

Development of speed and strength abilities of children aged 12-13 years in physical education classes in the COVID-19 pandemic

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Author contributions: A - Study design; B - Data collection; C - Qualitative analysis; D - Manuscript preparation; E – Funds Collection

Abstract

Background and Study Aim The COVID-19 pandemic has created unusual conditions for physical education teachers to work with schoolchildren. Children are forced to spend some time at home, which reduces the time for physical activity. The aim of the work is to track changes in the indicators of speed and strength abilities of children aged 12-13 years during the year in the conditions of mixed and distance learning.

Material and Methods Schoolchildren aged 12-13 years took part in the study (Kharkiv, Ukraine; n=31; boys - n=16; girls - n=15). Parental consent was obtained for their children's participation in the study. The following tests were used: "30 meter sprint test, sec."; "60 meter sprint test, sec."; "Standing Long Jump Test (Broad Jump), cm"; "Long jump, cm". Assessment of schoolchildren's speed and strength abilities was conducted at the beginning of the school year and repeated data – at the end of the school year. The obtained results were analyzed by methods of mathematical statistics: correlation analysis was conducted to identify relationships between the results of control standards of schoolchildren, the reliability of the difference was determined by the Student's criterion.

Results There is a significant decrease in physical activity of children. Trends to reduce the level of development of speed and strength abilities of schoolchildren during the school year have been identified. There are high and medium correlations between speed and power tests.

Conclusions It is recommended to reduce the number of mandatory control standards in the school of choice between: "30 meter sprint test" - "60 meter sprint test"; "Standing Long Jump Test (Broad Jump)" - "Long jump".

Keywords: schoolchildren, physical culture, development, speed and power qualities.

Introduction

The need for regular assessment of the physical fitness of school-age children is actively raised by many scholars. In their work, they emphasize the importance of regular assessment of the level of development of physical qualities [1, 2, 3] and the state of physical development of children [4]. This approach allows to timely and expediently regulate the process of physical exercises at school, adjust the content and volume of schoolchildren workload, maintain the health of schoolchildren.

Increasingly, the authors point to negative trends in changing the level of physical training of schoolchildren. Researchers have established the assessment of junior high school schoolchildren in terms of strength [1] and speed [2] abilities at the level of the average mark, coordination skills [3] - at a sufficient and high level. The results of the assessment of these physical qualities in high school schoolchildren tend to deteriorate every year [4]. In turn, the reduction of physical activity among schoolchildren has a negative impact on their mental health [5, 6, 7].

The realities of the last school year have forced many schoolchildren to acquire knowledge in terms

of distance and blended learning. Teachers were forced to quickly master and develop a system of communication with schoolchildren remotely for the effective conduct of physical education lessons. Dunton et al. [7], Raiola et al. [8] note that during the pandemic, the number of schoolchildren who began to engage in various types of physical activity through the use of network systems and the Internet has increased significantly.

Hsu et al. [9], Jieun et al. [10] propose to use the ADDIE system for the organization of distance physical education classes – analysis, design, development, implementation and evaluation. At the first stage of the analysis, teachers determine the needs of schoolchildren. The second stage involves setting educational goals and determining what needs to be taught. At the design stage, teachers provide instructions for achieving goals according to a broad overview or plan. The instruction component is specifically planned at the development stage. Then teachers give instructions for practical training. During the assessment phase, teachers receive feedback on a practical lesson or lecture. Then adjust the training programs.

Avanesian et al. [11] analyzed the effectiveness of distance learning policies by ministries of education in response to school closures due to

the COVID-19 pandemic. The authors note that wealth and place of residence are key factors influencing the availability of distance learning policies. Another study [12] found that children from historically disadvantaged groups may be particularly vulnerable to the mental health consequences of the COVID-19 pandemic.

It is known that the sedentary lifestyle of schoolchildren has a negative impact on their health. These more negative consequences are quite possible during the COVID-19 pandemic. This is facilitated by the rampant fascination with mobile devices and the use of the Internet. Chen et al. [13] studied changes in children's health in problematic use of the Internet (problematic use of smartphones, problematic use of social networks and problematic games). The authors identified various changes in trends in additive behavior during the COVID-19 outbreak and recovery periods. Another study [14] noted the important role of parents in distance work with schoolchildren.

All of the above indicates the urgency of monitoring changes in the state of physical development and physical fitness of schoolchildren in the COVID-19 pandemic. The consequences of such a mixed and distance learning form force teachers to look for ways to adjust the curriculum and control.

The aim of the study: to track changes in the indicators of speed and strength abilities of children aged 12-13 years during the year in terms of mixed and distance learning.

Materials and methods

Participants.

The study involved schoolchildren aged 12-13 years (Kharkiv Lyceum №89, Kharkiv, Ukraine). A total of 31 schoolchildren took part (boys - n=16; girls - n=15). Parental consent was obtained for their children's participation in the study.

Research design.

Pedagogical testing was aimed at determining the indicators of speed and strength abilities of children. Testing was conducted at the beginning of the school year and repeated data – at the end of the school year. During the school year, the educational process of schoolchildren was organized in three forms: full-time (traditional) education (5 months), distance (3 months) and mixed (1 month) forms of education. 4 test exercises were used (fig. 1, 2, 3): "30 meter sprint test, sec."; "60 meter sprint test, sec."; "Standing Long Jump Test (Broad Jump), cm"; "Long jump, cm". The test results were evaluated according to the recommendations of the Ministry of Education and Science of Ukraine [15].

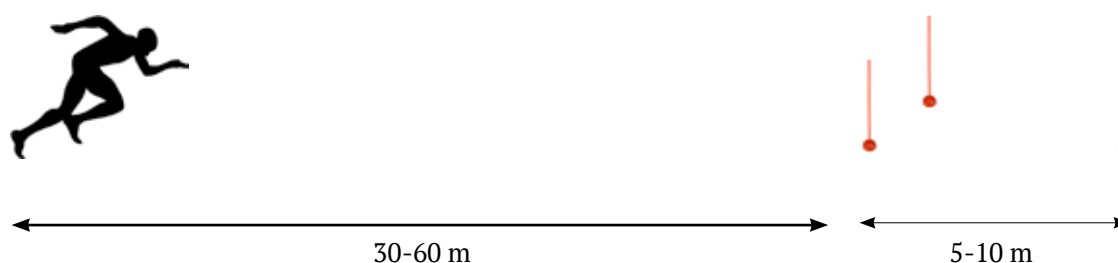


Figure 1. 30-60 m sprint test

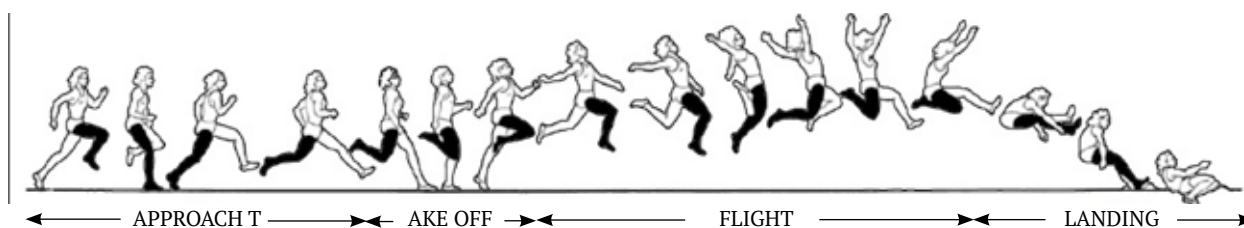


Figure 2. Long Jump [16]



Figure 3. Standing Long Jump [16]

Statistical analysis.

The obtained results were analyzed by methods of mathematical statistics: correlation analysis was conducted to identify relationships between the results of control standards of schoolchildren; the reliability of the difference in indicators was determined by the Student's criterion.

Results

Table 1 shows the results of testing schoolchildren in different periods of the study (table 1).

Table 1 shows that at the beginning of the school year, the average result of the boys in the "Standing Long Jump Test" was 174.00 ± 5.96 cm. This corresponded to a high level of competence. The average result of the boys in the long jump test was 278.67 ± 8.34 cm. This corresponds to the average level of competence of schoolchildren. The result of the "30 meter sprint test" was recorded at a sufficient level of competence. The result of the "60 meter sprint test" was recorded at a high level of competence.

At the beginning of the school year the girls' results corresponded to a high level of competence: "Standing Long Jump Test", "Long jump", "30 meter sprint test". The result of the "60 meter sprint test" corresponded to a sufficient level of competence. It should also be noted that between the results of boys and girls, the level of development of speed

and strength qualities had no statistical significance ($p < 0.05$).

At the end of the school year the results of these test exercises showed the following: in boys the result of "Standing Long Jump Test" was 176.00 ± 4.39 cm. This corresponded to a sufficient level of competence of schoolchildren. The result of "Long jump" had an average level of competence. The increase for the year was only 2.87 cm. The average result of the "30 meter sprint test" remained high. The improvement rate was 0.06 s. The level of competence "60 meter sprint test" has changed for the worse – the indicator decreased by only 0.44 s. This figure was 10s (high level of competence).

Changes in levels of competence can be clearly seen in Figure 4.

The average score of the Standing Long Jump Test at the end of the school year was high. The increase was only 1.2 cm. This fact cannot be considered sufficient. The average result of "Long jump" increased by 4.89 cm. This is a high level of competence. The results of the "30 meter sprint test" remained at a high level of competence. The results of the girls' 60 meter sprint test remained in the "sufficient" position.

The correlation analysis of the obtained data shows that between all the results of test exercises there are relationships of medium and high level (Table 2).

Table 1. Indicators of speed and strength abilities of schoolchildren 12-13 years ($n = 31$)

Period of study, statistical indicators	Sex of schoolchildren	Standing Long Jump Test (Broad Jump), cm $\bar{x} \pm m$	Long jump, cm	30 meter sprint test, sec.	60 meter sprint test, sec.
At the beginning of the school year	boys	174.00 ± 5.96	278.67 ± 8.34	5.38 ± 0.30	10.44 ± 0.12
	girls	165.33 ± 3.33	263.67 ± 7.55	5.56 ± 0.08	10.90 ± 0.19
At the end of the school year	boys	176.00 ± 4.39	281.54 ± 5.76	5.32 ± 0.54	10.00 ± 0.21
	girls	166.51 ± 5.48	268.56 ± 6.45	5.52 ± 0.23	10.51 ± 0.31
t_{boys}		0.27	0.28	0.11	1.20
t_{girls}		0.24	0.49	0.16	1.10
p		< 0.05			

Table 2. Correlation analysis of test exercise results

Tests	Standing Long Jump Test (Broad Jump), cm	Long jump, cm	30 meter sprint test, sec.	60 meter sprint test, sec.
Standing Long Jump Test (Broad Jump), cm	1			
Long jump, cm	0.737067	1		
30 meter sprint test, sec.	-0.81241	-0.63979	1	
60 meter sprint test, sec.	-0,86806	-0,68909	0,817342	1

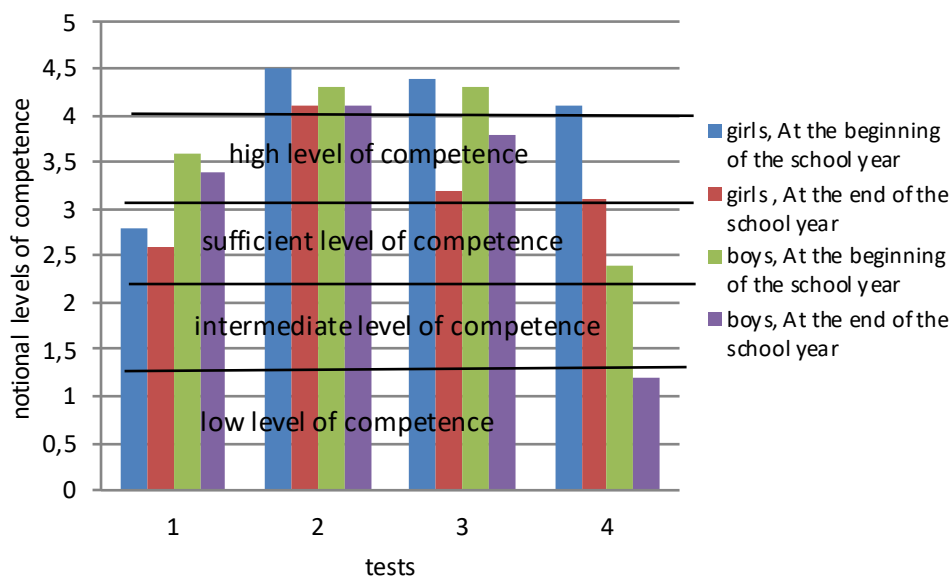


Figure 4. Changes in the levels of competence in the indicators of speed and strength abilities of schoolchildren during the year of mixed and distance learning: 1 - “60 meter sprint test”, 2 - “30 meter sprint test”, 3 - “Standing Long Jump Test”, 4 - “Long jump”.

Discussion

Our results confirm the data of other studies [17, 18]. The authors draw attention to the declining physical activity of the population during the COVID-19 pandemic. Mattioli et al. [19], Giustino et al. [20], Dunton et al. [7] note that under the conditions of quarantine restrictions during the COVID-19 pandemic, remote physical activity for the population intensified. However, the difficulty of performing technically correct individual movements through visual observation on the Internet carries certain risks of injury to the musculoskeletal system. The authors also point out that human inaction in just two weeks leads to the possibility of losing many beneficial metabolic and cardiovascular changes. Sopa et al. [5], Brooks et al. [6] noted the likelihood of deteriorating mental health in schoolchildren. According to the authors in conditions of reduced physical activity, the incidence of bad mood, imbalance, nervousness, poor sleep.

Some teachers quickly adapted to these conditions. They tried to improve the health of schoolchildren and develop their basic physical qualities. Teachers used a variety of multimedia platforms, messengers, social networks with these recommendations. However, this organization of the educational process in Ukraine had its downsides: the number of schoolchildren in online classes fell sharply; the rest of the schoolchildren simply did not perform any actions during the lessons. The reasons were voiced variously: lack of space to perform movements and the necessary equipment or improvised means, etc.

Josip Karuc et al. [21] studied the physical

activity of middle school schoolchildren in Croatia during the COVID-19 pandemic. The authors note a decrease in the level of physical activity in those schoolchildren who led an active lifestyle before quarantine. There was also an increase in the level of physical activity in schoolchildren who did not exercise before quarantine. Similar trends were observed by Dunton et al. [7] studying the impact of the COVID-19 pandemic on the physical activity and sedentary behavior of children living in the United States. Štveráková et al. [22] studied the physical activity of Czech children during the second wave of the COVID-19 pandemic. The authors note that Czech children are less physically active than their peers abroad. The authors note that further significant reductions in children’s physical activity due to epidemic restrictions are alarming and should be regulated by government agencies and school administrations. Atiković et al. [23] note a decrease in the time that schoolchildren began to devote to various types of physical activity during anti-epidemiological measures. However, most studies have shown a decrease in physical activity in different regions. These data are based on the use of online questionnaires. In our opinion, this may somewhat distort the real situation.

In our study, there is a tendency to reduce the growth rate of speed and strength qualities of schoolchildren. This is a consequence of reduced physical activity of schoolchildren. Similar conclusions were obtained by Natasa Zenic et al. [24]. The authors draw attention to the decrease in indicators of basic physical qualities and the level of physical activity in general of high school schoolchildren in Croatia. The authors also note that most schoolchildren did not follow the

recommendations of teachers on the recommended minimum physical activity. Wei Xia et al. [25] observed a decrease in the results of 50, 800 and 1000 m in boys and girls in China. The authors note the improvement of strength training in the exercises “Eurofit Sit Up Test”, “Pull-Up Bars” for boys and “Squats Test” for girls.

The results of the tests in our study indicate a deterioration in the health of schoolchildren. We attribute this fact to the fact that distance learning does not allow to fully master motor tasks. This is confirmed by studies of other authors. Research by Jarnig et al [26] suggests that joint efforts are needed to improve children’s health. This will prevent long-term negative health consequences.

The results of our study are just an attempt at one school level to show the ability to counter the negative effects of the COVID-19 pandemic. In this regard, we recommend taking the example of national measures for physical activity during the pandemic COVID-19 pandemic of the Republic of Slovenia. Jurak et al. [27] note that the Republic of Slovenia implements the world’s largest longitudinal database of physical fitness of children - SLOfit. Slovenia has some of the most physically active children in the world. The authors found that the crisis in children’s fitness requires integrated community participation and a strong response to health policies. In Cyprus and Greece, three enhanced health measures have been taken to control the COVID-19 pandemic [28].

The authors used wearable sensors to constantly monitor the personal location and physical activity of schoolchildren (mean age - 9.7 years). The authors argue that such technology provides objective, continuous real-time location and activity data. Although we have not studied children’s physical activity with such devices, we fully agree with this approach. This may be the goal of our next study.

The presence of high correlations between individual indicators of speed and strength training in our study indicates the appropriateness of reducing the number of test exercises for schoolchildren. This leaves more time for mastering movements, improving schoolchildren’ health and entertaining them during physical education lessons.

Conclusions

The presence of high and medium correlations between the tests of speed and power orientation allows us to recommend reducing the number of mandatory control standards in the school: the choice of long jump from a place or long jump from a run; running 30 meters or running 60 meters.

Over the last year, forced mixed and distance learning has led to a significant trend to reduce the level of development of speed and strength abilities of schoolchildren aged 12-13.

Conflict of interest

The author report no conflict of interest.

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Cite this article as:

Nesen O. Development of speed and strength abilities of children aged 12-13 years in physical education classes in the COVID-19 pandemic. *Pedagogy of Health*, 2022;1(1):4-10.
<https://doi.org/10.15561/health.2022.0101>

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Received: 25.05.2021

Accepted: 25.06.2021; Published: 18.01.2022