

ORIGINAL ARTICLE

State of students' health and physical fitness under the restrictions of martial law

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ABSTRACT

Aim: To study the impact of martial law restrictions on the level of students' health and physical fitness at higher educational institutions.

Materials and Methods: The research conducted in 2022-2024 involved 127 students (58 men, 69 women). Methods included analysis, synthesis and generalization of literary sources, express methodology for assessing physical health, testing of physical qualities, and methods of mathematical statistics.

Results: It has been established that martial law restrictions negatively impact students' health and physical fitness. Over the two years of war, the level of physical health has significantly deteriorated by 1.8 for male students and by 2.0 for female students. The results of all physical fitness tests have also significantly deteriorated for both male and female students. Among the physical qualities, the most pronounced negative changes occurred in the endurance, strength, and flexibility indicators.

Conclusions: The research results show that students' education under martial law in Ukraine, which takes place in various formats, is accompanied by significant emotional and intellectual intensity, extremely limited motor activity, and stressful situations. This negatively affects the health and physical fitness of today's students. Future specialists' poor health and low physical fitness can negatively impact their professional working capacity and cause various diseases.

KEY WORDS: health, physical fitness, motor activity, students, martial law

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INTRODUCTION

Many global problems in modern education need to be addressed immediately, but among them are vital issues on which the existence of the educational system and the entire society depends. One of them is the state of students' health, which, unfortunately, is a serious concern in Ukraine [1, 2]. Among the factors that negatively affect the health of students, not the least role is played by constant mental and psycho-emotional strain, information stress, insufficient material security, disorders in diet and sleep, and, especially, a decrease in motor activity. Moreover, in recent years, quarantine restrictions caused by the COVID-19 pandemic and martial law factors have led to even greater restrictions on motor activity among Ukrainian students [3, 4].

According to the World Health Organization, physical activity is any body movement performed by skeletal muscles that requires energy expenditure, including activity during work, play, homework, travel, and recreational activities [5]. According to the World Health Organization recommendations, a person needs 150 minutes of moderate activity or 75 minutes of vigorous physical activity to stay healthy [5, 6]. These recommendations can be fulfilled at home without special equipment and in limited space.

Scientists [7, 8] argue that most students currently have insufficient motor activity, which leads to the development of hypokinesia. This is an important risk factor for developing various diseases and a decrease in mental and physical performance. During the global quarantine, when educational institutions switched to distance learning, this situation worsened many times over [9]. The war in Ukraine has led to a difficult and unique challenge for both students and the education sector as a whole, as it is a sector that plays a crucial role in overcoming its negative consequences and restoring the health of young people in particular and society as a whole [10]. The martial law in Ukraine has affected the education of today's generation, as today's students face distance learning, relocation, changes in

their usual living conditions, constant stress, threats to life due to missile danger, and a reduction in sports activities in educational institutions and at their place of residence. There was a communication restriction and a dramatic change in lifestyle, education, and employment [11]. According to scientists [12], all this negatively impacted their health and physical fitness. Our research aims to verify these conclusions by assessing the dynamics of Ukrainian students' physical health and physical fitness during the two years of war.

AIM

The aim is to study the impact of martial law restrictions on the level of students' health and physical fitness at higher educational institutions.

MATERIALS AND METHODS

The research was conducted at the Ivan Franko Zhytomyr State University in 2022-2024. The research involved 127 students (58 men, 69 women) aged 17-20 who entered the Faculty of Philology in 2022. Students' health and physical fitness indicators were assessed at the beginning of the 1st semester and at the end of the 4th semester of their study. Physical education, as a compulsory academic subject area, was conducted only during the first instructional year in the amount of 2 hours per week.

The following methods were used to achieve the aim of the research: analysis, synthesis and generalization of literature sources, express methodology for assessing physical health by H. L. Apanasenko, testing of physical qualities, and methods of mathematical statistics. The express methodology of physical health assessment by H. L. Apanasenko provided for determining the sum of points for five indices characterizing both the physical development of students and the functional capabilities of the main systems of their body (body mass index, vital index, strength index, Robinson index, time of heart rate recovery to the initial values after 20 squats in 30 seconds) [13]. The following seven tests assessed physical fitness: 100 m run (to determine the level of development of quickness), pull-ups (for female students – push-ups) (to determine the level of development of strength), standing long jump (to assess the level of development of speed and strength qualities), lifting the torso to the sitting position for 1 min (to determine the level of development of strength endurance), 4 x 9 m shuttle run (to assess the level of development of agility), 1 km run (to determine the level of development of endurance), torso tilt forward (to assess the level of development of flexibility).

The significance of the difference in the results of the students was determined during the studying based on the Student's test. Before the experiment, the groups of adolescents were tested for normal distribution using the Kolmohorov-Smyrnov test in IBM SPSS Statistics 23.0. The distributions were found to be normal, which allowed for statistical calculations using Student's t-test. The significance for all statistical 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 results of the assessment of the dynamics of physical health indicators in male students during martial law in Ukraine are presented in Table 1; female students are presented in Table 2.

The analysis of body mass index indicators showed that during the two years of war, there was a significant deterioration by 1.3 kg/m^2 in male students ($p < 0.05$) and by 1.4 kg/m^2 in female students ($p < 0.01$). The deterioration of this index is due to an increase in body fat in students due to a significant decrease in their motor activity during the war. Despite the fact that the value of the body mass index in students of both sexes is within the age norm, the indicators have a steady tendency to deteriorate, which can lead to overweight and obesity in the future.

The analysis of the vital index showed a significant ($p < 0.05$) deterioration in the functional capabilities of the respiratory system of students during the war: in men – by 2.4 ml/kg, in women – by 3.5 ml/kg. This confirms the conclusions of many scientists about the negative impact of martial law restrictions, accompanied by stress and hypokinesia, on students' lung capacity. After the two years of war, the indicators of the vital index correspond to a below-average level.

The strength capabilities of students, which were assessed by indicators of the strength index, also significantly deteriorated over the two years of war. Thus, in male

Table 1. Dynamics of health indicators in male students during martial law (X ± m, n = 58)

Health indicators	Before martial law	After the two years of war	The difference	Reliability of the difference	
				t	p
Body mass index, kg/m^2	23.2±0.32	24.5±0.35	1.3	2.74	<0.05
Vital index, ml/kg	56.2±0.79	53.8±0.84	2.4	2.08	<0.05
Strength index, %	58.7±1.07	55.3±1.12	3.4	2.20	<0.05
Robinson index, c. u.	85.4±1.14	88.9±1.18	3.5	2.13	<0.05
Heart rate recovery time, s	122.6±2.61	131.2±2.73	8.6	2.28	<0.05
Health level, points	5.4±0.48	3.6±0.51	1.8	2.47	<0.05

Table 2. Dynamics of health indicators in female students during martial law (X ± m, n = 69)

Health indicators	Before martial law	After the two years of war	The difference	Reliability of the difference	
				t	p
Body mass index, kg/m^2	21.3±0.27	22.7±0.31	1.4	3.41	<0.01
Vital index, ml/kg	50.9±0.97	47.4±1.02	3.5	2.49	<0.05
Strength index, %	48.4±0.95	43.8±1.06	4.6	3.26	<0.01
Robinson index, c. u.	83.9±1.08	87.1±1.13	3.2	2.05	<0.05
Heart rate recovery time, s	125.9±2.28	134.2±2.45	8.3	2.48	<0.05
Health level, points	5.1±0.39	3.1±0.42	2.0	3.49	<0.01

students, the difference between the initial and final data of the research is 3.4 % ($p < 0.05$), and in female students – 4.6 % ($p < 0.01$). At the same time, the strength index of students of both sexes at the end of the research is estimated as "low," which indicates a significant deterioration in the training of the muscular system during the period of martial law. Changes in the Robinson index allow us to judge the effectiveness of the cardiovascular system of students. In contrast, the growth of the index shows a deterioration in the system's functional capabilities. Thus, in the process of studying students under martial law for the two years, a significant decline of the Robinson index is observed: in male students – by 3.5 c. u. ($p < 0.05$), in female students – 3.2 c. u. ($p < 0.05$). These conclusions are confirmed by the negative dynamics of the duration of heart rate recovery after exercise. This indicator worsened by 8.6 s ($p < 0.05$) in male students, and in female students – by 8.3 s ($p < 0.05$).

Assessment of students' general level of physical health using the method of H. L. Apanasenko showed that, like all indices, the level of health also deteriorated during the two years of war. The difference between the indicators before and at the end of the research is 1.8 points ($p < 0.05$) in male students and female students – 2 points ($p < 0.01$). In general, the level of physical health of students of both sexes after the two years of war decreased to a low level, which confirms the negative impact of martial law restrictions on students' bodies.

The results of assessing the dynamics of physical fitness of male and female students, presented in Tables 3 and 4, confirmed our previous conclusions about the negative impact of martial law restrictions on students' physical health. The largest and most significant changes were in the endurance, strength, and flexibility indicators. Thus, male students' results in running for 1 km deteriorated by 34.89 s ($p < 0.01$), in pull-ups – by 3.09 times ($p < 0.01$), in torso tilt forward – by 3.67 cm ($p < 0.01$).

Female students have a similar trend to men – deterioration of results in all tests; however, the most pronounced negative changes occurred in the results of 1 km run (by 51.08 s ($p < 0.01$)), push-ups (by 4.31 times ($p < 0.01$)) and in torso tilting forward (by 2.89 cm ($p < 0.05$)).

DISCUSSION

Motivating students to engage in independent physical exercises during martial law is one of the central problems of education, which should preserve a healthy nation capable of defending its state, rebuilding it, eliminating the consequences of war, and integrating into the European educational space.

During martial law, a decrease in motor activity is usually associated with an irrational student's daily routine. In the context of studying the bulk of the material remotely, the time when students are forced to maintain an uncomfortable static position while sitting at their workplace and limit their natural motor activity increases [14]. It is also important to note that a negative consequence of a decrease in motor

Table 3. Dynamics of physical fitness of male students during martial law (X ± m, n = 58)

Tests	Before martial law	After the two years of war	The difference	Reliability of the difference	
				t	p
100 meter run, s	14.72±0.68	15.23±0.83	–0.51	0.48	>0.05
Pull-ups, times	8.93±0.72	5.84±0.97	–3.09	2.56	<0.05
Standing long jump, cm	223.21±7.64	218.26±7.43	–4.95	0.46	>0.05
Lifting the torso to the sitting position for 1 min, times	34.45±1.57	29.71±1.64	–4.74	2.09	<0.05
4 x 9 m shuttle run, s	9.58±0.93	10.37±0.76	–0.79	0.66	>0.05
1 km run, s	282.52±7.15	317.41±	–34.89	3.42	<0.01
Torso tilt forward, cm	12.81±0.81	9.14±0.75	–3.67	3.32	<0.01

Table 4. Dynamics of physical fitness of female students during martial law (X ± m, n = 69)

Tests	Before martial law	After the two years of war	The difference	Reliability of the difference	
				t	p
100 meter run, s	17.24±0.83	18.78±0.95	–1.54	1.20	>0.05
Push-ups, times	13.48±0.86	9.17±0.93	–4.31	3.40	<0.01
Standing long jump, cm	169.21±6.84	164.52±7.12	–3.69	2.91	<0.05
Lifting the torso to the sitting position for 1 min, times	31.67±1.57	27.35±1.78	–4.32	1.82	>0.05
4 x 9 m shuttle run, s	10.91±0.85	11.85±0.96	–0.94	0.73	>0.05
1 km run, s	327.14±9.21	378.22±9.85	–51.08	3.79	<0.01
Torso tilt forward, cm	15.35±0.91	12.46±0.98	–2.89	2.16	<0.05

activity is the exacerbation of symptoms of existing chronic diseases and the deterioration of the main functional systems of the body. As a result of insufficient motor activity in the daily routine, weakness and lethargy of muscles occurs, general cerebral circulation is disturbed, venous stasis of blood in the lower extremities occurs, and the body's working capacity decreases [15].

According to many scientists [16, 17], one of the urgent issues of state policy in Ukraine is the organization of student youth's health improvement. In the context of a significant deterioration in the psychophysical state of student youth, the issue of preserving their health cannot be considered outside the context of physical education of students in higher educational institutions. At the same time, one of the key problems is the proper organization of students' physical culture and health recreation activities in independent forms in the conditions of extremely limited motor activity in modern realities. Restriction of motor activity associated with distance learning in martial law is one of the main factors in reducing students' health reserves and physical fitness. In addition, physical inactivity leads to a decrease in the level of students' responsibility for maintaining their health and developing healthy lifestyle skills [18]. Therefore, there is a need to find new effective means and methods to solve the problems of attracting and engaging students in academic and independent physical exercises.

Poor health and a low level of psychophysical fitness of future professionals negatively affect professional skills and cause the emergence of occupational diseases. At the same time, good health, a high physical working capacity, and professional skills are the main factors contributing to successful performance in any profession [19].

Scientists [20] argue that physical activity is the best way to relieve psycho-emotional strain, overcome stress, and prevent various diseases. Physical loads improve mood and lead to an optimal level of functional state of the body. Regular exercise is a preventive measure against the negative effects of emotional stress [21]. Engaging in various types of physical activity has a positive impact on stabilizing the student's psychophysical state. While doing physical exercises, a student abstracts from mental activity, unpleasant sensations, fear, and excessive worries. Thanks to this switching, the nervous system is relatively calm, reducing stress's impact on the student's body.

At the same time, the adaptation of modern education in the field of physical education to the conditions of distance learning in martial law necessitates the development of a new model of this process based on the process of applying independent physical activity, which requires the search for new effective ways and means of physical improvement and personal responsibility for their health and physical fitness. It has been established that among the main factors of a healthy lifestyle, students' independent physical activity takes one of the last places. Instead, the lack of physical activity results in being overweight, disrupting daily routines, and causing a lack of motivation. Students must maintain a healthy lifestyle under martial law for a long time.

Training sessions in higher educational institutions during martial law should be aimed at solving the problems of preserving and improving the health of student youth, where students should be motivated to engage in systematic physical exercises, and the effectiveness of systematic physical exercises for each student should be established [22]. It is necessary to convince students that systematic exercise helps to improve the functioning of all organs and systems of the body, exercises in conditions of motor activity restriction are the most important means of preventing diseases and promoting health in stressful conditions of war.

Our research examines the aspects of a significant deterioration in student youth's health and physical fitness. It analyzes one of the key problems, i.e., the proper organization of students' physical culture and health recreation activities in various forms in the conditions of extremely limited motor activity caused by martial law in Ukraine. Martial law has necessitated the optimization of the structure and content of physical education in higher educational institutions. It is necessary to create conditions for increasing efficiency, promoting a healthy lifestyle, and overcoming public indifference to public health; ensuring the functioning and improvement of the network of physical culture and mass sports institutions; developing sports infrastructure, including the construction and modernization of sports

facilities; and providing quality sports and fitness services. This will help create appropriate conditions for developing physical culture and mass sports in Ukraine under martial law and post-war reconstruction.

CONCLUSIONS

It has been established that martial law restrictions hurt students' health and physical fitness. Over the two years of war, the level of physical health has significantly deteriorated by 1.8 for male students and by 2.0 for female students. The results of all physical fitness tests have also significantly deteriorated for both male and female students. Among the physical qualities, the most pronounced negative changes occurred in the endurance, strength, and flexibility indicators.

The results of the research show that students' education under martial law in Ukraine, which takes place in various formats, is accompanied by significant emotional and intellectual intensity, extremely limited motor activity of students, and the presence of stressful situations. This has a negative impact on the health and physical fitness of today's students. Poor health and low level of physical fitness of future professionals can negatively affect their professional working capacity and cause various diseases. Therefore, one of the important tasks of the educational process of higher educational institutions of Ukraine under martial law is to enhance the system of physical and sports improvement of students to strengthen their physical and mental health, boost their level of physical fitness, and foster motivation for systematic physical activity.

Prospects for further research include working out and implementing a modern methodology for developing and maintaining students' health and physical fitness through rational motor activity during martial law.

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CONFLICT OF INTEREST
The Authors declare no conflict of interest

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