

ORIGINAL ARTICLE

Improving students' somatic health through aerobic-oriented motor activity

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ABSTRACT

Aim: To investigate the impact of a rationally organized motor activity incorporating aerobic-oriented exercises on the somatic health of university students.

Materials and Methods: The research, conducted in 2025-2026, involved 82 first-year education majors. An experimental group (EG, n = 42) and a control group (CG, n = 40) were formed. The EG students followed the author-developed motor activity program, which incorporated aerobic-oriented exercises, while the CG students followed the traditional physical education program. The students' somatic health was assessed using body mass index (BMI), vital index (VI), strength index (SI), and the Ruffier test.

Results: Positive dynamics in indices were observed in the EG during the research: among male students – BMI by 0.3 kg/m², VI by 2.9 ml/kg, SI by 3.5 %, and the Ruffier test by 0.4 c. u.; female students – BMI by 0.5 kg/m², VI by 3.1 ml/kg, SI by 1.8 %, the Ruffier test by 0.9 c. u. No significant changes were observed in the CG. The comparative analysis of the studied indicators at the end of the research demonstrated statistically significant ($p \leq 0.05$ -0.001) better health indicators in the EG students compared to the CG.

Conclusions: The results of this research demonstrate the effectiveness of a rationally organized motor activity incorporating aerobic-oriented exercises in improving students' somatic health. This will help enhance mental and physical performance, reduce illness incidence, and, consequently, improve students' academic performance during martial law.

KEY WORDS: physical education, motor activity, somatic health, students, aerobic-oriented exercises

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INTRODUCTION

Harmonious personal development is supported by adequate motor activity, a key factor in determining the population's health. Adequate motor activity among students is the foundation for proper physical development. Insufficient motor activity leads to declines in students' health and physical fitness and contributes to the onset and progression of various diseases [1, 2].

The ineffective organization of physical education in higher education institutions (HEIs) in Ukraine under current martial law conditions leads to decreased motivation to engage in physical exercise and, as a result, a decline in motor activity among students [3]. According

to researchers [4, 5], insufficient motor activity (hypodynamia) significantly affects students' bodies, leading to general weakness, apathy, memory impairment, and a weakened immune system. Prolonged sitting at a desk or computer disrupts metabolism and leads to serious health problems. This can lead to poor posture, scoliosis, osteochondrosis, and muscle atrophy; ligaments become less elastic, increasing the risk of injury. The heart muscle weakens, the volume of blood pumped decreases, tachycardia occurs, and the risk of developing hypertension increases. Due to oxygen deprivation, concentration decreases, mental performance deteriorates, and insomnia, chronic fatigue, anxiety, and de-

pressive states appear. A slowed metabolism can cause weight gain, impair bowel function, and contribute to obesity [6, 7].

The analysis of the literature [8] indicates that most researchers focus on general issues regarding motor activity among young people; however, questions regarding the rational organization of students' motor activity using aerobic-oriented exercises to improve their somatic health remain unresolved. Aerobic exercises are rhythmic activities that engage large muscle groups and use oxygen to produce energy [9]. They train the cardiovascular system, accelerate metabolism, and reduce the risk of developing chronic diseases. Cardio training increases the amount of oxygen supplied to the muscles and improves cardiovascular function. They also help reduce the risk of cardiovascular disease, diabetes, and obesity [10]. Programs incorporating aerobic-oriented exercises consist of cyclic forms of motor activity: walking, running, swimming, cross-country skiing, cycling, aerobics, and cardio machine exercises [11, 12]. Therefore, research on the impact of motor activity involving aerobic-oriented exercises on students' somatic health during martial law is timely and relevant.

AIM

The aim is to investigate the impact of a rationally organized motor activity incorporating aerobic-oriented exercises on the somatic health of university students.

MATERIALS AND METHODS

PARTICIPANTS

The research, conducted in 2025-2026, involved 82 first-year students majoring in education at Dragomanov Ukrainian State University (aged 17-18), including 43 males and 39 females. An experimental group (EG, $n = 42$ (20 female students and 22 male students)) and a control group (CG, $n = 40$ (19 female students and 21 male students)) were formed. The students in the EG participated in the author-developed motor activity program incorporating aerobic-oriented exercises (4 training sessions of 1 hour per week under the guidance of health and fitness trainers). In comparison, the CG students followed the traditional physical education program at the HEI (2 training sessions of 2 hours per week under an instructor's guidance). The weekly volume of motor activity (exercise) in the EG and the CG was the same. No special selection of students for the EG and the CG was conducted: the EG included students from the 1st and 2nd academic groups enrolled

in 2025 at the Faculty of Pedagogy, and the CG included students from the 1st and 2nd academic groups enrolled in 2025 at the Faculty of Natural Sciences. The exception was students with health impairments, who were assigned to a special medical group and did not attend physical education training sessions. Assessment of baseline somatic health indicators also showed no significant differences between the EG and the CG ($p > 0.05$). The duration of the experiment was 9 months (September 2025 – May 2026). Limitations of the research: during the experiment, we did not account for students' motor activity levels in the EG and the CG during extracurricular hours (such as household and daily activities).

RESEARCH METHODS

Theoretical, medical-biological, and statistical. Theoretical methods enabled us to review the literature on the subject, develop a program for rationally organized motor activity among students, and discuss the results obtained. A total of 20 sources from international scientometric databases were used.

Medical-biological methods were applied to study indicators of students' somatic health. Students' somatic health was assessed using the following morphofunctional indices: body mass index (BMI), vital index (VI), and strength index (SI) (Table 1) [13, 14].

In addition, the Ruffier test was used to assess the functional status of the students' cardiovascular system. After a 5-minute rest in a seated position, the students' heart rate was measured over 15 seconds. Following this, the student performed 30 squats with arms extended forward for 45 seconds. After completing the squats, the HR was measured during the first 15 seconds of the first minute of recovery and during the last 15 seconds of the first minute of recovery. The assessment of the cardiovascular system's functional capacity was determined using a calculation method. The level of the heart's functional reserve and the body's adaptation to physical exertion were determined as follows: less than 3 c. u. – high level; 4-6 c. u. – above average (good); 7-9 c. u. – average; 10-14 c. u. – below average (satisfactory); above 15 c. u. – low level [15].

To determine the students' motor activity at the beginning of the research, we used the Framingham method, according to which each student recorded in a table the number of hours per day spent on activities of varying levels of physical activity. Accordingly, the motor activity index (MAI) was determined. This method describes the day from when students woke up after a night's sleep until they fell asleep, and daily

activity is divided into five levels: baseline, sedentary, low, average, and high [16].

STATISTICAL METHODS

At the beginning of the experiment, the homogeneity of all indicators of the EG and the CG was determined, i.e., the absence of a significant difference in the studied indicators ($p > 0.05$), and it was found that the distributions of the EG and the CG are normal, which allowed us to assess the reliability of the results using Student's t-test. The reliability of the difference was set at $p \leq 0.05$. All statistical analyses were performed using SPSS software. The results were presented as Mean $\pm$ m, where Mean is the arithmetic mean and m is the standard error of the arithmetic mean.

ETHICAL STANDARDS

The process of research implementation is built following the requirements of scientific ethics. The Academic Ethics Commission of the Dragomanov Ukrainian State University approved the research. The pedagogical experiment was open, and its participants were informed about the aim and tasks of the research, and they voluntarily participated in it.

AI STATEMENT

The author states that no AI tools were used in writing this article.

FRAMEWORK

This study was carried according to the research plan of the Faculty of Physical Education, Sports and Health of the Dragomanov Ukrainian State University in 2023–2027 in accordance with the theme “Monitoring, control and evaluation of learning results in physical culture, the basics of healthy lifestyle” (state registration number 0113U009185).

RESULTS

At the beginning of the research (September 2025), we determined the students' motor activity levels using the Framingham method. It was found that at baseline, which included sleep and rest while lying down, the level of motor activity among male students was 8.0 ± 1.9 hours. Traveling by public transport, resting while sitting, and eating – activities that fall under the sedentary level of motor activity – accounted for an average of 4.0 ± 1.4 hours. The analysis of the daily

motor activity timings of the students showed that the majority of time is spent at the low level (independent study preparation, personal hygiene, walking, learning sessions at the HEI, excluding physical education) of motor activity, the average duration of which is 9.1 ± 2.6 hours for male students. The indicators for average and high levels of motor activity were the lowest. Thus, the average level of motor activity, which includes household chores, walks, and morning exercises, amounted to 2.6 ± 2.0 hours for male students.

The baseline level, which includes sleep and resting while lying down, accounted for 8.7 ± 1.6 hours of motor activity among female students. Traveling by public transport, resting while sitting, and eating – activities that fall under the sedentary level of motor activity – accounted for an average of 4.2 ± 1.3 hours for female students. The average duration of low motor activity among female students was 10.8 ± 1.8 hours. Thus, the average level of motor activity, which includes household chores, walks, and morning exercises, was 2.6 ± 1.1 hours for female students.

The structure of students' daily motor activity indicates a predominance of sedentary and low levels of motor activity. Thus, on average, female students spend 5.1 hours on studying, and male students – 4.5 hours; approximately 2.5 hours for both female and male students are spent on commuting and eating, while preparation for learning sessions takes 3.0 hours for female students and 1.9 hours for male students. Sitting rest takes about 5.0 hours per day for female students and 3.4 hours for male students.

Thus, the MAI score based on the Framingham method was 25.4 ± 1.5 points for male students and 26.8 ± 2.9 points for female students. Given that the optimal MAI score is 42 points, which corresponds to an eight-hour duration of baseline activity, an eight-hour duration of sedentary activity, a two-hour duration of low physical activity, and a three-hour duration of high physical activity, our research found that no student achieved this score, confirming their low level of motor activity. At the same time, specially organized motor activity among female and male students amounted to 1.1 hours and 0.6 hours, respectively. The results indicate a lack of rationally organized motor activity among students before the start of the experiment.

In light of the above, we designed the author-developed program of rationally organized motor activity that incorporates aerobic-oriented exercises to improve students' somatic health. The program for the EG students was based on systematic, health-improving fitness training sessions led by professional trainers, who took into account the students' gender, level of physical fitness, and individual psychological character-

Table 1. Value of indices for assessing students' somatic health indicators

Indices	Male students					Female students				
	Low	Below average	Average	Above average	High	Low	Below average	Average	Above average	High
BMI, kg/m ²	≤18.9	19.0-20.0	20.1-25.0	25.1-28.0	28.1-30.0	≤16.9	17.0-18.6	18.7-23.8	23.9-26.0	26.1-28.0
Points	-2	-1	0	-1	-2	-2	-1	0	-1	-2
VI ml/kg	≤50	51-55	56-60	61-65	≥66	≤40	41-45	46-50	51-56	≥57
Points	-1	0	1	2	3	-1	0	1	2	3
SI, %	≤60	61-65	66-70	71-80	≥81	≤40	41-50	51-55	56-60	≥60
Points	-1	0	1	2	3	-1	1	1	2	3

Source: compiled by the authors of this study

Table 2. Dynamics in somatic health indicators among the EG and the CG students over the course of the research (Mean ± SD)

Indices	Research phase	Study groups		The difference	Significance of the difference	
		EG (n = 42)	CG (n = 40)		t	p
Male students						
BMI, kg/m ²	Beginning	22.8±0.27	23.1±0.25	0.3	0.82	>0.05
	End	22.5±0.26	23.4±0.28	0.9	2.36	≤0.05
	t	0.80	0.81			
VI, ml/kg	Beginning	53.7±0.85	54.2±0.89	0.5	0.41	>0.05
	End	56.6±0.86	53.8±0.91	2.8	2.24	≤0.05
	t	2.40	0.31			
SI, %	Beginning	63.6±0.75	63.9±0.78	0.3	0.28	>0.05
	End	67.1±0.74	63.7±0.80	3.4	3.12	≤0.01
	t	3.22	0.18			
Ruffier test, c. u.	Beginning	10.3±0.11	10.2±0.12	0.1	0.61	>0.05
	End	9.9±0.11	10.3±0.12	0.4	2.46	≤0.05
	t	2.57	0.59			
Female students						
BMI, kg/m ²	Beginning	21.7±0.19	21.5±0.21	0.2	0.71	>0.05
	End	21.2±0.20	21.8±0.22	0.6	2.02	≤0.05
	t	1.81	0.99			
VI, ml/kg	Beginning	44.2±0.79	44.6±0.81	0.4	0.35	>0.05
	End	47.3±0.77	44.1±0.83	3.2	2.83	≤0.05
	t	2.81	0.43			
SI, %	Beginning	48.3±0.71	47.7±0.69	0.6	0.61	>0.05
	End	50.1±0.72	47.2±0.70	2.9	2.89	≤0.05
	t	1.78	0.51			
Ruffier test, c. u.	Beginning	10.7±0.12	10.5±0.114	0.2	1.08	>0.05
	End	9.8±0.13	10.6±0.15	0.8	4.65	≤0.001
	t	5.09	0.49			

Legend: t – Student's t-test value, p – statistical significance indicator

Source: compiled by the authors of this study

istics when planning them. Health-improving fitness is a set of carefully selected physical exercises designed to promote health, prevent disease, improve posture, develop flexibility, and correct body alignment. Its main goal is to increase the body's overall tone without harming the heart or joints. Basic aerobics was used for female students, and strength fitness for male students. Basic aerobics is the most common type of aerobics, consisting of a combination of general developmental gymnastic exercises, various types of running, jumps, and hops, performed to music at a tempo of 120-160 beats per minute, using a continuous or series-continuous method. The primary physiological focus of this type of aerobics is the development of endurance and the improvement of the functional capacity of the cardiorespiratory system. High impact is high-intensity basic aerobics that involves active use of jumps and running; it was recommended for students with a high level of physical fitness. Low impact is low-intensity basic aerobics that includes training sessions primarily involving walking, half-squats, and lunges; recommended for students with low physical fitness levels. Step aerobics involves performing exercises on a special platform with an adjustable height ranging from 10 to 30 cm. In step aerobics, two categories were distinguished: students with coordination issues who could not dance during training sessions on the step platform, focusing not on dance movements but on athletic movements with increased physical exertion. Female students with good coordination and dance training performed dance exercises featuring quick transitions, varied movement patterns, and directions. Climbing up and down the steps strengthens the leg muscles and ligaments, while vigorous arm movements strengthen the upper body. Using dumbbells weighing up to 2 kg helped engage the shoulder girdle muscles. Approximately 250 movements were performed on the step platform. To prevent joint overload, the step height should be such that the angle of leg flexion when stepping onto the step is 90 degrees. The load (intensity) was adjusted based on heart rate.

Strength-fitness training sessions for students are aimed to improve cardiovascular function and building strength. Over 50 % of the exercises in the training sessions focused on developing the strength of the shoulder girdle, trunk, and abdominal muscles, as well as the leg and back muscles. Dumbbells, body bars (gymnastic sticks), barbells, medicine balls, and kettlebells were used in the training sessions. Various resistance bands were used to increase the load during strength exercises. Each training session included 6-10 exercises, with 10-12 or more repetitions per set, in 3-6 sets. The load was adjusted by the weight, number of

repetitions, sets, exercise pace, and the complexity of coordination.

The results of the study on the effect of a rationally organized, author-developed motor activity program on students' somatic health are presented in Table 2. For all indicators studied in both male and female students, no significant difference was found between the EG and the CG at the beginning of the experiment ($p > 0.05$).

The analysis of BMI showed that during the experiment, the BMI values improved among students in the EG, by 0.3 kg/m^2 among male students ($p > 0.05$) and by 0.5 kg/m^2 among female students ($p > 0.05$). In the CG, conversely, a non-significant deterioration in BMI was observed, by 0.3 kg/m^2 in male students ($p > 0.05$) and by 0.3 kg/m^2 in female students ($p > 0.05$). At the end of the experiment, the BMI values in the EG students were significantly ($p \leq 0.05$) better than in the CG, by 0.9 kg/m^2 in male students and by 0.6 kg/m^2 in female students, respectively. The improvement in BMI among the EG students can be explained by the positive effect of aerobic-oriented exercise on reducing body weight. The BMI values in the EG and the CG correspond to the average level.

Assessment of VI indicates that in the EG, there was a statistically significant ($p \leq 0.05$) improvement in the functional state of the respiratory system among students during the experimental period: by 2.9 ml/kg in male students and by 3.1 ml/kg in female students. In the CG, a negative trend in the VI values was observed ($p > 0.05$): in male students, by 0.4 ml/kg ; in female students, by 0.5 ml/kg . At the end of the experiment, the VI values were significantly higher ($p \leq 0.05$) in the EG than in the CG, by 2.8 ml/kg in male students and 3.2 ml/kg in female students. This indicates that aerobic-oriented exercises positively increase vital lung capacity and are quite effective in improving the respiratory system in students. In the CG, the VI at the end of the research was assessed as below average, while in the EG, it was assessed as average.

Assessment of students' muscular system development using the SI values indicates that, in the EG, as with the previous indices, there was an improvement in students' strength, particularly among male students. Thus, over the course of the experiment, the SI values in male students of the EG improved significantly by 3.5 % ($p \leq 0.01$), and in female students by 1.8 % ($p > 0.05$). In the CG, the SI values did not change significantly ($p > 0.05$), although a tendency toward deterioration was observed during training. At the end of the research, the SI values in the EG were significantly higher than in the CG, by 3.4 % in male students ($p \leq 0.01$) and by 2.9 % in female students ($p \leq 0.05$). In the EG, the SI was assessed as average after the experiment, while in the CG, it was assessed as below average.

Assessment of the functional state of the cardiovascular system in students using the Ruffier index indicates that the EG students exhibited positive changes in indicators of cardiac functional reserve and the body's adaptation to physical exertion. Thus, during the experiment, the EG students showed a statistically significant improvement in the Ruffier index values of 0.4 c. u. in male students ($p \leq 0.05$) and 0.9 c. u. in female students ($p \leq 0.001$). No significant changes were observed in the CG ($p > 0.05$). After the experiment concluded, the Ruffier index values in the EG were significantly higher than those in the CG by 0.4 c. u. in male students ($p \leq 0.05$) and by 0.8 c. u. in female students ($p \leq 0.001$). This allows us to conclude that aerobic-oriented exercises positively affect endurance development and the functional capacity of the cardiovascular system in students during their studies. At the same time, the EG exhibited an average level of cardiovascular functional capacity at the end of the experiment, while the CG's level was below average.

The results convincingly demonstrate the greater effectiveness of rationally organized motor activity, based on aerobic-oriented exercises, in strengthening students' somatic health compared to traditional physical education methods in HEIs.

DISCUSSION

Modern living conditions place increased demands on the health and intellectual abilities of young people. Future professionals must possess high professional qualifications and be healthy and physically fit; therefore, students' health is a crucial factor throughout their learning and professional activities [17].

One of the most important factors in improving students' health is active motor activity [18]. This activity is a complex process given the objectively existing contradictions, which include: the contradiction between the large volume of academic and scientific information and the lack of time for motor activity; the contradiction between the desire for autonomy in selecting physical education and health-promoting activities based on personal interests and the rigid framework of the curriculum and academic programs. Furthermore, an extremely significant negative factor currently adversely affecting students' health and motor activity is the war in Ukraine and all its consequences [2, 19].

Therefore, among the main directions of educational modernization, one key priority is improving the quality of management of students' motor activity, a crucial condition for enhancing their somatic health. This requires developing modern programs that rationally organize motor activity to improve students' somatic

health and increase motor activity during physical education [3, 20]. Researchers [9, 10] believe that aerobic-oriented exercises – activities during which oxygen serves as the primary source of energy for muscle activity – are the most effective for improving students' health during their studies under martial law. They are widely used as an effective means of strengthening students' health and enhancing their work capacity. In addition, aerobic activity involves prolonged, intense work of many large muscle groups and has physiological and biomechanical effects. With regular aerobic-oriented exercises, heart and lung function improve, the risk of cardiovascular disease decreases, and so on [8, 11]. Taking into account the findings of numerous studies, we designed the author-developed, rationally organized motor activity program using aerobic-oriented exercises to improve students' somatic health, based on systematic health-oriented fitness sessions during their studies at the HEI. Basic aerobics was used for female students, and strength fitness for male students. The results of the research demonstrated a more pronounced effect of rationally organized motor activity based on aerobic-oriented exercises (health-improving fitness) on strengthening students' somatic health than traditional physical education methods in HEIs.

Thus, rationally organized motor activity, which contributes to increasing the capacity and stability of general adaptation mechanisms by improving the functions of the central nervous system, allows not only for maintaining health but also for ensuring high performance in specific types of student activities. The results of our research confirm the conclusions of many scientists in this field and expand upon them.

CONCLUSIONS

The impact of rationally organized motor activity incorporating aerobic-oriented exercises on somatic health among university students was investigated. Positive dynamics in morphofunctional indices were observed in the EG during the research: among male students – BMI by 0.3 kg/m², VI by 2.9 ml/kg, SI by 3.5 %, and the Ruffier test by 0.4 c. u.; female students – BMI by 0.5 kg/m², VI by 3.1 ml/kg, SI by 1.8 %, the Ruffier test by 0.9 c. u. No significant changes were observed in the CG. The comparative analysis of the studied indicators at the end of the research demonstrated statistically significant ($p \leq 0.05$ -0.001) better health indicators in the EG students compared to the CG, according to the following indices: BMI by 0.9 kg/m² in male students and by 0.6 kg/m² in female students; VI by 2.8 ml/kg in male students and by 3.2 ml/kg in female students; SI by

3.4 % in male students and by 2.9 % in female students; the Ruffier index by 0.4 c. u. in male students and by 0.8 c. u. in female students.

The results of this research demonstrate the effectiveness of a rationally organized motor activity incorporating aerobic-oriented exercises in improving students' somatic health. This will help enhance mental and physical performance, reduce illness incidence,

and, consequently, improve students' academic performance during martial law.

PROSPECTS FOR FURTHER RESEARCH

Future research will focus on determining individual levels of motor activity among students who use information and communication technologies.

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CONFLICT OF INTEREST

The Authors declare no conflict of interest

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