ФІЗИЧНА КУЛЬТУРА І СПОРТ

COMPARATIVE ANALYSIS OF ANTHROPOMETRIC INDICATORS OF 11-YEAR-OLD CHILDREN WITH VISUAL IMPAIRMENT IN COMPARISON TO THEIR HEALTHY PEERS

ПОРІВНЯЛЬНИЙ АНАЛІЗ АНТРОПОМЕТРИЧНИХ ПОКАЗНИКІВ ДІТЕЙ 11 РОКІВ З ПОРУШЕННЯМ ЗОРУ З ЇХ ВІДНОСНО ЗДОРОВИМИ ОДНОЛІТКАМИ

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Abstracts

The article discusses data from recent scientific research dedicated to the analysis and comparison of anthropometric indicators in 11-year-old children with visual impairments compared to their relatively healthy peers. Due to partial or profound impairment of the visual analyzer and its functions, the authors suggest that these children exhibit significant lag in physical development. Scientists note low anthropometric indicators, specifically in body weight, height, chest circumference, and chest excursion in children with visual impairments. **The goal of the research is** to conduct a comparative analysis of anthropometric indicators in 11-year-old children with visual impairments and their relatively healthy peers.

Research Methods. The study involved 20 children: 11-year-old, comprising 10 children with visual impairments attending the Educational and Rehabilitation Center "Zoresvit" in Odesa, and 10 relatively healthy children. The healthy children received basic secondary education at the Supportive Educational Institution "Vypasnyansky Educational Establishment of General Secondary Education" of the Molohivska village council in the Bilhorod-Dnistrovskyi district of the Odesa region. The scientific research was conducted in accordance with the fundamental principles of the "Ethical Principles for Conducting Human Research" as outlined in the Helsinki Declaration (1964–2013). **The accomplishment of the research objectives was carried out using commonly accepted methods:** including theoretical analysis of scientific literature on the chosen research topic, standard anthropometry, and mathematical data processing. **Results.** In conducting a comparative analysis of these indicators in groups of 11-year-old children with visual impairments and their relatively healthy peers, it is noted that for some of these indicators, children with visual dysfunctions exceed their peers. These indicators include body weight and body length by both absolute and sigma values, as well as the chest excursion indicator. However, corresponding statistical analysis showed that the difference between the groups is statistically significant only for body weight indicators ($p<0.01$), while for the rest of the indicators, the differences do not reach statistical significance. In other words, 11-year-old children with visual impairments significantly differed from their relatively healthy peers primarily in terms of body weight, both in kilograms and in sigma assessments, taking into account age-specific norms. **Conclusions.** The difference in anthropometric indicators between groups of children with visual impairments and their relatively healthy peers is statistically significant only for body weight indicators ($p<0.01$). This suggests that children with visual impairments have significant differences

in body weight compared to their healthy peers. Interestingly, for the rest of the investigated indicators, differences do not reach statistical significance. This may indicate that, despite visual impairments, other aspects of physical development in these children may be similar to their healthy counterparts. The conducted comparative analysis of anthropometric indicators highlights that some children with visual dysfunctions exceed their peers, specifically in terms of body weight and body length indicators by both absolute and sigma values.

Key words: physical development, anthropometric indicators, children, visual impairments.

У статті розглянуто дані сучасних наукових досліджень, присвячених аналізу та порівнянню антропометричних показників дітей 11 років з порушенням зору з їх відносно здоровими одно-літками. Внаслідок часткового або глибокого порушення зорового аналізатора та його функцій, на думку авторів, у дітей відзначається значне відставання у фізичному розвитку. Науковці відзначають низькі антропометричні показники, а саме маси та зросту тіла, обводу грудної клітини й екскурсії у дітей із порушенням зору. **Мета дослідження** полягає у порівняльному аналізі антропо-метричних показників у дітей 11 років із порушенням зору з їх відносно здоровими однолітками. **Методи дослідження.** У дослідженні взяли участь 20 дітей 11 років, з яких 10 дітей із порушенням зору, які навчались у Навчально-реабілітаційному центрі «Зоресвіт» м. Одеси, та 10 дітей відносно здорових. Останні здобували базову середню освіту в Опорному закладі освіти «Випаснянський заклад загальної середньої освіти» Мологівської сільської ради Білгород-Дністровського району Одеської області. Наукове дослідження реалізовано з дотриманням основних положень «Правил етичних принципів проведення наукових досліджень за участю людини», затверджених Гельсін-ською декларацією (1964–2013 рр.). **Вирішення поставлених завдань дослідження проводилося загальноприйнятими методами:** теоретичного аналізу даних наукової літератури з вибраної теми дослідження, стандартної антропометрії та математичної обробки даних. **Результати.** Проводячи порівняльний аналіз цих показників у групах дітей 11 років із порушенням зору та їхніх відносно здорових однолітків, відзначимо, що за деякими з них діти із зоровими дисфункціями перевищують своїх однолітків. Це показники маси та довжини тіла за абсолютними та сигмальними значення-ми, а також показник екскурсії грудної клітини. Втім відповідний статистичний аналіз показав, що різниця між групами є статистично достовірною лише за показниками маси тіла (р<0,01), а за рештою показників відмінності не набувають рівня статистичної значущості. Тобто 11-річні діти із порушенням зору суттєво відрізнялися від їхніх відносно здорових однолітків значно більшою масою тіла, як у кілограмах, так і у сигмальних оцінках, визначених з урахуванням норм для віку. **Висновки.** Різниця за антропометричними показниками між групами дітей із порушенням зору та їх відносно здоровими однолітками є статистично достовірною лише за показниками маси тіла (р<0,01). Цікавим є той факт, що за рештою досліджуваних показників відмінності не набувають рівня статистичної значущості. Проводячи порівняльний аналіз досліджуваних антропометричних показників у групах дітей 11 років із порушенням зору та їхніх відносно здорових однолітків, від-значимо, що за деякими з них діти із зоровими дисфункціями перевищують своїх однолітків. А саме за показниками маси та довжини тіла за абсолютними та сигмальними значеннями.

Ключові слова: фізичний розвиток, антропометричні показники, діти, порушення зору.

Introduction. Significant lag in physical development is observed in children due to partial or profound impairment of the visual analyzer and its functions [4]. Scientists note [5; 6] low anthropometric indicators, a body weight and body height, chest circumference and excursion [7]. Authors particularly note a rapid lag in physical development indicators [6] of middle school-aged children with visual impairments compared to their relatively healthy peers [1; 17]. These changes may be due to difficulties in visual-motor coordination [3; 9], which subsequently of lead to hypodinamia, which, overall, has a negative impact on the development of motor activity in children with visual impairment [8]. Analysis of recent research [11] and publications dedicated to analysis [14] and comparison [16] of indicators of physical development in children with visual impairments compared to their relatively healthy peers [18] determined the discrepancy in opinions regarding the severity of delay. This statement is supported by the exceeding of certain indicators of physical development in children with visual impairments compared to their relatively healthy peers. For example: significant overweight in children with visual impairments [12]. It is possible to assume that the increase in body weight in children with

visual impairments is due to a sedentary lifestyle, hypodynamia, or spatial-coordination disorders [9; 12]. The lack of consensus regarding the delay in physical development disorders or the exceeding of certain anthropometric indicators in children with visual impairment compared to their healthy peers underscores the relevance of the presented study.

The aim of the study is to conduct a comparative analysis of anthropometric indicators in 11-year-old children with visual impairment in relation to their healthy peers.

Materials and Methods of the Study. Twenty 11-year-old children participated in the study, including 10 children with visual impairment who attended the Educational and Rehabilitation Center "Zoresvit" in Odesa, and 10 relatively healthy children. The latter received basic secondary education at the Educational Institution "Vypasniansky Educational Institution of General Secondary Education" of the Mologivska village council in the Bilhorod-Dnistrovskyi district of the Odesa region. The scientific research was conducted in accordance with the fundamental principles of the "Rules of Ethical Principles for Conducting Human Research", as approved by the Helsinki Declaration (1964–2013). **The tasks set in the research were addressed using commonly accepted methods:** theoretical analysis of scientific literature on the chosen research topic [13], standard anthropometry [15], and mathematical data processing [2].

To analyze and compare anthropometric indicators of 11-year-old children with visual impairment relative to their healthy peers, methods of central tendency assessment (mean, mode) and distribution variability (standard deviation, quartiles) were employed. To prepare the data for the application of statistical procedures, a procedure for checking the research results for normality was employed using the Kolmogorov-Smirnov goodness-of-fit tests with Lilliefors correction and Shapiro-Wilk test. To determine differences in anthropometric indicators between children with visual impairment and their relatively healthy peers, as well as within this sample, the method of comparing independent samples using the Mann-Whitney U test and

Student's t-test was applied. The processing of research results was conducted using IBM SPSS Statistics 21 software, and graphical material was prepared in the Microsoft Excel package.

The research findings. In the group of 11-year-old children with visual impairment, body weight ranged from 35 kg to 58 kg, with an average of (45.8±7.3) kg. Height varied from 140 cm to 156 cm, with an average of (148.1±5.65) cm. Chest circumference during inhalation ranged from 68 cm to 80 cm, with an average of (74.2±4.39) cm, and during exhalation from 65 cm to 79 cm, with an average of (71.7±5.21) cm. Chest excursion ranged from 2 cm to 4 cm, with an average of (2.9±0.88) cm.

The data presented in figure 1 showed that in the majority of 11-year-old children with visual impairment, body weight exceeded the norm for their age (80%). The height of these children was above the average level in 30% and high in another 30%. Regarding chest circumference, 30% of the children corresponded to a high level, 30% were above average, and 40% were at an average level. In terms of chest excursion, 70% of the children showed an average level, while 30% showed a low level. This indicates that the majority of 11-year-old children with visual impairment had anthropometric indicators characterized by above-normal values for weight, height, and chest circumference, with moderate chest excursion. Before proceeding to the comparative analysis of the obtained anthropometric results for 11-year-old children in this group, let's evaluate the distribution parameters within the group and determine the appropriate statistical methods to apply to them (Table 1).

The table data indicate that body weight and chest circumference indicators are normally distributed, and therefore, we will characterize the distribution center by means and standard deviations. To assess the statistical significance of differences, we will apply the Student's t-test. The distribution of height also has normal parameters in the group of 11-year-old children. However, chest excursion is characterized by a non-normal distribution. It is evident that for the latter two indicators, we will choose non-parametric
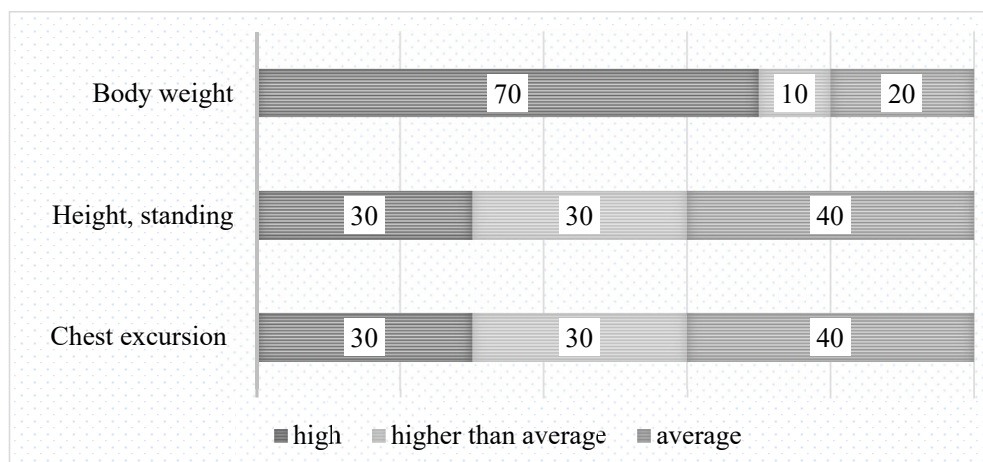
Fig. 1. Distribution of 11-year-old children with visual impairment by the expression of anthropometric indicators in percentages (n=10)

Table 1

The results of checking the distribution of physical development indicators in 11-year-old children with visual impairment for normality

The indicators	11 years old (n=10)			
	"Kolmogorov-Smirnov with Lilliefors correction"		"Shapiro-Wilk"	
	D	p	W	p
Body weight, kg	0.156	p>0.20	0.945	p>0.20
Height, standing, cm	0.163	p>0.20	0.93	p>0.20
Chest circumference inhalation, cm	0,.259	p<0.05	0.899	p>0.20
Chest circumference exhalation, cm	0.171	p>0.20	0.913	p>0.20
Chest excursion	0.248	p<0.05	0.805	p<0.05
Body weight (σ)	0,218	p>0.10	0,.917	p>0.20
Height, standing (σ)	0,217	p>0,20	0,909	p>0.20
Chest circumference (σ)	0.178	p>0.20	0.936	p>0.20

statistical analysis criteria. Among relatively healthy children, there were no individuals with a high body weight level overall. Fifty percent of the children were characterized by above-normal body weight, and 50% had normal body weight (Fig. 2).

The height of these children corresponded to the norm in 50% of cases, with the remaining children either slightly taller than the norm for 11 years (30%) or considered tall for their age (20%). Regarding the chest circumference and excursion indicators, the data for 11-year-olds without visual deprivation were the same as those in the group with visual deprivation. In other words, 11-year-old children without visual deprivation generally have lower body weight

and height. However, chest circumference and excursion in them are approximately the same as in children with visual deprivation. The check for normality of the results of measuring physical development indicators in the group of relatively healthy children showed that all of them, except for the chest excursion indicator by frequency distribution, are similar to normal (Table 2).

To compare anthropometric indicators of 11-year-old children with visual impairment with their relatively healthy peers, the results will be analyzed using the mean and standard deviation. Comparative analysis of anthropometric indicators will be conducted using the Student's t-test. Only for the chest excursion indicator, we will choose quartiles of distribution and
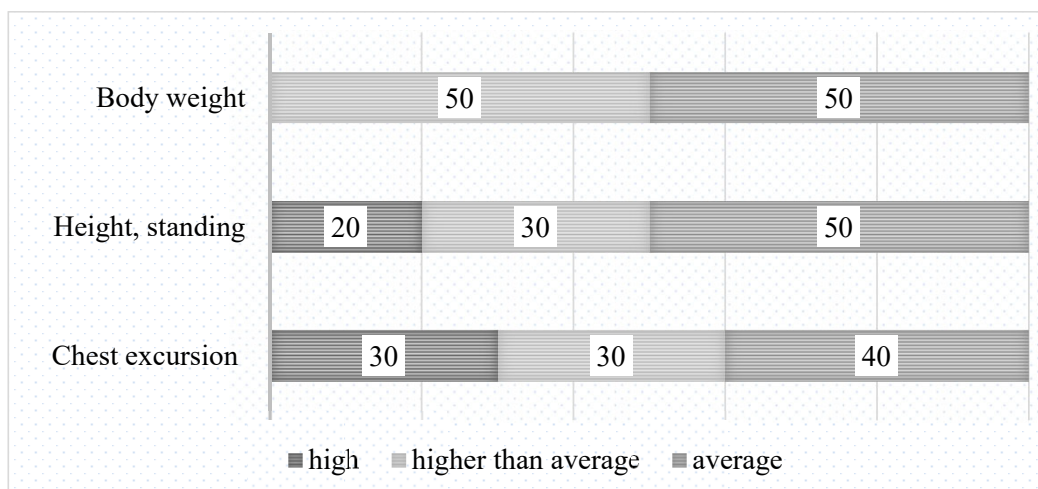
Fig. 2. Distribution of relatively healthy 11-year-old children by the expression of anthropometric indicators in percentages (n=10), depicting levels of development

Table 2

The results of checking the distribution of anthropometric indicators in 11-year-old children with visual impairment and their relatively healthy peers for normality

Indicators	11-year-olds with visual impairment (n=10)				11-year-old relatively healthy peers (n=10)			
	Kolmogorov-Smirnov with Lilliefors correction		Shapiro-Wilk		Kolmogorov-Smirnov with Lilliefors correction		Shapiro-Wilk	
	D	p	W	p	D	p	W	p
Body weight, kg	0.156	p>0.20	0.945	p>0.20	0.197	p>0.20	0.951	p>0.20
Height, standing, cm	0.163	p>0.20	0.93	p>0.20	0.225	p>0.10	0.904	p>0.20
Chest circumference inhalation, cm	0.259	p<0.05	0.899	p>0.20	0.214	p>0.20	0.881	p>0.10
Chest circumference exhalation, cm	0.171	p>0.20	0.913	p>0.20	0.197	p>0.20	0.899	p>0.20
Chest excursion	0.248	p<0.05	0.805	p<0.05	0.381	p<0.05	0.64	p<0.05
Body weight (σ)	0.218	p>0.10	0.917	p>0.20	0.177	p>0.20	0.919	p>0.20
Height, standing (σ)	0.217	p>0.20	0.909	p>0.20	0.202	p>0.20	0.89	p>0.10
Chest circumference (σ)	0.178	p>0.20	0.936	p>0.20	0.17	p>0.20	0.926	p>0.20

the U-criterion. Conducting a comparative analysis of these indicators in groups of 11-year-old children with visual impairment and their relatively healthy peers, it is noteworthy that in some of them, children with visual impairments exceed their peers (Table 3). These are indicators of body weight and height in absolute and sigma values, as well as the chest excursion indicator.

At the same time, data on chest circumference in relatively healthy 11-year-old children are somewhat higher than in the group to which we pay careful attention. However, the corresponding statistical analysis showed that the difference between the groups is statistically significant only for body weight indicators (p<0.01), while for the other indicators, the differences do not reach the level of statistical significance. In other words, 11-year-old children with visual impairment significantly differed from their relatively healthy peers in terms of body weight, both in

Table 3

Differences in the expression of anthropometric indicators between 11-year-old children with visual impairment and their relatively healthy peers

Compared groups	Statis-tical indi-cators	Indicators of physical development							
		Body weight, kg	Height, cm	Chest circumference, inhalation, cm	Chest circumference, exhalation, cm	Chest excursion	Body weight (σ)	Height (σ)	Chest circumference (σ)
with visual impairment (n=10)	$\bar{x}$	45.8	148.1	74.2	71.7	2.9	2.27	1.10	0.97
	s	7.32	5.65	4.39	5.21	0.88	1.65	0.88	1.21
	Me	45	149	76	73	3	2.51	1.36	1.24
	25%	43	143	71	67	2	1.39	0.32	-0.22
	75%	51	152	77	75	4	2.62	1.77	1.74
relatively healthy (n=10)	$\bar{x}$	37	146.5	74.7	72.5	2.6	0.56	0.84	1.04
	s	1.94	4.81	4.5	4.86	0.52	0.59	0.74	1.26
	Me	38	147	77	74	3	0.6	0.93	1.33
	25%	35	142	71	68	2	-0.01	0.12	-0.19
	75%	38	150	78	76	3	0.98	1.33	1.67
Validity of differences	t	3.29	0.68	0.25	0.36	–	2.8	0.70	0.12
	U	–	–	–	–	41	–	–	–
	p	p<0,01	p>0,05	p>0,05	p>0,05	p>0,05	p≤0,01	p>0,05	p>0,05

Note: The level of significance of differences was determined using the following critical values: $U_{кр}(10; 10; 0.05)=23$; $t_{кр}(18; 0.01)=2.88$.

kilograms and in sigma values, determined taking age norms into account.

Discussion. Analyzing the data of the scientific study, it was found that in some anthropometric indicators, children with visual impairments exceed their peers. These are the indicators of body weight and height in both absolute and sigma values. The chest excursion indicator of children with visual impairment also exceeds the corresponding indicator in comparison with their healthy peers. However, the conducted study revealed that the difference in anthropometric indicators between groups of children with visual impairment and their relatively healthy peers is statistically significant only for body weight indicators (p<0.01). This assumption has already been discussed by the authors [16]. It is interesting that for the rest of the investigated indicators, the differences do not reach the level of statistical significance. Analyzing the data of chest circumference in relatively healthy children, it was found that they are slightly higher than in the group of children with visual impairment. The experiment confirmed the data on reduced indicators of physical development in

children with visual impairment [11] compared to their healthy peers [18]. The presented values of physical development indicators in children with visual impairment exceeding the results of their relatively healthy peers may be due to difficulties in visual-motor orientation and a sedentary lifestyle [1; 3; 9].

Conclusions. The data from recent scientific research confirm the fact that children with visual impairment may experience a slowdown in the natural growth of anthropometric indicators, which are indicators of physical development. However, the age dynamics of changes in physical development in children with visual impairments remain preserved. In the presented scientific study, data were obtained that confirm the opposite statement. The difference in anthropometric indicators between groups of children with visual impairment and their relatively healthy peers is statistically significant only for body weight indicators (p<0.01). Interestingly, for the rest of the investigated indicators, the differences do not reach the level of statistical significance. Performing a comparative analysis of the studied anthropometric indicators in groups

of 11-year-old children with visual impairments and their relatively healthy peers, it is noteworthy that, in some aspects, children with visual dysfunctions exceed their peers. Specifically, in terms of body weight and height indicators by both absolute and sigma values. There is an observed excess by both absolute and sigma values in representatives of the group with visual impairments compared to their healthy counterparts in the chest excursion indicator. The obtained data on these indicators may be a consequence of difficulties in visual-motor orientation and a less active lifestyle among children with visual impairments.

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