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CONTROL OF PHYSICAL FITNESS OF 5TH–9TH GRADES SCHOOL STUDENTS

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Abstract ***Background and Study Aim*:** Recently, in Ukraine, along with the deterioration of health, there has been a decrease in the level of physical fitness of schoolchildren. Management of the process of physical education of schoolchildren is based on a system of control over the level of their physical fitness. Testing of physical fitness is an element of stage control both in the system of sports training and in the practice of physical education. In recent years, scientific literature and reports by researchers and practitioners have actively discussed the appropriateness of using movement tests to assess schoolchildren's physical fitness during physical education. These discussions focus on the informational value of such tests in relation to physical health indicators, as well as the standards for interpreting the test results.

Purpose: to determine the dynamics of physical fitness of students of grades 5–9 during their studies at school.
Material & methods: 300 students of grades 5–9 of Lutsk comprehensive school No. 17 took part in the study. Nine control exercises were used to determine the level of physical fitness. The research was at the school stadium and in the school's sports hall. We obtained parental consent for their children's participation in the experiment.
***Results*:** Studies have shown that children have an average level of physical fitness. A low level of physical fitness was demonstrated during the endurance test. Below average physical fitness was found during the speed test and the long jump test while the sit up test demonstrated above average results.
Conclusion. The relevance of our research lies in the fact that it has revealed which physical qualities are underdeveloped in schoolchildren. This will help the physical education teacher to introduce appropriate adjustments to the pedagogical process to enhance the physical fitness of students.

Key words: physical education, students, speed, endurance, strength.

Introduction

In recent years, the special literature discusses the feasibility of using motor tests to monitor physical fitness (Aperman-Itzhak et al., 2018; Grasten, 2017). The basis of the national system of physical education is a set of indicators. It includes: the number of weekly physical activity, physical development, functional state of body systems, physical performance and motor skills (Baranowski, 2017; WHO, 2019).

This set of indicators can sufficiently characterize person's physical condition (Greco et al., 2019; WHO, 2019). It makes it possible to determine the viability of the human body and improve it through exercise (Hynynen et al., 2016; WHO, 2019). This is particularly relevant for assessing physical fitness (Andrieieva et al., 2020; Jongenelis et al., 2018).

By choosing tests, you can determine the level of functioning of individual body systems (Drljačićet al., 2012; Jongenelis et al., 2018; Yelizarova et al., 2020). Performing physical exercises in the classroom can influence the level of their functioning, and thus improving health (Minatto et al., 2019; Yuksel, 2019; Andrieieva et al., 2019).

Basic physical abilities improve as the body grows and develops. Each of them has sensitive periods (Pbert et al., 2016; Panhelova & Tsapuk, 2018; Van de Kop et al., 2019). The processes of growth and development in adolescents are characterized by irregularity and fluctuation. (Drozdovska et al., 2020; Fedorov & Sharmanova, 2004). This is an adaptation, the development of evolution (Tian et al., 2017; Krutsevich, 2003; Petrachkov et al., 2022). The development of the child's body directly depends on the activity of skeletal muscles. Also sufficient musculoskeletal activity or hypodynamics and hypokinesia, which inhibits this process (Hakman et al., 2020; To et al., 2019; Erhan & Tamer, 2017). A certain amount of muscular load is necessary for a teenager not only for physical but also for intellectual development (Kuzmenko, 2013; Physical education curriculum for secondary schools. Grades 5 – 9. MONU). During the study, test tasks that were used have a high degree of reliability and informativeness (Mameshina et al., 2015; Yarmak et al., 2018).

The purpose of the study was to examine the dynamics of physical fitness among students in grades 5 to 9 during their school years.

Material and Methods

Participants: 300 schoolchildren (150 boys and 150 girls) of the 5th–9th grades of the Lutsk General Education School of the I–III degrees No. 17 took part in the study. The study was conducted at the school stadium and in the school's sports hall.

The scientific research procedure was conducted in accordance with the ethical standards of the responsible human rights committee with the approval of the Department of Education and Science of the executive body of the Lutsk City Council and the written consent of the director of school and the parents of the respondents, which is confirmed by relevant documents.

Procedure: The research was conducted during the 2023–2024 academic year and consisted of three stages. At the first stage of the research, we analyzed the scientific and methodological and special literature. For control tests, a test battery was used to determine the level of development of various physical qualities, namely:

- 30 m and 60 m sprint;
- Steady running (1000 m and 1500 m);
- Pull-ups on a horizontal bar (boys) and push-ups from a lying position (girls);
- Handgrip dynamometry;
- Sit-ups in 1 minute;
- Standing long jump;
- 4 × 9 m shuttle run;
- Sit and reach test (forward bend from a sitting position);
- Flamingo balance test.

All of students systematically took part in physical education classes twice a week. Control tests from the school physical education program for grades 5–9 were used, with the permission of the school doctor.

Reception of control exercises was carried out twice. Primary testing at the beginning of the school year – to determine the initial level of physical fitness of students in grades 5–9. Final testing – at the end of the school year to determine changes in the physical fitness of children during their studies.

The Eurofit test battery was used for the study (Drljačić et al., 2012; Fedorov et al., 2004; Yelizarova et al., 2020). At the third stage, based on the use of the method of mathematical and statistical processing of the obtained data, we found out the level of development of the basic motor qualities of students of grades 5–9 and their dynamics during the academic year.

Statistical analysis: informed consent for participation in this experiment was obtained from all participants. Statistical processing of the study materials was conducted using Microsoft Excel 2010. The arithmetic mean and the bias of the arithmetic mean were calculated. The credibility of differences between sample rates was tested using the Student's t-test and considered statistically significant at $p > 0,05$.

Results

To determine the physical fitness of adolescents, we used motor tests aimed at assessing each physical quality (Table 1, Table 2). In physical education and wellness training, it is important to cultivate the ability to exhibit speed in holistic motor activity. Speed is characterized by the ability to perform the maximum number of movements

over a period of time. This quality is extremely important in cyclic motor actions. Therefore, the speed study was based on the analysis of the dynamics of running adolescents 30 m, 60 m.

Table 1. Indicators of physical fitness of 5-th – 9-th grade boys (n = 150)

n	Test	Before the experiment		After the experiment		Δx	t	p
		X	s	X	s			
				5th grade				
1	30 m sprint (s)	6.70	1.36	6.30	0.3	0.1	0,04	< 0,05
2	Steady running 500 (m)	690	143	750	0.75	0.5	0,2	< 0,01
3	Pull-ups on a horizontal bar	7.52	1.18	8.63	0.73	0.01	0,69	< 0,05
4	Handgrip dynamometry	13,6	0,96	13,8	1,2	0,2	1,35	< 0,05
5	Sit-ups in 1 minute	24.80	1.03	26,34	0,8	0,1	0.65	< 0,05
6	Standing long jump(c)	134.5	2.32	141.20	2.09	1.1	2,50	< 0,05
7	4 × 9 m shuttle run(s)	12.24	6.0	12.0	0.18	0.11	0,03	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	3.4	0.52	3.6	0.73	0.1	0,9	< 0,05
9	Flamingo balance test	16	2.3	14	1.01	0.02	10,28	< 0,01
				6th grade				
1	60 m sprint (s)	6.29	0.15	6.0	0.2	0.2	0,04	< 0,05
2	Steady running 600 (m)	855	145	1000	0.34	0.3	0,1	< 0,01
3	Pull-ups on a horizontal bar	12.70	0.3	13.1	0.1	0.1	0.23	< 0,05
4	Handgrip dynamometry	4.03	0.4	4.7	0.2	0.4	1.19	< 0,05
5	Sit-ups in 1 minute	27.10	0.31	28.09	0.3	0.3	1,01	< 0,05
6	Standing long jump(c)	148.67	1.13	150.0	1.0	1.0	2.13	< 0,05
7	4 × 9 m shuttle run(s)	11.58	0.7	11.3	0.24	0.1	0,02	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	3.67	0.24	4.11	0.08	0.1	2,07	< 0,05
9	Flamingo balance test	9	0,45	8	0.11	0.1	9,89	< 0,05
				7th grade				
1	60 m sprint (s)	6.06	0.4	5.9	0.1	0.1	0,03	< 0,01
2	Steady running 1000 (m)	4.36	0.32	5.8	0.26	0.2	0,22	< 0,05
3	Pull-ups on a horizontal bar	5.33	0.67	6.0	0.41	0.3	0,09	< 0,05
4	Handgrip dynamometry	12.48	1.02	13.19	1.01	0.1	0,5	< 0,05
5	Sit-ups in 1 minute	29.57	0.32	31.83	0.59	0.1	0,37	< 0,05
6	Standing long jump(c)	149,17	1.56	152,0	2,9	0,7	0,13	< 0,05
7	4 × 9 m shuttle run(s)	11,3	0.15	11.0	0.15	0.2	0,1	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	4.33	0.21	4.54	0.15	0.1	1,01	< 0,05
9	Flamingo balance test	8	0.23	7	0.01	0.3	9.19	< 0,01
				8th grade				
1	60 m sprint (s)	9.6	0.2	9.4	0.3	0.3	0,2	< 0,05
2	Steady running 1500 (m)	7.6	0.3	7.30	0.2	0.1	0,2	< 0,01
3	Pull-ups on a horizontal bar	3.5	2.5	6.0	0.3	0.1	0,19	< 0,05

4	Handgrip dynamometry	19.98	1.3	21.27	0.2	0.1	0,1	< 0,05
5	Sit-ups in 1 minute	32,63	0.15	33.96	0.46	0.1	0.1	< 0,05
6	Standing long jump(c)	160.19	0.5	162.0	0.8	0.3	0,3	< 0,05
7	4 × 9 m shuttle run(s)	11.15	0.55	11.0	0.1	0.1	0,2	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	5.33	1.2	6.0	0.1	0.2	0,1	< 0,05
9	Flamingo balance test	7	0.14	6	0.1	0.2	6.93	< 0,01
	9th grade							
1	60 m sprint (s)	10.24	0.2	10.00	0.1	0.1	0,1	< 0,05
2	Steady running 1500 (m)	7.38	0.3	7.10	0.1	0.2	0,1	< 0,01
3	Pull-ups on a horizontal bar	4.2	2.5	8.0	0.2	0.3	0,1	< 0,05
4	Handgrip dynamometry	21.00	1.1	22.53	0.1	0.1	0,1	< 0,05
5	Sit-ups in 1 minute	33,63	1,8	36,86	0.21	0.13	0.1	< 0,05
6	Standing long jump(c)	174.00	0.5	178.0	0.3	0.2	0,2	< 0,05
7	4 × 9 m shuttle run(s)	10.47	0.55	10.3	0.3	0.1	0,2	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	6.23	1.2	7.0	0.2	0.3	0,1	< 0,05
9	Flamingo balance test	6	0.14	5	0.1	0.2	7.37	< 0,01

X – Arithmetic mean; s – Standard deviation; Δx – marginal sampling error for mean / confidence sampling error or marginal error; t – is Student's t test

Table 2. Indicators of physical fitness of girls of 5th–9th grades (n = 150)

n	Test	Before the experiment		After the experiment		Δx	t	p
		X	s	X	s			
	5th grade							
1	30 m sprint (s)	7.07	7.3	7.3	0.68	0.3	0,4	< 0,05
2	Steady running 400 (m)	648	53	700	0.1	0.2	0,2	< 0,01
3	Bending and extending the arms in a lying position	15.97	0.76	16.0	0.2	0.34	0,35	< 0,05
4	Handgrip dynamometry	5,55	1.03	6.17	0.56	0.02	1,12	< 0,05
5	Sit-ups in 1 minute	22.40	2.32	24.30	1.17	0.1	1,35	< 0,05
6	Standing long jump(c)	120.25	6.0	125.0	2.09	1.1	2,50	< 0,05
7	4 × 9 m shuttle run(s)	13.14	0.52	13.00	0.18	0.11	0,03	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	4.4	2.22	4.9	1.11	0.2	2,27	< 0,05
9	Flamingo balance test	17	2.3	15	1.01	0.02	10,28	< 0,01
	6th grade							
1	60 m sprint (s)	6.29	0.15	6.0	0.2	0.2	0,04	< 0,05
2	Steady running 500 (m)	855	145	1000	0.34	0.3	0,1	< 0,01
3	Bending and extending the arms in a lying position	17.45	0.3	18.1	0.1	0.1	0.13	< 0,05
4	Handgrip dynamometry	15.23	0.12	16.17	0.01	0.01	0.05	< 0,05
5	Sit-ups in 1 minute	23.67	1.32	26.17	0.7	0.1	0,5	< 0,05
6	Standing long jump(c)	140.67	1.13	145.0	1.0	1.0	2,13	< 0,05
7	4 × 9 m shuttle run(s)	12.18	0.7	12.0	0.24	0.1	0,02	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	4.67	0.24	5.01	0.08	0.1	2,07	< 0,05
9	Flamingo balance test	12	0.45	10	0.11	0.1	9,89	< 0,01

				7th grade				
1	60 m sprint (s)	6.06	0.4	5.9	0.1	0.1	0,03	< 0,01
2	Steady running 1000 (m)	4.36	0.32	5.8	0.26	0.2	0,22	< 0,05
3	Bending and extending the arms in a lying position	18.05	0.1	20.0	0.2	0.1	0.3	< 0,05
4	Handgrip dynamometry	18.48	1.02	20.19	1.01	0.01	0,5	< 0,05
5	Sit-ups in 1 minute	25.15	0.2	26.15	0.2	0.4	0,1	< 0,05
6	Standing long jump(c)	146.17	1.56	149.0	2.9	0.7	0,13	< 0,05
7	4 × 9 m shuttle run(s)	12.15	0.15	12.0	0.15	0.2	0,1	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	5.33	0.21	5.54	0.15	0.1	1,01	< 0,05
9	Flamingo balance test	9	0.23	9	0.01	0.3	9,19	< 0,01
				8th grade				
1	60 m sprint (s)	9.6	0.2	9.4	0.3	0.3	0,2	< 0,05
2	Steady running 1000 (m)	7.6	0.3	7.30	0.2	0.1	0,2	< 0,01
3	Bending and extending the arms in a lying position	19.98	1.3	21.27	0.2	0.1	0,1	< 0,05
4	Handgrip dynamometry	19.98	1.3	21.27	0.2	0.1	0,1	< 0,05
5	Sit-ups in 1 minute	31.45	0.1	32.18	0.1	0.1	0,1	< 0,05
6	Standing long jump(c)	149.17	0.5	155.0	0.8	0.3	0,3	< 0,05
7	4 × 9 m shuttle run(s)	12.0	0.55	11.30	0.1	0.1	0,2	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	5.33	1.2	7.0	0.1	0.2	0,1	< 0,05
9	Flamingo balance test	9	0.14	8	0.1	0.2	6,93	< 0,01
				9th grade				
1	60 m sprint (s)	10.24	0.2	10.00	0.1	0.1	0,1	< 0,05
2	Steady running 1000 (m)	7.38	0.3	7.10	0.1	0.2	0,1	< 0,01
3	Bending and extending the arms in a lying position	21.03	0.3	22.26	0.1	0.1	0,1	< 0,05
4	Handgrip dynamometry	21.00	1.1	22.53	0.1	0.1	0,1	< 0,05
5	Sit-ups in 1 minute	31.10	1.1	32.02	0.2	0.2	0,2	< 0,05
6	Standing long jump(c)	160.00	0.5	163.0	0.3	0.2	0,2	< 0,05
7	4 × 9 m shuttle run(s)	11.37	0.55	11.0	0.3	0.1	0,2	< 0,05
8	Sit and reach test (forward bend from a sitting position);(c)	7.17	1.2	8.23	0.2	0.3	0,1	< 0,05
9	Flamingo balance test	7	0.01	6	0.1	0.2	0.37	< 0,01

X – Arithmetic mean; s – Standard deviation; Δx – marginal sampling error for mean / confidence sampling error or marginal error; t – is Student's t test

The first and seventh tests were determined in seconds (seconds, s), the second – in meters (m), the third and fifth – in number of times, the fourth – in conventional units stronger hand, the sixth, eighth – in centimeters, the ninth test – in the number of attempts.

The increase in results in speed among boys occurs up to the 7th grade. Further deterioration of indicators is observed. A similar trend is observed among girls (Fig. 1).

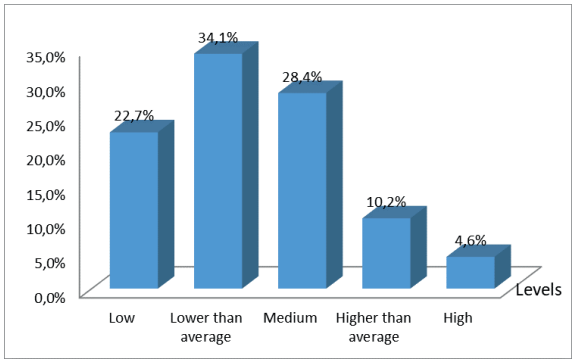

Fig. 1. Average speed indicators in children of 5th–9th grades, %

Endurance is characterized by a person's ability to perform work for a long time without reduction its performance. Overall endurance is based on the functions of the aerobic system, which includes cardiovascular, respiratory and circulatory.

In general, boys have a tendency to increase in endurance results, in the representatives of 5th, 7th and 9th grades, followed by stabilization and even a slight deterioration of the indicators. Girls have a similar tendency, with the highest increase in results occurring in the 5th and 6th grade representatives (Fig. 2).

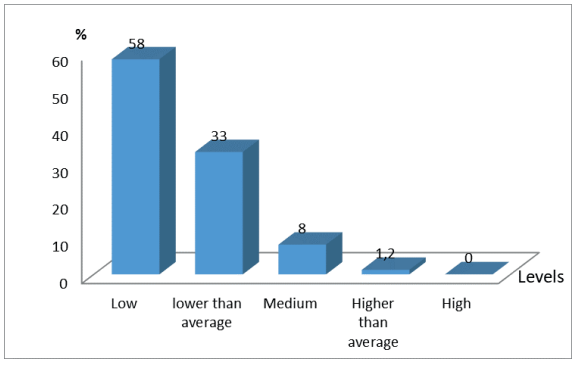

Fig. 2. Average indicators of the level of endurance in children of 5th–9th grades, %

Regarding the analysis of the results of students' strength abilities, we observe the following trend. During the pull-up test on the horizontal bar, boys showed improved results up to the 7th grade. A stabilization in strength development is observed in grades 7–8. From the 9th grade there is an increase in strength. In girls, there is an increase in strength to 9th grade (Fig. 3).

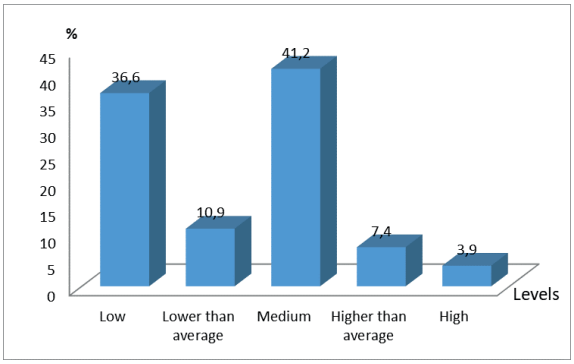

Fig. 3. Average indicators of the level of strength in boys of 5th–9th grades, %

An analysis of the strength level of girls when performing arm bending and extending test is presented on (Fig. 4).

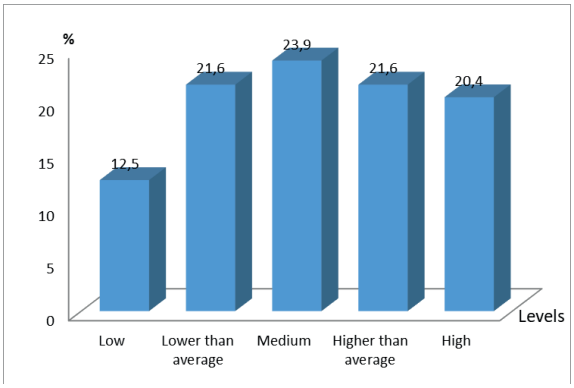

Fig. 4. Average indicators of strength level in girls of 5th–9th grades, %

It is established that the indexes of force (in particular – wrist dynamometry), in pupils of secondary schools of II and III degree are within the age norm and are estimated as average.

The results of the test «sit-ups» increase to the 6th–7th grade. A similar trend was found in the standing long jump. A moderate increase in speed-strength qualities is observed in boys in the 5th grade and in girls in the 9th grade. Boys show the most significant improvement in grades 8 and 10, while girls experience the greatest increase in grades 5–6.

Analyzing the results obtained in the test «standing long jump» for both boys and girls, there is an increase with age.

The analysis of the 4 × 9 m shuttle run test results indicated that boys exhibited performance improvements through the 6th grade, followed by a decline in the 7th grade, and subsequent improvement between the 8th and 9th grades.

A similar trend is observed in girls. Increased dexterity occurs up to 6th grade. In the 7th–8th grades stabilization takes place. In the 9th grade there is an increase in performance. In the 9th grade it gets worse. The analysis of indicators of the level of agility in students during the test «4 × 9 m shuttle run» is presented.

Analysis of the flexibility of students during the test «push-ups from a lying position» found that the results improve until the 7th grade. From the 8th to the 9th grade there is a decline in results.

The following trend is observed in girls. By the 7th grade there is an increase in flexibility. In the 8th and 9th grades stabilization occurs. It is worth noting that the rates of flexibility in girls are higher than in boys. This phenomenon is natural.

The Flamingo balance test is intended to assess statistical equilibrium. The results of our research showed that the average student performs this exercise from 3 to 14 attempts. Boys perform better than girls.

Discussion

The study was based on the indicators of test exercises, which are provided in the curriculum for physical education for secondary schools, grades 5–9. We determined the level of physical fitness of students. It was found that students have an average rate of physical fitness when performing tests to identify the development of strength, agility, flexibility and statistical balance. A significant percentage of children who have a low level of physical fitness was demonstrated when taking an endurance test. Below the average indicator of physical fitness among students of 5th – 9th grades was found when passing the speed test and in the control exercise «standing long jump». When passing the test «side torso lifts », a significant proportion of children showed above average level of physical fitness. No high level of physical fitness was found in any student.

The value of our study is that we identified which physical qualities are underdeveloped in schoolchildren. Therefore, in physical education lessons, teachers need to be given such exercises that would develop in children such motor skills as: endurance, speed and speed-strength abilities. The results of our research supplemented the data of Krutsevich (2003) on the periodic monitoring of the level of physical fitness of adolescents. It will allow the physical education teachers to see the shortcomings in the physical fitness of students and, if possible, individually plan physical activity, realistically assess the level of achievement and systematically adjust them. And for students it should be a stimulus of motivation for self-improvement of their physical abilities. Kuzmenko (2013) suggested reviewing the tests and requirements for them. The endurance test generally does not take into account time, for students of 5th–6th grades. Therefore, it is quite difficult to assess this quality in students. We share this view. Mameshina (2015) suggests that there is an urgent need today to develop a system of tests and standards of physical fitness for students. Test exercises must meet the age and appropriate standards of physical fitness. They should focus on a «safe» level of physical health. We support this view.

The results of other studies by Rodríguez. (2025) indicate that 41–44% of schoolchildren are characterized by a low level of physical fitness, and 33–34% – a very low level of physical fitness. Only 2% of students have a good level of physical fitness. Today, the physical fitness of students is at a low level. A particularly significant lag is observed in tests related to the manifestation of speed abilities and speed endurance. These students cannot fulfill the minimum regulatory requirements of the school program in physical education and quickly get tired, have lower functional abilities of the body.

Conclusions

The relevance of our research lies in the fact that it has revealed which physical qualities are underdeveloped in schoolchildren. This will help the physical education teachers to introduce appropriate adjustments to the pedagogical process to enhance the physical fitness of students.

Thus, studies have shown that children have an average level of physical fitness when performing tests to identify strength, agility, flexibility, and statistical equilibrium. A significant percentage of children with low fitness levels have been demonstrated with the endurance test. Below the average of physical fitness among students of 5th – 9th grades was found when passing the speed test and in the control exercise «standing long jump». When taking the «sit-up» test, a significant proportion of children demonstrated above average fitness. No high level of physical fitness was found in any student. The differences we have found in the level of motor performance are the basis for introducing a differentiated approach to the students in determining the optimal physical activity, volume and intensity of exercise for shaping a healthy lifestyle of students.

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