)

Assessment	Gender	
	Males (n = 143)	Females (n = 319)
Positive	51 / 35.7	75 / 23.5
Negative	92 / 66.4	244 / 76.5
As a temporary necessity	137 / 95.8	294 / 92.2
Increased level of theoretical knowledge	129 / 90.2	301 / 94.4
Increased level of methodological preparedness	123 / 86.0	298 / 93.4
Decreased level of motor activity	131 / 91.6	293 / 91.9
Decreased level of physical fitness	127 / 88.8	296 / 92.8
Deteriorated state of health	138 / 96.5	284 / 89.0
Psychological discomfort and nervousness	134 / 93.7	276 / 86.5
Decreased ability to communicate	119 / 83.2	307 / 96.2

Table 3. Comparative analysis of students' physical health indicators before and after quarantine

Physical health indicators	Research stages		Difference	Reliability of the difference	
	Before quarantine	After quarantine		t	p
		Males			
Body mass index, kg/m^2	23.2 ± 0.25	24.7 ± 0.29	1.5	3.92	< 0.01
Vital index, ml/kg	57.8 ± 0.83	55.1 ± 0.96	2.7	2.13	< 0.05
Strength index, %.	54.5 ± 1.17	49.6 ± 1.23	4.9	2.89	< 0.05
Robinson index, c. u.	85.6 ± 1.21	89.4±1.27	3.8	2.17	< 0.05
Martinet-Kushelevsky test, s	132.4 ± 3.21	141.8±3.38	9.4	2.02	< 0.05
		Females			
Body mass index, kg/m^2	20.7±0.28	22.3±0.30	1.6	3.90	<0.01
Vital index, ml/kg	48.5±1.06	44.9±1.13	3.6	2.32	<0.05
Strength index, %.	42.3 ± 1.13	37.2±1.19	5.1	3.11	<0.01
Robinson index, c. u.	85.1 ± 1.09	88.4 ± 1.14	3.3	2.09	< 0.05
Martinet-Kushelevsky test, s	136.7±3.52	147.5±3.71	10.8	2.11	<0.05

Table 4. Comparative analysis of students' physical fitness before and after quarantine

Tests	Research stages		Difference	Reliability of the difference	
	Before quarantine	After quarantine		t	p
		Males			
100 meters run (s)	14.53 ± 0.64	15.78 ± 0.83	1.25	2.41	< 0.05
Pull-ups (times)	8.93 ± 0.91	6.47 ± 0.94	2.46	3.38	< 0.01
Standing long jump (cm)	228.41 ± 2.13	220.26 ± 1.79	8.15	2.54	< 0.05
Lifting torso to the sitting position over 1 min (times)	38.29 ± 1.84	29.97 ± 1.83	8.32	3.21	< 0.01
4 x 9 m shuttle run (s)	9.13 ± 0.96	10.83 ± 0.89	1.70	2.82	< 0.01
Leaning torso forward (cm)	14.81 ± 0.97	10.18 ± 0.87	4.63	2.57	< 0.05
		Females			
100 meters run (s)	17.34± 1.19	18.67 ± 1.28	1.33	2.46	< 0.05
Push-ups (times)	14.57 ± 1.36	8.67 ± 1.29	5.90	3.58	< 0.001
Standing long jump (cm)	174.21 ±7.48	165.46 ± 7.64	8.74	2.23	< 0.05
Lifting torso to the sitting position over 1 min (times)	35.23 ± 2.75	27.51 ± 2.69	7.72	2.82	< 0.01
4 x 9 m shuttle run (s)	10.87 ± 0.68	11.96 ± 0.83	1.09	2.79	< 0.01
Leaning torso forward (cm)	15.76 ± 0.93	12.24 ± 0.91	3.52	2.24	< 0.05

The results of a comparative analysis of students' physical health indicators before and after quarantine are presented in Table 3. The analysis showed that all the studied indicators of students (both men and women) significantly ($p < 0.05$-0.01) deteriorated during the quarantine period. Thus, the difference between the values of body mass index of students before and after quarantine was 1.5 kg/m^2 in men and 1.6 kg/m^2 in women; between the values of vital index – 2.7 ml/kg in men and 3.6 ml/kg in women; between the values of strength index – 4.9 % in men and 5.1 % in women; between the values of Robinson index – 3.8 c. u. in men and 3.3 c. u. in women; between the values of the Martine-Kushelevsky test – 9.4 s in men and 10.8 s in women.

It was also found that distance learning during quarantine had the worst effect on the indicators of vital, strength indices and the Martine-Kushelevsky test (the duration of heart rate recovery after 20 squats over 30 seconds). The values of these indices after quarantine correspond to below-average and low levels in students of both sexes. The analysis reliably indicates a low motor activity of students during quarantine and martial law, which led to an increase in students' body weight, deterioration of their cardiovascular and respiratory systems, and a decrease in strength indicators, which in general led to a deterioration in their health. The comparative analysis of the physical fitness of students before the pandemic (2019) and after, when they started studying as usual (2023), showed a significant

decrease in physical fitness during the period of distance learning (Table 4). In all physical fitness tests, there was a significant decrease in men's indicators, namely: in 100 m run by 1.25 s, in pull-ups – by 2.46 times, in standing long jump – by 8.15 cm, in lifting torso to the sitting position over 1 min – by 8.32 times, in 4 x 9 m shuttle run – by 1.7 s, in leaning torso forward – by 4.63 s ($p < 0.05$-0.01).

Similar results in physical fitness testing were obtained for female students, where the indicators decreased in 100 m run by 1.33 s, in push-ups – by 5.9 times, in standing long jump – by 8.74 cm, in lifting torso to the sitting position over 1 min – by 7.72 times, in 4 x 9 m shuttle run – by 1.09 s, in leaning torso forward – by 3.52 s ($p < 0.05$-0.001). This indicates that students' motor activity during the period of distance learning associated with quarantine and martial law in Ukraine was very low, which negatively affected their physical fitness.

DISCUSSION

According to the results of scientific research [8], students are the most vulnerable to health deterioration in Ukraine, as they face several difficulties related to low motor activity, increased academic workload, and problems in social and interpersonal communication. One of the most serious reasons for the indifferent attitude of young people towards maintaining their health is the state of the current system of physical and health education in Ukrainian higher educational institutions of various professional orientations [9]. There has been a loss of the educational focus of the physical education process, which has resulted in a low level of physical education among students. As a result of the COVID-19 pandemic and the full-scale war in Ukraine, negative trends in the deterioration of student health continued at an even faster pace. Currently, Ukraine's health care system is not able to solve the problem of improving student health.

In modern conditions, scientists [10] consider health as a multidimensional phenomenon with a heterogeneous structure that combines qualitatively different components and reflects the fundamental aspects of human existence. At the same time, the system of physical education does not help to solve the problems of preserving students' health. The concept of "health" in our minds turns into a rather mundane, widely used term, the content of which is not necessary to think about every day, which practically does not stimulate the assessment of its importance in everyday life. The whole complexity of organizing health education in the system of physical education of students in a distance format is a complex, dynamic process and belongs to the spheres of both education and attitude development.

A high degree of academic load connected with distance learning for most students led to a decrease in the level of motor activity, which resulted in the development of various diseases, and a decrease in their mental and physical working capacity [11, 12]. At the same time, the authors [13] point out that performing daily physical exercises for 20-50 minutes will improve physical and mental health, ensure that physical fitness is maintained at the proper level, and strengthen the immune system. Therefore, physical education departments in distance learning should recommend that all students train and exercise (subject to quarantine conditions) to promote their health in order to maintain a sufficient level of motor activity, promote health, and spend time in self-isolation not only without negative consequences for the body but also with benefit.

CONCLUSIONS

1. Quarantine restrictions have created extremely difficult conditions for ensuring the quality of the educational process in physical education, especially practical training sessions. The issue of organizing and conducting physical education training sessions during quarantine has become extremely acute: lack of necessary information on working in such conditions, a completely new format of physical education training sessions to ensure the necessary motor activity of students with a safe and interesting approach, skepticism of the general public about physical education through a computer monitor, etc. At the same time, distance learning in physical education has provided ample opportunities for students to acquire theoretical knowledge on healthy lifestyles, health care, knowledge of their bodies, and mastery of health-saving technologies. On the other hand, distance physical education has significantly limited the motor capabilities of students, reduced the level of their motor activity, health, and physical fitness, and limited the mastery of skills in various sports.

2. The comparative analysis of the state of health and physical fitness of students before quarantine restrictions and after their completion convincingly confirmed the low quality of practical physical education training sessions in remote mode, and low level of motor activity, which significantly reduced the level of health and physical fitness of students, both men and women.

3. Physical education in a distance format is the process of students' learning the values of physical culture, and mastering special knowledge and vital motor actions, which results in their ability to independently "manage" their health, carry out preventive, and, if necessary, rehabilitation and corrective measures. Designing the process of distance learning for students is a new direction in pedagogical science that requires the development of special pedagogical methods and physical education and health technologies for their implementation during quarantine conditions. At the same time, it is necessary to develop students' responsible attitudes towards their health, and not just the accumulation and expansion of health-saving methods and teaching technologies. On the contrary, it is necessary to specify, define, and substantiate the content of students' physical education and health activities in distance learning. During distance learning in physical education, it is important to form fundamental general theoretical health-preserving knowledge, methodological skills, and practical implementation of available physical exercises.

Prospects for further research are aimed at testing the effectiveness of the author's methodology for conducting physical education training sessions in the distance learning mode.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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