

## Original Article

### The analysis of physical fitness of students of 13-14 years in the process of physical education

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#### Abstract

The article deals with the results of the study of the physical fitness of students aged 13-14 years, including such motor qualities: speed, agility, flexibility, endurance, strength and speed-strength qualities. The aim of the work is to determine and evaluate the indicators of physical fitness of the secondary-school-age children who attend only physical education classes according to the school curriculum. The study involved 324 people, including 161 girls and 163 boys, the students under study were 13-14 years old.

The results obtained in the course of the study were compared with the control standards of school tests. The analysis of the results of pedagogical testing made it possible to determine the leading and insufficiently developed motor qualities in the students studied and to make an analysis of the level of physical fitness. We found out that in students of the 7<sup>th</sup> grade 51.8 % of boys and 1.5 % of girls correspond to a low level of agility; 40.7 % of boys and 10.4 % of girls correspond to a low level of strength qualities; 31.5% of boys and 38.8% of girls have a low level of speed; 9.3 % of boys and 34.3 % of girls have a low level of flexibility; there is a low level of endurance in 3.7 % of boys and in 16.4 % of girls.

Analysing the level of development of motor qualities in schoolchildren of the 7<sup>th</sup> and 8<sup>th</sup> grade, we came to the conclusion that the overwhelming majority of students had individual results at an average and low levels, although there is a positive dynamics of improvement with age. The received data can be an orienting point for the physical fitness improvement and correction of its level in the process of physical education.

**Key words:** students, physical fitness, motor qualities.

#### Introduction

The priority task of the system of physical education in Ukraine is the orientation of the pedagogical process on the improvement of the health of the younger generation. The main goal of physical education is to strengthen health, to improve physical condition, to promote the development of basic physical qualities and motor abilities of students. (Kashuba, 2010; Galan, 2017; Yarmak, 2017).

The optimal level of general physical fitness is the basis of the process of physical perfection of a person. Constant dynamic observation of indicators of physical fitness is a means of the effectiveness monitoring of the process of physical education in general educational establishments and making appropriate adjustments to the curricula and pedagogical activity of the physical education teachers. (Krutsevych, 2001; 2012). Control exercises enable the teacher to identify students with a low level of physical fitness and individualize the process of physical education. (Yarmak, 2017). Determining the students' physical fitness level is one of the most important tasks in the work of scientists and physical education teachers. Testing in this direction helps to solve a number of complex pedagogical tasks: to reveal the level of development of motor qualities, to evaluate the quality of the process of physical education. On the basis of the test results, it is possible: to compare the fitness of different age groups, to carry out objective control over the development of physical qualities, to determine the advantages and disadvantages of the applied means, training methods and forms of organization of lessons (Dudnyk, 2013). The question of the peculiarities of the development of various motor qualities in adolescents of different gender and their adequate evaluation in the course of school lessons, remains a topical issue, it should be an incentive for motivation to improve the physical qualities of students. This problem is especially urgent against the background of the need for the radical reorganization of physical education in the education system, which is associated with a sharp exacerbation of the issue of the physical fitness of student youth.

These provisions determine the relevance of the research related to the need to solve a scientific task that is of significant theoretical and practical importance for improving the process of physical education of the students of secondary school age.

#### Materials and Methods

During the research there were used: the method of theoretical analysis and generalization of data from scientific and methodological literature and analysis of documentary materials, that made it possible to study the

theoretical and methodological foundations of the organization of physical education of schoolchildren of 13-14 years; the method of pedagogical observation of the educational process of schoolchildren; pedagogical testing of physical fitness. The results were processed using the mathematical statistics method.

The study was carried out on the basis of the Chernivtsi specialized school of levels I-III of the Physical and Mathematical profile No. 6, the Chernivtsi specialized school of levels I-II No.22, Chernivtsi General Education School of levels I-III No. 27, the General Education School of levels I-III at the Vasyl Stefanyk Precarpathian National University, Ivano-Frankivsk. Students of grades 7-8 took part in the summative experiment. 324 people (163 boys and 161 girls) were examined.

## Results

Basic physical abilities are improved as the body grows and develops. Each of them has its sensitive period. The processes of growth and development in adolescents are characterized by unevenness and undulation, which is an adaptation produced by evolution. The development of the organism is directly dependent on the activity of the skeletal musculature: hypodynamia and hyperdynamics inhibit this process (Galan, 2015). To characterize the physical fitness of schoolchildren of secondary school age, we used 7 motor tests (running 30 m race, running 1,000-1,500 m race, shuttle running 4x9 m, bending forward from the sitting position, the standing long jump, flexion and extension of arms in front lying support, pull-up) all of them are included in the curriculum for physical education for grades 5-9 of general education schools.

When comparing the average statistical results presented in Tables 1-2 to the curriculum standards for physical education for students of grades 7 and 8, it should be noted that in girls and boys of the 7<sup>th</sup> grade an average and sufficient levels of the motor qualities development are dominated. Analysing the running of 30 m race, which characterizes the development of high-speed qualities, we found out that in boys of the 7<sup>th</sup> grade the average result is significantly lower ( $p < 0.05$ ) than in girls. In the process of studying individual results, we found that in the 7<sup>th</sup> grade only 6.0 % of the girls had a high level of speed, 37.3 % of girls had a sufficient level, 17.9 % of girls had an average level, and 38.8% of girls had a low level. In the schoolboys of the 7<sup>th</sup> grade, 9.2 % of the boys had a high level of speed qualities, 38.9 % of boys had a sufficient level, 20.4 % of boys had an average level and 31.5 % of boys had a low level.

The minimum and maximum results of running 30-meter race of the 7<sup>th</sup>-grade schoolchildren were as follows: girls - 5.4 seconds and 10.7 seconds; boys 5.1 seconds and 6.9 seconds, respectively. The variation coefficients of the indicators of the speed qualities development of schoolchildren of the 7<sup>th</sup> grade were less than 14.6 %, which indicates the homogeneity of the samples. Some of the main prerequisites of the high speed manifestation are: the structure of the muscle fibres, the internal muscle and intermuscular coordination, the mobility of the nervous processes, which manifests itself in the perfection of the excitation and inhibition processes in various parts of the nervous system, and the level of neuromuscular coordination, the capacity and capability of the creatine phosphate sources of energy and buffer systems of the body, the level of development of speed-strength qualities and flexibility; intensity of volitional efforts.

Table 1. The average statistical indicators of physical fitness of the girls and boys of the 7<sup>th</sup> grade ( $n = 121$ )

Indicators	$\bar{X}$	S	Me	25 %	75 %	V, %
Girls (n=67)						
Running 30m, s	6.7	0.45	6.6	5.6	6.1	6.7
Shuttle running 4 × 9 m, s	12.7	0.48	12.5	11.9	12.5	3.8
Pull-up, times	6.5	1.38	7.0	6.0	7.0	21.2
Bending forward from the sitting position, cm	9.3	3.36	10.0	6.0	12.0	36.1
Standing long jump, cm	148.0	14.18	145.0	140.0	152.0	9.5
Sit-up from the back-lying position, times /30 seconds	12.7	5.20	16.0	18.0	26.0	31.1
Running 1,000 m race, min. sec	5.30	0.52	5.14	5.06	5.29	9.8
Boys (n=54)						
Running 30m, s	6.2*	0.36	6.0	5.6	5.9	5.8
Shuttle running 4 × 9 m, s	11.9*	0.50	12.0	11.4	12.4	4.2
Pull-up, times	3.2	1.77	3.0	4.0	7.0	55.3
Bending forward from the sitting position, cm	3.9*	1.79	4.0	3.0	5.0	45.9
Standing long jump, cm	157.3*	30.97	162.0	135.0	180.0	19.7
Sit-up from the back-lying position, times /30 seconds	16.3*	5.05	14.5	12.0	21.0	31.0
Running 1,500 m race, min. sec	5.19*	0.49	5.17	5.49	5.21	9.4

Note: \* -  $p < 0.05$ , statistically significant difference compared to the girls.

The average results of students of the 8<sup>th</sup> grade indicate that the speed of overcoming the distance increases with age. Considering the age-related dynamics of the natural development of speed in all its manifestations, it can be concluded that it progresses during life significantly less than other motor qualities and it undergoes age-related evolutionary changes earlier than other motor qualities, even with its special development. We found that the speed qualities in boys are significantly higher ( $p < 0.05$ ) than in girls. In the girls of the 8<sup>th</sup> grade, 29.8 % had a high level of development of speed qualities, 56.4 % had a sufficient level, 11.7 % had an average level and 2.1 % of the girls had a low level. In the schoolboys of the 8<sup>th</sup> grade, 5.5 % of

the boys had a high level, 56.9 % of the boys had a sufficient level, 32.1 % of the boys had an average level and 5.5 % of the boys had a low level of development of speed qualities. The minimum and maximum results of running 30-meter race in the schoolchildren of the 8<sup>th</sup> grade were as follows: the girls - 5.1 seconds and 6.9 seconds; the boys - 5.1 seconds and 6.3 seconds respectively. The variation coefficients of the indicators of speed development for schoolchildren of the 8<sup>th</sup> grade were less than 14.6 %, which indicates the homogeneity of the samples. Analysis of the schoolchildren's agility, which was assessed by the results of shuttle running 4x9 m race also indicates that in boys of the 7<sup>th</sup> grade, the average statistical result is significantly lower ( $p < 0.05$ ) than in girls. We have established that in the schoolgirls of the 7<sup>th</sup> grade, 22.4 % of the girls had a high level, 34.3 % of the girls had a sufficient level, 41.8% had an average level and 1.5 % of girls had a low level. In the 7<sup>th</sup> grade, we did not find boys who had a high level of agility, 20.4 % of the boys had a sufficient level, 27.8 % of the boys had an average level and 51.8 % of the boys had a low level of agility. The minimum and maximum results of a 4x9 m shuttle race for schoolchildren of the 7<sup>th</sup> grade were as follows: girls had 11.2 seconds and 13.3 seconds; the boys had 11.2 seconds and 12.8 seconds, respectively. The variation coefficients of the indicators of the agility development for schoolchildren of the 7<sup>th</sup> grade were lower than 14.6 %, which indicates homogeneity of the samples. Analysis of the results of the shuttle run of the students of the 8<sup>th</sup> grade testifies that the average statistical rate in boys is significantly lower ( $p < 0.01$ ) than in girls. In the schoolgirls of the 8<sup>th</sup> grade, 23.4 % of the girls had a high level of the agility development, 20.2 % of the girls had a sufficient level, 43.6 % of the girls had an average level, and 12.8 % of the girls had a low level. In the schoolboys of the 8<sup>th</sup> grade, we did not find boys who had high and sufficient levels of agility, 34.9 % of the boys had an average level and 65.1 % of the boys had a low level of agility. The minimum and maximum results of a shuttle running 4x9 m in the schoolchildren of the 8<sup>th</sup> grade were as follows: the girls had 11.2 seconds and 12.8 seconds; the boys had 11.2 seconds and 12.8 seconds, respectively. The variation coefficients of in the agility development index for schoolchildren of the 8<sup>th</sup> grade were lower than 14.6 %, which indicates the homogeneity of the samples.

Table 2. The average statistical indicators of physical fitness of the girls and boys of the 8<sup>th</sup> grade ( $n = 203$ ).

Researched indicators	$\bar{X}$	S	Me	25 %	75 %	V, %
Girls (n=94)						
Running 30m, s	6.1	0.38	5.9	5.6	6.1	6.2
Shuttle running 4 × 9 m, s	12.0	0.49	12.1	11.7	12.4	4.1
Pull-up, times	7.5	1.61	7.0	6.0	8.0	21.5
Bending forward from the sitting position, cm	10.5	18.18	7.5	5.0	14.0	173.1
Standing long jump, cm	152.6	20.56	141.5	135.0	170.0	13.5
Sit-up from the back-lying position, times /30 seconds	17.2	3.48	17.0	15.0	19.0	20.2
Running 1,000 m race, min. sec	5.24	0.57	5.19	5.03	5.56	10.9
Boys (n=109)						
Running 30m, s	5.8*	0.31	5.7	5.5	6.1	5.3
Shuttle running 4 × 9 m, s	11.8**	0.47	11.7	11.4	12.2	4.0
Pull-up, times	4.9	2.46	4.0	3.0	7.0	50.2
Bending forward from the sitting position, cm	3.6*	1.99	3.0	2.0	4.0	55.3
Standing long jump, cm	161.1*	17.55	162.0	156.0	177.0	10.9
Sit-up from the back-lying position, times /30 seconds	18.1*	3.91	17.0	16.0	21.0	21.6
Running 1,500 m race, min. sec	7.32	0.44	7.28	7.17	7.34	6.0

Note: \* -  $p < 0.5$ ; \*\*  $p < 0.01$  statistically significant difference compared to the girls.

To assess the level of the strength development in schoolchildren of grades 7-8, the "pull-up" test was used, for girls in the lying position, and for the boys in the hang position; this test is used to determine the strength level of the muscles of the arms and the shoulder girdle.

When comparing the average statistical results characterizing the development of strength qualities in schoolchildren of the 7<sup>th</sup> and 8<sup>th</sup> grade with normative requirements, we found out that the average level prevails in girls and in boys, as well. In the 7<sup>th</sup> grade, 1.5 % of the girls had a high level of development of strength qualities; a sufficient level was not detected; 88.1% of the girls had an average level and 10.4 % of the girls had a low level. In the 7<sup>th</sup> grade, 7.4 % of the boys had a high level of the strength qualities development, 11.2 % of boys had a sufficient level, 40.7 % of the boys had an average level, and 40.7 % had a low level. The minimum and maximum test results in the schoolchildren of the 7<sup>th</sup> grade were as follows: the girls - 3 times and 19 times; the boys - 1 time and 9 times, respectively. The variation coefficients of the indicator of the strength development in the schoolchildren of the 7<sup>th</sup> grade were higher than 14.6 %, which indicates the heterogeneity of the samples.

The analysis of the results of the strength qualities development in the students of the 8<sup>th</sup> grade testify that the indicator improves with age both in girls and boys. In the 8<sup>th</sup> grade we did not find girls with a high level of strength development, 71.3 % of the girls had sufficient level, 16.0 % had an average level and 12.7 % of girls had a low level. In the male students of the 8<sup>th</sup> grade, 9.2 % of the boys had a high level of strength, 27.5 %, had

a sufficient level, 48.6 % of the boys had an average level, and 14.7 % of the boys had a low level of the strength qualities development. The minimum and maximum test results for schoolchildren of the 8<sup>th</sup> grade were as follows: the girls - 2 times and 9 times; the boys - also 2 times and 9 times, respectively. The variation coefficients of the strength development indicators in the schoolchildren of the 8<sup>th</sup> grade were higher than 14.6 %, which indicates the heterogeneity of the samples. The evaluation of flexibility was carried out based on the results of the bending forward from the sitting position, the absolute results of the test in the girls is significantly higher ( $p < 0.05$ ) than in boys.

Analysis of the average statistical results of flexibility in schoolchildren of the 7<sup>th</sup> and 8<sup>th</sup> grades testifies that boys have an average level of development, and girls have a sufficient level of the flexibility development. We found that in girls of grades 7 and 8, individual flexibility indices are significantly higher ( $p < 0.05$ ) than in male students of grade 7 and 8. In girls of the 7<sup>th</sup> grade, 31.3% had a high level of flexibility development, 25.4 % of the girls had a sufficient level, 9.1 %, of girls had an average level of and 34.3 % of the girls had a low level. In the 7<sup>th</sup> grade, 7.4 % of the boys had a high level of the flexibility development, 50.0 % of boys had a sufficient level, 33.3 % of boys had an average level, and 9.3 % of boys had a low level. The minimum and maximum test results in the schoolchildren of the 7<sup>th</sup> grade were as follows: girls - 4 cm and 15 cm; boys - 1 cm and 8 cm respectively. The variation coefficients of the flexibility development indicators in the schoolchildren of the 7<sup>th</sup> grade were higher than 14.6 %, which indicates the heterogeneity of the samples.

In the schoolgirls of the 8<sup>th</sup> grade, 29.8 % of the girls had a high level of the flexibility development, 12.8 % of the girls had a sufficient level, 7.4 % of an average level of and 50.0 % of the girls had a low level. In the students of the 8<sup>th</sup> grade, 4.6% of boys had a high level of the flexibility development, 11.0 % of the boys had a sufficient level, 83.5 % of the male students had an average level, and 0.9 % had a low level. The minimum and maximum test results in the 8<sup>th</sup> grade students were as follows: in the girls - 4 cm and 19 cm; in the boys – 1 cm and 15 cm, respectively. The variation coefficients of the flexibility development indicators in the schoolchildren of the 8<sup>th</sup> grade were higher than 14.6%, which indicates the heterogeneity of the samples.

The speed-strength qualities were estimated by the results of standing long jump. It was determined that the speed-strength qualities of the boys of the 7<sup>th</sup> grade were significantly higher ( $p < 0.05$ ) than in the girls. The average results of the students of the 8<sup>th</sup> grade corresponded to a sufficient and average level. There is a positive dynamics of improvement of the result with age, so the average statistical result of girls and boys of the 8<sup>th</sup> grade was improved by 4 cm. In the schoolgirls of the 7<sup>th</sup> grade, 11.9 % of the girls had a high level of development of the speed and strength qualities, 64.2 % of the girls had a sufficient level, 20.9 % of the girls had an average level, and 3.0 % of the girls had a low level. In the 7<sup>th</sup> grade male students, 24.1 % of the boys had a high level of development of the speed-strength qualities, 44.4 % of the boys had a sufficient level, 7.4 % had an average level, and 24.1 % of the male students had a low level. The minimum and maximum test results in the schoolchildren of the 7<sup>th</sup> grade were as follows: in the girls - 108 cm and 190 cm; in the boys - 130 cm and 187 cm respectively. The variation coefficients of the speed and strength development indicators in the girls of the 7<sup>th</sup> grade were lower than 14.6 % which indicates homogeneity of the sample; these coefficients in the boys of the 7<sup>th</sup> grade were higher than 14.6 %, which indicates the heterogeneity of the samples.

In the female students of the 8<sup>th</sup> grade, 30.8 % of the girls had a high level of development of the speed-strength qualities, 16.0 % of the girls had a sufficient level, 52.1 % of the girls had an average level and 1.1 % of the girls had a low level. In the male students of the 8<sup>th</sup> grade, 12.8 % of the boys had a high level of development of the speed-strength qualities, 24.8 % had a sufficient level, 38.5 % of the boys had an average level, and 23.9 % of the boys had a low level. The minimum and maximum test results in the schoolchildren of the 8<sup>th</sup> grade were as follows: in girls - 125 cm and 187 cm; in boys - 135 cm and 188 cm respectively.

The variation coefficients of the speed and strength development indicators in the students of the 8<sup>th</sup> grade were lower than 14.6 % which indicates homogeneity of the sample. The level of endurance development in schoolchildren of grades 7-8 according to the results of the average statistical data corresponded to the sufficient level in girls and to an average level in boys. The average result in the boys of the 7<sup>th</sup> grade is significantly lower ( $p < 0.05$ ) than the average result in the girls of the 7<sup>th</sup> grade. In the schoolgirls of the 7<sup>th</sup> grade, 35.8 % of the girls had a high level of the endurance development, 43.3% of girls had a sufficient level, 4.5 % had an average level and 16.4 % of the girls had a low level. In the schoolboys of the 7<sup>th</sup> grade, 57.4 % of the boys had a high level of endurance, 9.3 % of the boys had a sufficient level, 29.6 % had an average level, and 3.7 % of the boys had a low level. The minimum and maximum test results in the schoolchildren of grade 7 were as follows: in the girls – 4:01.00 s and 6:41.00 s; in the boys – 3:57.00 s and 5:45.00 s, respectively. The variation coefficients of the endurance indicators in the students of the 7<sup>th</sup> grade were lower than 14.6 % which indicates homogeneity of the sample. In the schoolgirls of the 8<sup>th</sup> grade, 31.9 % of the girls had a high level of the endurance development, 30.8 % of the girls had a sufficient level, 20.2 % had an average level and 17.1 % of the girls had a low level. In the schoolboys of the 8<sup>th</sup> grade, 9.2 % of the boys had a high level of endurance, 24.8 % had a sufficient, 51.4 % of the boys had an average level, and 14.6 % of the boys had a low level. The minimum and maximum test results for schoolchildren of the 8<sup>th</sup> grade were as follows: in the girls 4:01.00 s and 6:59.00; in the boys – 5:09.00 s and 8:32.00 s, respectively. The variation coefficients of the endurance indicators in the students of the 8<sup>th</sup> grade were lower than 14.6 % which indicates homogeneity of the sample. Such qualities as the flexibility in the male students, and the strengths in both girls and boys are the most

backward. Analysing the level of physical fitness of schoolchildren of the 7<sup>th</sup> and 8<sup>th</sup> grades, we came to the conclusion that the vast majority of students had individual indicators that corresponded to a sufficient and average level, although there is a positive dynamics of improving the result with age.

### Discussion

Physical fitness is an important characteristic of health, an integral indicator of a person's physical activity (Krutsevych, 2007; Bodnar, 2015). It is known that practically all organs and systems of the body interact during physical exercises. By regulating a set of the health-improving and training loads, it is possible to make a purposeful impact on the stimulation of certain systems, thereby increasing their level of functioning and, accordingly, the level of health (Blahii, 2015; Yarmak, 2017). Traditional means of the physical education and health-improvement work with children's contingent do not meet the modern requirements today and need to be changed to more effective ones. (Tomenko, 2017). The search for new means and methods of physical training of schoolchildren is associated with a time limit at the physical education lessons, outdated approaches to the organization of physical education (Honcharova, 2012; Galan, 2016). It is also specific that the situation with a low level of the schoolchildren's physical fitness reflects not only long-term trends, but also the all-Ukrainian nature of the issue of physical education in schools.

In our time, the issue of the development and improvement of the physical education programs for schoolchildren in general education school, contributing to the strengthening of health, the upbringing of a healthy lifestyle, the development of physical abilities, and the normalization of the psychophysical state of schoolchildren is currently seen with a sense of urgency (Cherniavskiy, 2010; Andrieieva, 2017).

As evidenced by the research results, the use of extracurricular forms of physical education is effective. The most accessible means of physical education for schoolchildren at the physical education lessons are physical exercises of applied orientation and sport orienteering (Kolomiets, 2008; Celestino, 2012; Korol, 2013; Rebryna, 2013; Celestino 2015; Khimenes, 2016; Galan, 2016; Berezovskyi, 2016; Chobaniuk, 2017).

The results of the conducted research confirmed and supplemented already known developments in the aspect of the studied problem. The obtained results are confirmed by the data of numerous studies (Krutsevych, 2007; Dudnyk, 2014; Bodnar, 2015; Dudnyk, 2017) on the low level of development of basic motor qualities in schoolchildren aged 13-14 years, including strength, flexibility and endurance (Zamiatina, 2012; Bodnar, 2015 Galan, 2015) about the low level of physical fitness of schoolchildren (Vaskan, 2013; Galan, 2015).

### Conclusions

Analysis and evaluation of the development of physical qualities of the schoolchildren aged 13-14 years revealed the heterogeneity of the population in terms of the level of physical training. It is also specific that only one third of the students surveyed perform test tasks at the normative level. The analysis of the summary list of the results shows that in the students of the 7<sup>th</sup> grade 31.5 % of the male students and 38.8 % of girls correspond to a low level of speed; 51.8 % of boys and 1.5 % of girls correspond to a low level of agility; 40.7 % of boys and 10.4 % of girls correspond to a low level of strength qualities; 9.3 % of boys and 34.3 % of girls have a low level of flexibility; 3.7 % of boys and 16.4 % of girls correspond to low level of endurance. The students of the 8<sup>th</sup> grade have a positive dynamics of the studied indicators: a high level of speed qualities development is observed in 29.8 % of girls and 5.5 % of boys; 23.4 % of girls have a high level of agility, whereas in comparison with the boys of the 8<sup>th</sup> grade, the result that corresponds to a low level of agility has the highest percentage - 65.1 %. The vast majority of the 8<sup>th</sup> grade students had individual results that corresponded to the sufficient and average levels. The presented materials testify to the urgency of improving the curriculum for physical education in order to enhance sports fitness and improve the health of schoolchildren with a low level of physical fitness.

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