

# SIGNS OF PHYSICAL ABILITY OF 11-12-YEAR OLD STUDENTS DURING THE COVID-19 PANDEMIC IN 2020/2021 SCHOOL YEAR

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## ABSTRACT

*Sport and physical activity contribute to people's physical, mental, and social health. The state of students' physical ability is an accurate and objective indicator, with the help of which the influence and efficiency of the educational process in physical education and sports can be revealed. The aim of this study was to determine the level of development of the physical ability of students in 5th and 6th grade, through analysis and evaluation, according to the new regulatory system for evaluation. The research was carried out with 75 pupils at a secondary school in the city of Sofia. To realize it, we used a test battery that carries information about the significant indexes of physical fitness. The battery includes five tests: running 30 m., standing long jump with both feet, 3 kg medicine ball throwing with both hands from a standing position, running 200 m., and agility and spatial coordination test. The testing and mathematical-statistical methods (variation analysis comparative analysis with t-criterion of Student and sigma evaluation method) were used in our study. The analysis of the results showed that there was a statistically significant difference between the students from 5th and 6th grade, only in terms of the indicator of agility and spatial coordination. Such a difference was found in the same test, by gender and age, among the boys from the two study groups. Our research showed that the state of physical ability of the students participating in the study was at a good level, which corresponds to the average in the country.*

**Keywords:** physical fitness, testing, students, quality evaluation

## INTRODUCTION

It has long been known that physical education and sports provide harmonious physical development, help strengthen the body's natural defenses, and prevent a number of diseases. Sport and physical activity contribute to people's physical, mental, and social health (Hristova, 2020). Nowadays, the problem of physical condition and physical capacity of students is quite relevant and is considered in a number of scientific papers (Badicu, 2017; Bailey, 2006; Bodnar et al., 2016; Borukova, 2019; Neil-Sztramko et al., 2021; Tzankova-Kaloyanova, 2020; Tankusheva, 2019).

Physical capacity reflects individuals' overall health, viability, and physical fitness (Slanchev, 1992). It is a complex indicator that

provides information about the general functional state of people and their motor abilities, closely related to the level of development and demonstration of the basic motor qualities. Physical ability depends on physical development, gender, age, and hereditary conditions. The motor qualities, skills, and habits determine the level of physical ability.

Physical ability is a condition that combines the influence of physical development with the motor activity of humans and is most often determined by measuring a person's basic motor qualities using a set of motor tests. Therefore, the physical ability can be derived as a leading factor in terms of the functional state of individuals, which is essential for their quality of life (Borisov et al., 2019).

The need for analysis of the state of physical capacity arises from two tasks - on the one hand, the current assessment by teachers, and on the other hand, the feedback on the impact of the process on students (Lovkov, 2020). The state of students' physical abilities is an accurate and objective indicator, with the help of which the influence and efficiency of the educational process in physical education and sports can be revealed.

The COVID-19 pandemic has caused severe problems worldwide, affecting all activities in many areas. One of these is the educational system, which had to adapt to the epidemiological situation in a number of countries around the world, including Bulgaria (Borukova & Kuleva, 2021). For the second year in a row, the attendance classes in the schools in Bulgaria were affected. This also affected the practical classes in physical education and sports, which had to be replaced by online learning in an e-environment.

One of the main problems in this epidemic situation is the maintenance of the children's physical health. The influence of physical activity on health is undoubted (Bailey, 2006). The younger generation needs a high level of physical activity to maintain the body's ability to work, but in online learning, this is quite a difficult task (Muhiddinov et al., 2020).

As it is known, the main goal in the school education system is to strengthen students' health and form habits for regular sports activities. Prolonged classes with physical exercise develop complexly physical qualities and increase the strength and mobility of nervous processes (Borukova & Kuleva, 2021). A lot of researchers have found that increased physical activity is also a successful coping strategy with mental health and leads to a reduction of stress and anxiety, and in general, to overcoming the negative consequences as-

sociated with social isolation (Iancheva, Rogaleva, García-Mas, Olmedilla, 2020; Mladenova, 2021).

All of the above made us research the consequences of breaking the normal learning process in physical education and sports and their influence on students' physical condition.

*The aim* of this study was to determine the level of development of the physical ability of students in 5<sup>th</sup> and 6<sup>th</sup> grade, during the pandemic of COVID-19, through analysis and evaluation, according to the new regulatory system for an evaluation in physical education and sports.

In order to achieve the aim of the study, the following *tasks* were set:

- ✓ To conduct testing of the pupils from 5<sup>th</sup> to 6<sup>th</sup> grades.
- ✓ To process, analyze and compare the obtained results.
- ✓ To make a qualitative evaluation of the level of students' physical ability.

## METHODOLOGY

The study was carried out in May 2021.

### *Participants*

Seventy-five children (boys and girls), students at a secondary school in the city of Sofia, were studied. The research was aimed at examining the leading indicators of physical fitness of 11–12-year-old students.

### *Measurement and indexes*

For the needs of the study, sports-pedagogical testing was conducted with the participants. A tested and standardized test battery was used (Miladinov et al., 2019), which includes five indicators bearing information about the main signs of physical capacity (Table 1).

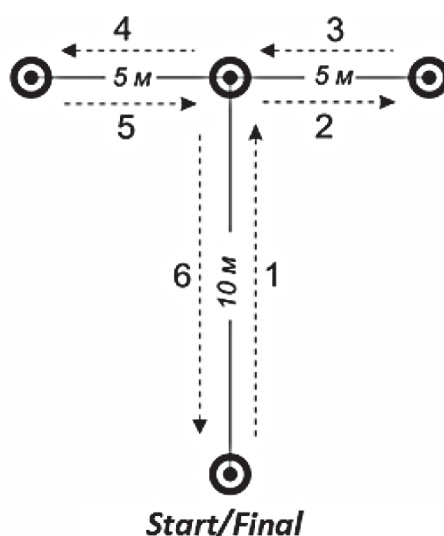
**Table 1.** *Indicators examined*

Indexes	Measure unit	Measurement direction
Running 30 m.	0.01 s	-
Standing long jump with both feet	1.00 cm	+
3 kg medicine ball throwing with both hands from a standing position	1.00 cm	+
Running 200 m.	0.01 s	-
Agility and space coordination test (T-test for Agility)	0.01 s	-

The first four tests: *running 30 m., standing long jump with both feet, 3 kg medicine ball throwing with both hands from a standing position, and running 200 m.* are standard and have so far been applied in physical education

and sports classes. The only new test is for *agility and spatial coordination.*

T-test description: Four small rubber hoops (15-20 cm in diameter) are placed in the shape of the letter T (Figure 1).



**Figure 1.** *T-test for Agility*

There is one tennis ball in each hoop. Performance: The pupil stands behind the hoop at the start/finish position. At the starting signal, the pupil bends down, takes the ball, and moves to the rest of the hoops in the direction indicated with figures from 1 to 6 (see Figure 1). Pupils take the ball from every following hoop, leaving the one they have taken from the previous hoop. The recording ends as soon as the ball touches the start/finish area of the hoop. The time is measured with an accuracy of up to 0.01 sec. The student is entitled to two attempts.

**Limitations of the research**

Regardless of the research team’s desire to cover a larger number of the children in the respective age group, due to the short period of attendance in the school year 2020/2021, we had the opportunity to study only four classes.

**Research methods**

In order to fulfill the set tasks and aim of the research, we used the following methods: a *study of the specialized literature and sports-pedagogical testing.*

### *Procedure*

We conducted the research at the school within the regular classes in physical education and sports. The teachers of the researched individuals carried out the testing. Prior to the testing, informed consent was provided by the parents for the purpose of the study, namely an assessment of the state of physical ability and information about how the obtained data would be used. Pupils' anonymity was guaranteed because all of them were recorded under different numbers. All participated voluntarily in the research and received no monetary or financial compensation for their contribution. None of the participants refused to take part; only those who were unwell did not participate in the study. Prior to testing, brief instructions, a video, and a demonstration of the test battery were provided. The testing was carried out in the gym and the running track in the schoolyard by our research team, with the active participation of physical education and sports teachers. To perform the tests, we used the following equipment: a stopwatch, tape measure, four small rubber hoops, four tennis balls, and a medicine ball – 3 kg. The participants performed each test twice. In the analysis of the results, the better results were used.

### *Data analysis*

The results of the study were subjected to mathematical-statistical processing with SPSS 20 and illustrated with Excel 2013. Depending

on the tasks of the research, the following statistical methods were applied:

- *variation analysis* – for defining average values, normality of distribution, and variety of indicators under study;
- *comparative analysis with t-criterion of Student for independent samples* – or checking the reliability of differences between average levels of indicators under study between both groups - girls and boys. The critical value of the t-criterion, at high statistical reliability ( $P_{t \geq 95\%}$ ), is critical = 1.99 (Gigova, 2002);
- *sigma method* – for the quantitative assessment of the condition of the measured signs. Based on the average level of the measured characteristics for a given age group, scores are calculated, which are normalized values presented in a 20-point system, which allows comparing the achievements in different dimensions of tests and indicators – number, time, meters (Gigova, 2009; Miladinov et al., 2019).

## **RESULTS**

The results from the variation analysis of the indicators of the physical fitness of the 5<sup>th</sup> and 6<sup>th</sup>-grade students showed that the distribution of the values was normal and close to normal.

Table 2 presents the results of the applied variation analysis of 5<sup>th</sup>-grade students.

**Table 2.** *Variation analysis of the indicators of the physical ability of students from 5<sup>th</sup> grade*

<b>Indexes</b>	<b>n</b>	<b>Mean</b>	<b>min</b>	<b>max</b>	<b>R</b>	<b>S</b>	<b>V%</b>	<b>As</b>	<b>Ex</b>
<i>Running 30 m</i>	35	6.45	5.32	7.53	2.21	0.52	8.05	0.38	-0.04
<i>Standing long jump</i>	35	150.37	120	180	60	16.91	11.24	0.29	-0.94
<i>3 kg medicine ball throwing</i>	35	394.29	310	610	300	77.74	19.71	0.97	0.49
<i>Running 200 m</i>	35	52.37	42.72	63.50	20.78	4.62	8.81	0.37	0.04
<i>Agility test</i>	35	17.30	13.52	20.74	7.22	1.84	10.65	0.13	-0.78

The analysis showed that in four of the tests, the values of the coefficient of variation “V” were below 12%, which means that the study group was highly homogeneous in terms of these indexes. The coefficient of variation was between 8.05% and 11.24%. Only in the “3 kg medicine ball throwing” test, the coefficient of variation “V” was 19.71%, which

shows that the group was relatively homogeneous in terms of the explosive power of the shoulder girdle and upper limbs. Given the age of children who are in the phase of pre-pubescent development and some of them are already in puberty, we consider this normal.

Table 3 presents the results of the applied variation analysis of 6<sup>th</sup>-grade students.

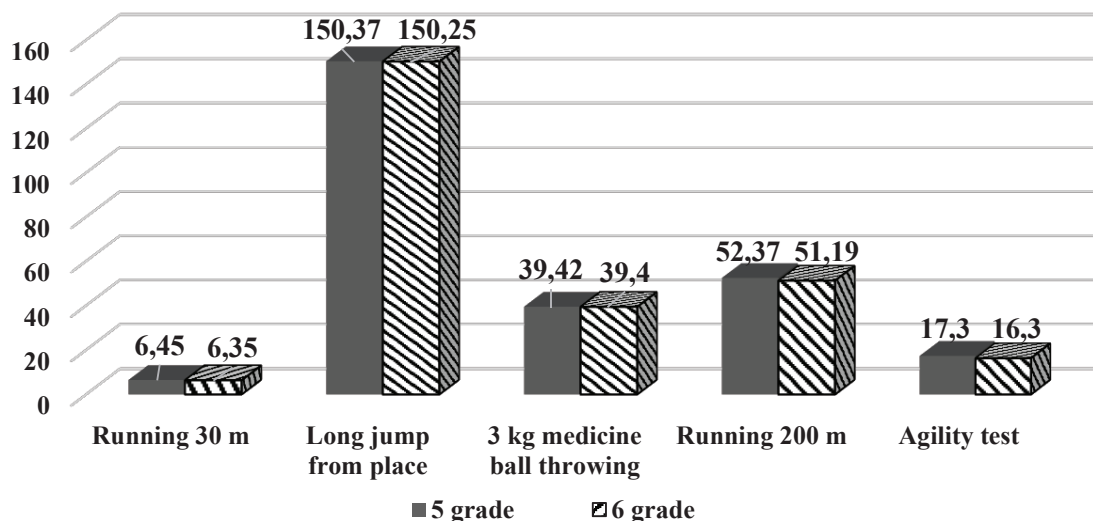
**Table 3.** Variation analysis of the indicators of physical ability of students from 6<sup>th</sup> grade

Indexes	n	Mean	min	max	R	S	V%	As	Ex
<i>Running 30 m</i>	40	6.35	5.01	7.72	2.71	0.72	11.30	0.02	-0.69
<i>Standing long jump</i>	40	150.25	110	192	92	23.66	15.75	-0.04	-0.78
<i>3 kg medicine ball throwing</i>	40	394.00	310	620	310	68.00	17.26	1.41	1.70
<i>Running 200 m</i>	40	51.19	40.73	58.97	18.24	5.65	11.03	-0.15	-1.17
<i>Agility test</i>	40	16.30	13.65	19.85	6.2	1.55	9.48	0.22	-0.47

The analysis of the table shows that in the studied group of students from 6<sup>th</sup> grade, there were no significant deviations from the average value in “Running 30 m.”, “Running 200 m.” and “Agility test”, which means that the group was highly homogeneous, as the coefficient of variation “V” was below 12% (between 9.48% and 11.30%). For the other two indexes, giving information about the explo-

sive power of the lower and upper limbs, the coefficient of variation was above 12% ( $V_2 = 15.75\%$  and  $V_3 = 17.26\%$ ), which shows that the group was relatively homogeneous along these indicators.

For the needs of the research, we applied a comparative analysis of the average values of the individual characteristics of the students from 5<sup>th</sup> and 6<sup>th</sup> grade, presented in Figure 2.

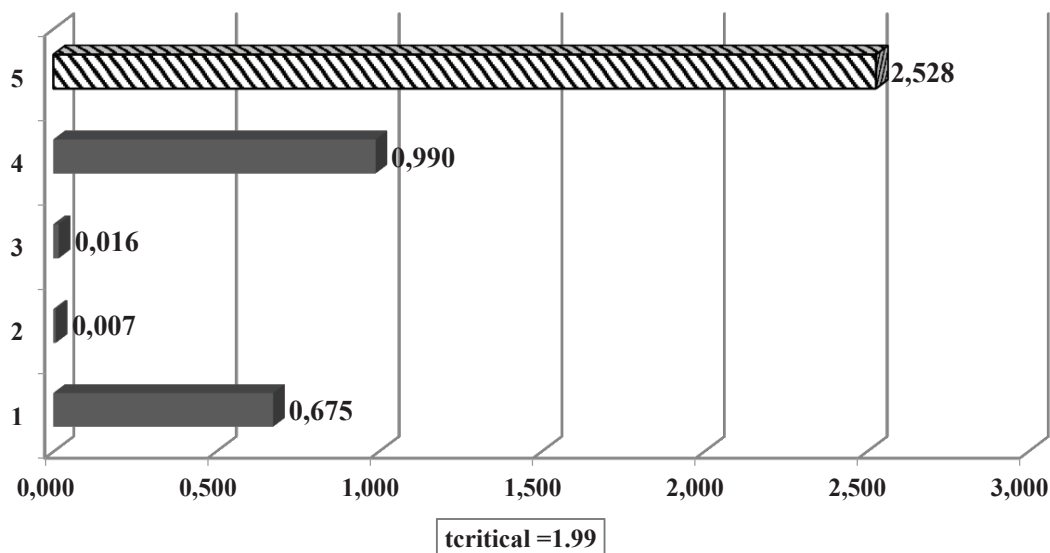


**Figure 2.** Mean values of the indicators of physical ability of students of 5<sup>th</sup> and 6<sup>th</sup> grade

According to most indicators, 6<sup>th</sup>-grade students had better results - in the first test, "Running 30 m", the average values were very close. Along two of the indicators – "Standing long jump" and "3 kg medicine ball throwing", the average values of the 5<sup>th</sup>-grade students were higher than those of the 6<sup>th</sup> graders. According to human biological development and the increase in strength at different stages of physical development, it is surprising why the 5<sup>th</sup>-grade students had

better explosive power of the lower and upper limbs. To establish why this was so, we applied a comparative analysis of the mean values by class and gender using Student's t-criterion for independent samples. The critical value of the t-criterion for both samples at a high level of statistical reliability ( $Pt \geq 95\%$ ) is  $t_{critical} = 1.99$ .

The significance of the differences in the mean values for the individual traits of the 5<sup>th</sup> and 6<sup>th</sup> graders is presented in Figure 3.



**Figure 3.** Significance of the differences of the mean values of studied indicator between students of 5<sup>th</sup> and 6<sup>th</sup> grade

The analysis of Figure 3 shows that there was no statistically significant difference in four of the studied indicators related to speed abilities, the explosive power of the upper and lower limbs, and the students' endurance. This gives the reason for the high guaranteed probability ( $Pt \geq 95\%$ ) that the null hypothesis is confirmed, according to which the observed differences between 5<sup>th</sup> and 6<sup>th</sup>-grade students are not significant and can be explained by random reasons. There was a statistically significant difference only in the indicator "T-test for agility", where the empirical value of the t-criterion was higher than the critical one –

$t_{emp} = 2.52$ . This gives us a reason, in terms of the level of development of agility, to say that the 6<sup>th</sup>-grade students are superior to the 5<sup>th</sup>-grade students.

In similar studies conducted with an older age group of 14-15 years, it was found that gender differences affected the physical abilities of students, and these differences were most pronounced in the explosive power of the lower and upper limbs (Borukova & Mavrudiev, 2020).

There was no significant difference between students in 5<sup>th</sup> and 6<sup>th</sup> grade as regards the explosive power of the upper and lower

limbs, so we applied the comparative t-criterion and divided them by gender factor. The significance of the differences is presented in Table 4.

**Table 4.** Comparative analysis of the mean values of the surveyed indicators of boys and girls of the two groups

Indexes	n <sub>1</sub>	$\bar{X}_1$	S <sub>1</sub>	n <sub>2</sub>	$\bar{X}_2$	S <sub>2</sub>	d	Cohen's d	t emp	P (t)
<b>Running 30 m</b>	34	6.29	0.626	41	6.49	0.630	-0.195	0.318	-1.316	80.76
<b>Standing long jump</b>	34	152.00	22.333	41	148.83	19.240	3.171	0.152	0.651	48.90
<b>3 kg medicine ball throwing</b>	34	408.53	81.617	41	382.20	61.867	26.334	0.363	1.548	88.35
<b>Running 200 m</b>	34	50.98	5.294	41	52.37	5.085	-1.388	0.267	-1.145	74.59
<b>Agility test</b>	34	16.67	1.993	41	16.84	1.546	-0.171	0.095	-0.409	32.40

Note. n<sub>1</sub> boys; n<sub>2</sub> girls

Table 4 shows that for all indicators, t<sub>emp</sub> was lower than t<sub>critical</sub> (t<sub>critical</sub> = 2.04). This shows that the observed differences between the boys and the girls regarding their physical capacity were not statistically significant and were due to random reasons.

In a study conducted with 13–14-year-old students (Borukova, 2019), the results showed that boys were better than girls in terms of four indicators. Only in the agility and spatial coordination test no statistically significant difference was found between the two groups.

At the age of 11-12 years, however, a statistically significant difference was found in

the sign related to agility and coordination in space in favor of the 6th-grade students. For the purposes of the study, we applied a comparative analysis based on gender and age to determine whether there were differences in physical abilities between the boys in 5<sup>th</sup> and 6<sup>th</sup> grade and between the girls aged 11 and 12 years. No statistically significant difference was found in all examined indicators. There was a statistically significant difference only in the indicator “T-test” between the boys from 5<sup>th</sup> and 6<sup>th</sup> grade (Table 5). The table analysis shows that the obtained temp (3.75) was higher than t<sub>critical</sub> (2.05).

**Table 5.** Comparative analysis of the mean values of “T-test for agility” of boys of 5<sup>th</sup> and 6<sup>th</sup> grade

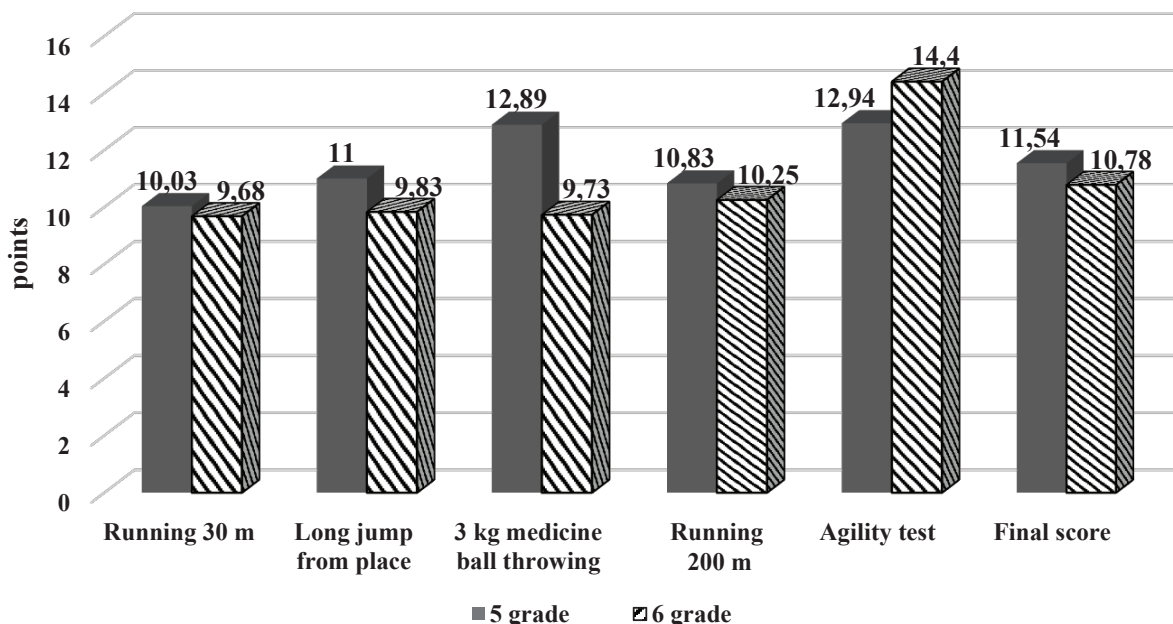
Indexes	n <sub>1</sub>	$\bar{X}_1$	S <sub>1</sub>	n <sub>2</sub>	$\bar{X}_2$	S <sub>2</sub>	d	Cohen's d	t emp	P (t)
<b>Agility test</b>	15	17.91	1.911	19	15.68	1.458	2.23	0.131	<b>3.745</b>	99.95

Note. n<sub>1</sub> 5<sup>th</sup> grade; n<sub>2</sub> 6<sup>th</sup> grade

An evaluation of the level of physical abilities of the students was applied according to the developed national “System for assessment of the physical capacity of the students from I to XII grade” in the Republic of Bulgaria. In it, the tables with the test results are divided

by age and gender, and a 20-point scale is used to evaluate these results. For the needs of the research, each student is evaluated for the respective age – 11 and 12 years.

Figure 4 presents the average scores of the study results of students in 5<sup>th</sup> and 6<sup>th</sup> grade.



**Figure 4.** Comparative analysis of average scores of physical abilities of students from 5<sup>th</sup> and 6<sup>th</sup> grade

All results fall into the rating scale from 8 to 14 points. The analysis of the results shows that the 5<sup>th</sup>-grade students had higher scores along most indicators. The average scores in the test for speed endurance “Running 200 m” were very close, respectively, 10.83 – for 5<sup>th</sup> grade and 10.25 points – for 6<sup>th</sup> grade. Only in the agility and spatial coordination test, the 6<sup>th</sup>-grade students had a higher score of 14.40 points.

Both groups received a grade of “Good 4”, which is average for the respective age and the country. For 5<sup>th</sup> grade, it is 11.54, and for 6<sup>th</sup> grade – 10.78 points.

## DISCUSSION

The results of the study show that 5<sup>th</sup> and 6<sup>th</sup>-grade students have the physical capacity of the average for the age group 11-12 years old. Opposite to logic, the 5<sup>th</sup>-grade students have higher average scores than 6<sup>th</sup>-grade students in most of the indicators, which shows a low level of development of physical abilities in this age group. Similar results were ob-

tained in the study of the coordination abilities of students from 1<sup>st</sup> to 12<sup>th</sup> grade (Tarnichkova & Petrova, 2020). Both study groups are highly homogeneous in most signs of physical ability. Along the indicator “3 kg medicine ball throwing”, students from both classes are relatively homogeneous. In another study, with younger students aged 7-10 (Petrova & Tarnichkova, 2019), it was found that gender differences affected the explosive power of the upper limbs. Although there are no statistically significant differences in the physical abilities of 5<sup>th</sup> and 6<sup>th</sup>-grade students along the different indicators, it should be noted that, in general, 6<sup>th</sup>-grade students have worse results except for the agility and spatial orientation test. We believe this is related to the shorter period of in-class learning of 6<sup>th</sup>-grade students. A comparative analysis by gender and age showed that the 6<sup>th</sup>-grade boys were statistically significantly better on the “T-test for agility” than the 5<sup>th</sup>-grade boys. However, such a difference was not observed in girls of the same age group. We can say that a year of age development has a

greater impact on agility and spatial orientation in boys than in girls. We believe that these results are natural given that it is the age of 7-12 years (puberty), and these years of human development are associated with sensitive periods of development of coordination skills (Dimitrova, 2014; Borukova, 2019).

On the other hand, a sedentary lifestyle and low physical activity are also serious problems. A study by Kirilova & Andonov (2019) showed that 32.7% of children aged 10-14 were physically active almost every day in their free time, and the percentage of girls was lower – 24.1%. There was also a large share of students who were physically active once a week or less often - 13.6% of boys and 25.9% of girls. Children did not play sports mainly because of a lack of desire and a convenient venue. Another study found that 43.4% of those surveyed decreased their physical activity during the period of social isolation, and one of the most affected groups was adolescents (Mladenova, 2021).

Another important factor is the duration of exercise and sports. WHO recommendations for the 5-17 age group are moderate to vigorous-intensity physical activity, at least 60 minutes per day (WHO, 2010). A study by Neil-Sztramko, et al. (2021) stated that less than 30% of children and adolescents met these recommendations. According to the author, schools could be ideal sites for interventions, given that children spent a substantial amount of time in transit to and from school or attending school.

## CONCLUSIONS

Our research showed that the state of physical ability of the students participating in the study is at a good level, which corresponds to the average in the country.

We believe that these results are due to the low physical activity of students, related, on the one hand, to inactive participation in physical education classes, and on the other hand, to

the inability to conduct regular classes as a result of anti-epidemic measures for COVID-19 in 2020/2021 and in particular online learning.

In connection with the obtained results and to improve the level of physical abilities of the students, we recommend that the classes of physical education and sports include more exercises with various small devices – balls, dumbbells, rings, etc. (which can be performed even in an online situation), as well as moveable games with a competitive character, which include natural-applied exercises (running, jumping, catching, hunting, passing, carrying).

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