

ANALYSIS OF PHYSICAL FITNESS INDICATORS OF SCHOOLCHILDREN
WITH SENSORY DEPRIVATION IN COMPARISON
WITH RELATIVELY HEALTHY PEERS

АНАЛІЗ ПОКАЗНИКІВ ФІЗИЧНОЇ ПІДГОТОВЛЕНOSTІ ШКОЛЯРІВ
ІЗ СЕНСОРНОЮ ДЕПРИВАЦІЄЮ ПОРІВНЯНО
З ВІДНОСНО ЗДОРОВИМИ ОДНОЛІТКАМИ

Bukhovets B. O.¹, Bondarenko O. V.², Onyshchuk S. O.³

^{1,2}SI “Southern Ukrainian National Pedagogical University named after K. D. Ushinsky”,
Odesa, Ukraine

³Municipal Higher Education Institution “Odesa Academy of InService Education
of the Odesa Regional Council”

¹ORCID: 0000-0002-8819-3104

²ORCID: 0000-0002-0769-6683

³ORCID: 0000-0002-3101-8524

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Abstracts

The article presents a scientific study on the analysis of physical fitness of 11-year-old schoolchildren with visual impairment in comparison with their relatively healthy peers. Repeated studies in the field of physical culture and sports in recent years have indicated a low level of physical development and physical fitness of schoolchildren with visual impairment. There is an assumption that the indicators of physical development and physical fitness of schoolchildren with visual impairment differ significantly from their relatively healthy peers, but there is a lack of modern scientific research to support this assumption. *The purpose of the study* is to analyze the physical fitness of schoolchildren with visual impairment in comparison with their relatively healthy peers. *Research methods*: theoretical (analysis of scientific and methodological literature, theoretical analysis and generalization, system analysis), pedagogical (experiment, testing), mathematical. Primary methods of mathematical processing were used to study general features of schoolchildren's physical fitness indicators. *Results of the study*. Schoolchildren with visual impairment needed 0.5 seconds more to complete the speed and agility exercise compared to their relatively healthy peers. This difference is statistically significant at the level of $p < 0.01$ and thus confirms the data that 11-year-old students with visual impairment have a significant lag in the development of speed and agility compared to their relatively healthy peers. There was also a difference in jumping rope performance in one minute, which was 7 times ($p < 0.01$). *Conclusions*. Thus, the study of physical fitness indicators of 11-year-old schoolchildren with visual impairment showed that, compared to the standards of physical fitness, most of the subjects had low or satisfactory development of speed and strength, sufficient or satisfactory endurance, and satisfactory flexibility. The data obtained confirm that students with visual impairment lag behind their peers in the ability to perform work for a certain period of time without reducing productivity.

Key words: schoolchildren, vision, deprivation, program, physical fitness, motor function, correction, physical education.

У статті представлено наукове дослідження, що присвячене аналізу показників фізичної підготовленості школярів 11 років із порушенням зору порівняно з їхніми відносно здоровими однолітками. Багаторазові дослідження в галузі фізичної культури і спорту останніми роками вказують на низький рівень фізичного розвитку та фізичної підготовленості школярів із порушенням зору. Є припущення, що показники фізичного розвитку та фізичної підготовленості у школярів із порушенням зорової функції істотно відрізняються від їхніх відносно здорових однолітків, але сучасних наукових досліджень, що підтверджують це припущення, вкрай не досить. *Мета дослідження* полягає в аналізі показників фізичної підготовленості школярів із порушенням зору порівняно з їхніми відносно здоровими однолітками. *Методи дослідження*: теоретичні (аналіз наукової й методичної літератури, теоретичний аналіз та узагальнення, системний аналіз), педагогічні (експеримент, тестування), математичні. Для

дослідження загальних особливостей показників фізичної підготовленості школярів було застосовано первинні методи математичної обробки. *Результати дослідження.* Школярі із порушенням зору потребували на 0,5 секунди більше для виконання вправи на швидкість та спритність порівняно з їхніми відносно здоровими однолітками. Ця відмінність має статистичну значущість на рівні $p < 0,01$, і, таким чином, підтверджено дані, що 11-річні школярі із порушенням зору мають помітне відставання у розвитку швидкості та спритності порівняно з їхніми відносно здоровими однолітками. Також спостерігалася різниця у виконанні стрибків на скакалці за одну хвилину, яка за медіанами становила 7 разів ($p < 0,01$). *Висновки.* Таким чином, проведене дослідження показників фізичної підготовленості школярів 11 років із порушенням зору показало, що порівняно зі стандартами фізичної підготовленості більшість із досліджуваних мали низький або задовільний розвиток швидкості та сили, достатню або задовільну витривалість, задовільну гнучкість. Отримані дані підтверджують значне відставання школярів із порушенням зору в умінні протягом певного часу виконувати роботу без зниження продуктивності порівняно з їхніми однолітками.

Ключові слова: школярі, зір, депривація, програма, фізична підготовленість.

Introduction. Pathology of the visual organs negatively affects the motor function of schoolchildren and, as a result, the development of their physical qualities [12]. Physical inactivity, as a forced form of behavior for students with visual impairment, leads to hypodynamia and hypokinesia, which has a number of negative consequences [2; 5]. Scientists point out that the ability of schoolchildren with visual impairments to perform physical exercises is determined by the important role of the muscular system in their entire life [13]. Modern scientific research has shown that exercise by visually impaired students has a positive effect on strengthening the muscular corset [1; 6]. There is an assumption that under the influence of physical activity, the functional state of the muscular system of students with visual impairment increases and the activity of other systems of their body improves [3; 10]. With systematic physical education and sports using optimal loads, students with visual impairment approach the norm in many indicators of physical fitness, and some may even surpass it [6]. By increasing the activity of the motor analyzer in representatives of this nosology, it is even possible to obtain positive changes in the visual analyzer and even to direct the improvement of visual functions [8]. Determining the influence of physical activity on the level of physical fitness of schoolchildren with visual impairment in many cases depends on properly organized correctional work and purposefully built system of physical exercises [9; 15]. Scientists have described and experimentally proved positive influence of physical exercises on functional state and physical fitness of schoolchildren of the presented nosology [1; 7; 9].

Scientists note that in students with visual impairment, visual orientation remains the leading one, which affects the amount, quality and speed of information received by the damaged analyzer [10; 16]. This affects: a decrease in the student's sensory experience, slowing down or impossibility of orientation in space, and also leads to disharmonious development of sensory and intellectual functions and a low level of physical fitness [2; 8].

Improving the level of physical fitness of visually impaired schoolchildren is one of the main tasks of physical culture and sports. Good physical fitness, determined by the level of development of basic physical qualities, is the basis of high performance in all types of further activities of schoolchildren [4; 11]. Nevertheless, numerous studies in the field of physical culture and sports in recent years have shown a low level of physical development and physical fitness of schoolchildren with visual impairments [9; 17]. There is an assumption that indicators of physical development and physical fitness in schoolchildren with visual impairment differ significantly from their peers with normal vision. However, there is a lack of research to support this assumption [3]. To determine the physical fitness of schoolchildren with sensory deprivation in the form of visual impairment, motor tests are used to assess the development of important physical qualities [7], i.e. strength, endurance, flexibility, speed and agility.

The purpose of the study is to analyze the indicators of physical fitness of schoolchildren with visual impairment in comparison with their relatively healthy peers.

Material and Methods. Guided by ethical principles and based on informed consent, a

pedagogical study was conducted. The study involved 20 schoolchildren aged 11, 10 of whom were visually impaired and 10 relatively healthy. The pedagogical research was conducted at the Zoresvit Educational and Rehabilitation Center in Odesa. Odesa and in the Supporting Educational Institution “Vypasnyanske Institution of General Secondary Education” of the Molohivka Village Council of the Bilhorod-Dnistrovskiy District of Odesa Region. The research was implemented in compliance with the main provisions of the “Rules for Ethical Principles for Research Involving Human Subjects” approved by the Declaration of Helsinki (1964–2013).

The following methods were used in the scientific research: theoretical (analysis of scientific and methodological literature, theoretical analysis and generalization, system analysis), pedagogical (experiment, testing), mathematical. Primary methods of mathematical processing were used to study general features of children’s physical fitness.

Physical fitness was tested according to the general methodology [14]. Speed and agility were measured by the results of a 4x9 m shuttle run in seconds. Strength was determined by the “long jump from a standing position” test in centimeters. Endurance was assessed by two tests: lifting the torso from the starting position lying down with fixing the number of successful attempts per minute; jumping rope with counting the number of times in 1 minute. Flexibility was measured by tilting the torso forward from a sitting position with simultaneous extension of the arms forward in centimeters [1]. The data

obtained in this way were compared with the norms of the relevant tests to determine the level of severity of each indicator according to the age of the students [14]. Then they were compared with similar data obtained from testing their relatively healthy peers [1; 14].

To describe the general features of physical fitness, the methods of estimating the central tendency (arithmetic mean, mode of distribution) and variability of distribution (standard deviation, quartiles of distribution) were used. Secondary methods of mathematical statistics: to prepare the data for the application of statistical procedures, in particular, to select adequate statistical criteria, the procedure for checking the results of the study for normality using the Kolmogorov-Smirnov consistency criteria with the Liliefors and Shapiro-Wilk corrections was used. The statistical processing of the research results was carried out using IBM SPSS Statistics 21 software, and the graphical material was prepared in Microsoft Excel.

Results of the study. The majority of relatively healthy pupils (67%) performed the speed and agility test at a sufficient level and above (Fig. 1). That is, these students demonstrated the ability to move from one place to another quickly enough, to perform motor tasks with accuracy and coordination, while students with visual impairment were inferior in these indicators.

In terms of strength, almost all relatively healthy schoolchildren had a sufficient and sometimes high level of long jump from a standing position. In terms of endurance, most of them demonstrated sufficient ability to perform

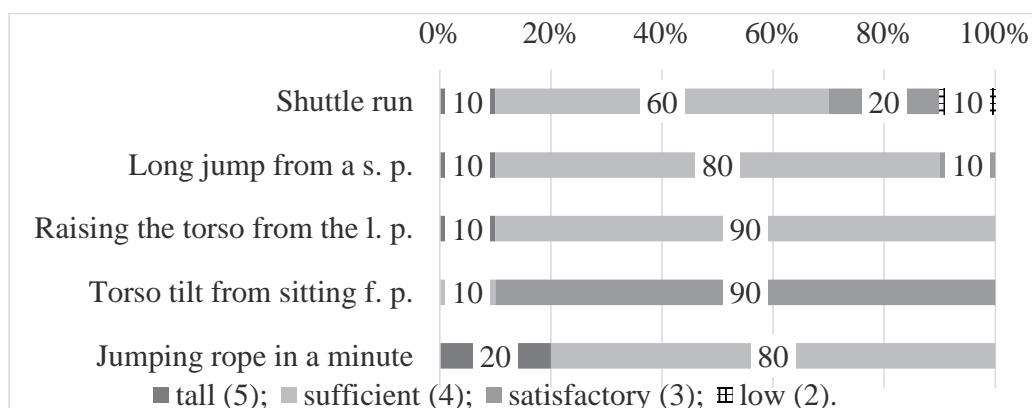


Fig. 1. Distribution of children aged 11 without visual impairment by levels of physical fitness in percentage (n=10), where the following levels are presented: tall, sufficient, satisfactory, low

physical activity for a long time. The distribution of results in terms of flexibility was not much different, as relatively healthy students, like their peers with visual impairment, were diagnosed with mostly satisfactory ability to move joints and muscles without restrictions and pain. If we summarize these data, it becomes obvious that 11-year-old students with visual impairment, compared to their relatively healthy peers, are less fast, agile, weaker and more tired. The analysis of the results of physical fitness tests of 11-year-old schoolchildren with and without visual impairment revealed that parametric methods of

mathematical statistics should not be applied to any of the compared indicators (Table 1).

Thus, while the nature of the distribution of results is close to normal in terms of speed, strength, and endurance in visually impaired pupils, there is no obvious compliance with the normal law in the second group. Similarly, the flexibility index is normally distributed only in the group of relatively healthy pupils. Therefore, nonparametric methods were used for statistical analysis in all cases. Let us consider the differences in the medians of the distribution of these indicators in the compared groups and provide data on their statistical reliability (Table 2).

Table 1

The results of checking the distribution of data on physical fitness of 11-year-old children with visual impairment and without visual impairment for normality

Indicators	11 y.o. with visual impairment (n=10)				11 y.o. without visual impairment (n=10)			
	Kolmogorov-Smirnov with Lilliefors correction		Shapiro-Wilk		Kolmogorov-Smirnov with Lilliefors correction		Shapiro-Wilk	
	D	p	W	p	D	p	W	p
Shuttle run	0.196	p>0.20	0.902	p>0.20	0.209	p>0.20	0.861	p<0.10
Long jump from a standing position	0.202	p>0.20	0.857	p<0.10	0.273	p<0.05	0.770	p<0.05
Raising the torso from the lying position	0.135	p>0.20	0.923	p>0.20	0.273	p<0.05	0.883	p>0.10
Torso tilt from sitting forward position	0.266	p<0.05	0.859	p<0.10	0.200	p>0.20	0.932	p>0.20
Jumping rope in a minute	0.182	p>0.20	0.879	p>0.10	0.287	p<0.05	0.794	p<0.05

Table 2

Differences in the severity of physical fitness indicators between 11-year-old children with visual impairment and their peers without visual impairment

group	n	Statistical indicators							U	p
		\bar{x}	S	Me	25%	75%	U	p		
Speed and agility (shuttle run, s)										
Children with visual impairment	n=10	12.5	0.41	12.4	12.2	12.8	7	p<0.01		
Children without visual impairment	n=10	11.79	0.43	11.9	11.6	12.1				
Strength (long jump from a standing position, cm)										
Children with visual impairment	n=10	145.7	9.80	146	144	154	21	p<0.05		
Children without visual impairment	n=10	160	13,3	164	146	172				
Endurance (lifting the body from the lying position, times)										
Children with visual impairment	n=10	31.9	3.35	32	29	35	13	p<0.01		
Children without visual impairment	n=10	36.3	1.64	36	35	37				
Flexibility (tilt of the torso from sitting forward with simultaneous extension of the arms forward, cm)										
Children with visual impairment	n=10	9.1	2.56	8	8	10	39	p>0.05		
Children without visual impairment	n=10	9.3	1,34	10	8	10				
Endurance (jumping rope in 1 minute, times)										
Children with visual impairment	n=10	101.5	2.42	101	99	102	15	p<0.01		
Children without visual impairment	n=10	107.1	4.91	108	102	111				

Notes. The level of significance of differences was determined by the following critical values: $U_{kp}(10; 10; 0.01)=16$; $U_{kp}(10; 10; 0.05)=23$.

The information presented in the table shows that pupils with visual impairments needed 0.5 seconds more to perform the speed and agility exercise compared to their peers without such complications. This difference is statistically significant at the level of $p < 0.01$, and thus confirms that 11-year-old pupils with visual impairment have a significant lag in the development of speed and agility compared to their relatively healthy peers.

During the long jump test, these students showed less strength, as they covered distances that were 18 cm shorter on average than their peers, and such differences were statistically significant at the 5% level of confidence. In endurance exercises, 11-year-old schoolchildren with visual impairment demonstrated significantly worse results than their peers. The difference in the number of successful attempts per minute during the exercise “lifting the torso from the supine position” was 4 times in median and was statistically significant at the level of significance less than 0.01. There was also a difference in jumping rope performance in one minute, which was 7 times ($p < 0.01$). These data confirm a significant lag in the development of the ability of 11-year-old schoolchildren with visual impairment to perform work for a certain period of time without reducing productivity compared to their peers. In terms of flexibility, these adolescents also showed lower results than their peers, but the difference in the forward torso bend exercise was only 2 cm, and this difference did not reach the appropriate level of statistical significance. Thus, 11-year-old schoolchildren with visual impairment differed significantly from their relatively healthy peers in terms of significantly worse development of speed and agility, strength and endurance.

Discussion. Analyzing the data of the scientific study, it was found that 11-year-old schoolchildren had significantly lower development of speed ($p < 0.01$), strength ($p < 0.05$)

and endurance ($p < 0.01$) compared to their relatively healthy peers. The data obtained during the speed test are interesting. Most relatively healthy students performed this test at a sufficient level and even higher, while students with visual impairment were significantly inferior in these indicators. The presented lower values of physical fitness indicators of schoolchildren with visual impairment in comparison with their relatively healthy peers can be caused by difficulties of visual-motor orientation and sedentary lifestyle [5; 7]. When generalizing indicators of physical fitness, it was found that 11-year-old schoolchildren with visual impairment, compared to their relatively healthy peers, are less fast, agile, weaker and more tired. The results of the presented study confirm the assumptions of scientists [13; 17] that visual analyzer dysfunction slows down spatial orientation and leads to a low level of physical fitness of schoolchildren due to motor hypodynamia [11; 16].

Conclusions. Thus, the study of the state of physical fitness of 11-year-old schoolchildren with visual impairment showed that, compared to the standards of physical education, most of them had low or satisfactory development of speed and strength, sufficient or satisfactory endurance, and satisfactory flexibility. Comparison with their relatively healthy peers showed that 11-year-old with visual impairment have lower speed and agility, and poorer development of strength and endurance. The obtained data of the scientific research substantiate the need to develop a modern physical education program for children with visual impairment, which will be aimed at both improving the level of physical fitness and correcting motor function by means of physical culture and sports. Further scientific research will be devoted to the development and testing of a physical education program for children with visual impairment aimed at improving physical fitness and correction of motor function by means of physical culture and sports.

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