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FEATURES OF THE PHYSICAL AND PSYCHO-EMOTIONAL STATE OF CHILDREN WITH COMPLEX DEVELOPMENTAL DISORDERS

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The article presents the results of a comprehensive study of the physical and psycho-emotional state of children of primary school age with complex developmental disorders, namely children with sensorineural hearing loss in combination with a mild degree of mental retardation. The purpose of the study was to check the indicators of physical condition, physical health, psycho-emotional development of children of a certain category. This study lasted during 2013-2020, during which a comprehensive diagnosis of physical and psycho-emotional state of 249 primary school students with complex developmental disorders and 340 peers with normative development was carried out. As a result of the study, it was found that the most characteristic manifestations were observed in the physical development of children with complex disorders: the vital index was significantly lower in 7-year-old children with complex developmental disorders compared with those, who did not have it, by 15.37 % (p<0.001), the strength index – by 15.11 % (p<0.001), Stange's test – by 9.59 seconds (p<0.001), Genchi's test – by 5.98 seconds (p<0.001), Ruffier's test – by 6.99 c.u. (p<0.001), Skibinski's index – by 4.79 c.u. (p<0.001); in 8-year-olds – by 17.42 % (p<0.001), 17.44 % (p<0.001), 12.11 seconds (p<0.001), 3.98 seconds (p<0.05), 8.10 c.u. (p<0.001), 6.04 c.u. (p<0.001), respectively; in 9-year-olds – by 17.90 % (p<0.001), 16.83 % (p<0.001), 13.10 seconds (p<0.01), 5.06 seconds (p<0.05), 6.89 c.u. (p<0.01), 7.16 c.u. (p<0.001) respectively; in 10-year-olds – by 18.87 % (p<0.001), 17.49 % (p<0.001), 16.09 seconds (p<0.01), 5.58 seconds (p<0.05), 6.42 c.u. (p<0.001), 6.84 c.u. (p<0.001), respectively.

Key words: rehabilitation, physical development, hearing disorders, intellectual disorders, children with complex developmental disorders, correctional and health-improving work.

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ОСОБЛИВОСТІ ФІЗИЧНОГО ТА ПСИХОЕМОЦІЙНОГО СТАНУ ДІТЕЙ ЗІ СКЛАДНИМИ ПОРУШЕННЯМИ РОЗВИТКУ

У статті представлені результати комплексного дослідження особливостей фізичного та психоемоційного стану дітей молодшого шкільного віку зі складними порушеннями розвитку, а саме дітей із нейросенсорною глухотою у поєднанні з легким ступенем розумової відсталості. Метою дослідження була перевірка показників фізичного стану, соматичного здоров'я, психоемоційного розвитку дітей означеної категорії. Дане дослідження тривало протягом 2013-2020 рр., в ході якого проведено комплексну діагностику фізичного та психоемоційного стану 249 молодшим школярам із складними порушеннями розвитку та 340 дітям-одноліткам із нормотиповим розвитком. В результаті дослідження було встановлено, що найбільш характерні прояви відмічені у фізичному розвитку дітей зі складними порушеннями: показник життєвого індексу був достовірно нижчим у 7 річних дітей, що мали складні порушення розвитку порівняно з тими, що не мали на 15,37 % (p<0,001), силового індексу – на 15,11% (p<0,001), проби Штанге – на 9,59 с (p<0,001), проби Генчі – на 5,98 с (p<0,001), індексу Руф'є – на 6,99 у.о. (p<0,001), індексу Скібінського – на 4,79 у.о. (p<0,001); у 8 річних – на 17,42 % (p<0,001), 17,44% (p<0,001), 12,11 с (p<0,001), 3,98 с (p<0,05), 8,10 у.о. (p<0,001), 6,04 у.о. (p<0,001) відповідно; у 9 річних – на 17,90 % (p<0,001), 16,83% (p<0,001), 13,10 с (p<0,01), 5,06 с (p<0,05), 6,89 у.о. (p<0,01), 7,16 у.о. (p<0,001) відповідно; у 10 річних – на 18,87 % (p<0,001), 17,49% (p<0,001), 16,09 с (p<0,01), 5,58 с (p<0,05), 6,42 у.о. (p<0,001), 6,84 у.о. (p<0,001) відповідно.

Ключові слова: реабілітація, фізичний розвиток, порушення слуху, інтелектуальні порушення, діти зі складними порушеннями розвитку, корекційно-оздоровча робота.

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One of the priorities of state policy in the field of medicine and education is to promote the right to equal access to effective rehabilitation of children with mental and physical disabilities, the number of which, unfortunately, is constantly growing and reaches (according to inclusive resource centers) more than 11 % of child's population of Ukraine. A prerequisite for organizing an effective process of correctional and health-improving work with children of primary school age with complex disorders is the study of manifestations of physical and psycho-emotional development, which provides a differentiated approach to solving the problem.

Numerous studies of scientists [2, 12, 13] performed in the field of studying individual and typical characteristics of children with psychophysical development disorders of various nosologies, convincingly indicate the importance of a differentiated approach in correctional and health-improving work. These views have given impetus to the scientific search for new ways to overcome complex developmental disorders in children.

A number of studies devoted to the study of the problem of complex disorders in children [1, 14] are carried out in the context of theoretical provisions on the complex structure of impaired development: the relationship between the primary lesion, which is caused by biological factors, and secondary, arising as a result [6, 10].

Along with this, the analysis of the results of modern studies of the ontogenesis of integrative activity of functional systems of the child's body convincingly testifies to the leading role of the motor analyzer in creating a compensatory basis for productive overcoming of functional limitations [3, 15]. That is why researchers identify the use of health potential of physical development as one of the means of successful habilitation, rehabilitation and further socialization of children with special educational needs [4, 5].

Revealing the concept of "health improvement", K. Kozlova [8] characterizes it as a set of measures of social, educational, medical, hygienic, physical culture, aimed at improving and strengthening the physical and psychological health of children who are in health-improving institutions during the health-improving shift.

According to A. Dushka [6], the success of compensatory processes in children with mental and physical disabilities depends on the organization of the system of medical and pedagogical measures, educational and rehabilitation areas based on special techniques and methods of correctional work, taking into account the individual potential of the child.

The individual approach should take into account the clinical diagnosis, the structure of the defect, secondary abnormalities, the presence of complications, the state of the analyzers, psychomotor development, individual characteristics of cognitive processes, the zone of actual and immediate development, self-esteem, the child's attitude to his own defect, compensatory capabilities, features of the psycho-emotional sphere and character features [10, 13].

Thus, the assessment of the level of physical and psycho-emotional development of children of primary school age with complex developmental disorders is, in our opinion, the basis for studying and understanding the structure of the combined defect. After all, in contrast to a single disorder, which has mostly constant symptoms and mechanism of occurrence, the components of complex disorders correlate with each other, forming unique clinical manifestations, which negatively affects the overall development of the child's body.

The purpose of the study was to establish and correct the clinical manifestations of physical and psycho-emotional development of children of primary school age with complex disorders.

Materials and methods. During 2013–2020, we performed a comprehensive study that identified the features of clinical manifestations of physical and psycho-emotional development of children with complex disorders.

The total of 589 children participated in the study. The control group of children without developmental disabilities who studied in regular schools consisted of 340 people aged 7–10 years. The mean age was 8.66 ± 0.63 years (including 177 boys and 163 girls). The experimental group consisted of 249 children of the same age with complex developmental disorders who were in educational and rehabilitation centers of different regions of Ukraine (Kyiv, Poltava, Chernivtsi, Dnipro, Mykolaiv, Kherson, Odessa regions). The mean age was 8.54 ± 0.75 years, including 119 boys and 130 girls. The study was performed with the prior written and informed consent of parents.

Given the complex structure of the defect, all children with complex developmental disorders underwent a retrospective analysis of outpatient cards to identify comorbidities.

Since physical development is a mirror of the structural and functional characteristics of the body, it is an important criterion for assessing the somatic health of children with complex developmental disorders. The following methods and indicators were used in the study: functional tests of Stange and Genchi, heart rate (HR), blood pressure (BP), Robinson's index, Skibinski's index, Ruffier's index, which determine the assessment of physical health by the method of G.L. Apanasenko [9]. We will describe them in more detail.

Blood pressure measurement (BPM). Blood pressure was measured by auscultatory method (Korotkoff sounds) 2 times with an interval of 2 minutes, using a mechanical tonometer "Gamma 700k", UK. The obtained blood pressure values were used to monitor the child's condition before exercise, during classes and after it.

Heart rate monitor (HRM). It was examined by palpation and the heart rate was determined in 30 seconds on the radial artery. The obtained indicators were used to monitor the physical condition of the child.

Handheld dynamometry (HHD). The strength of the flexor muscles of the hand was determined in two measurements on each arm using a hand dynamometer for children DK-25, Russia. The data obtained made it possible to calculate the strength index of the hand muscles – the ratio between absolute strength and body weight as a percentage.

Spirometry. Spirometry was used to determine the vital capacity (VC) of the lungs using a portable dry spirometer SSP, Ukraine. The maximum value was recorded in ml from two or three measurements with pauses of 15–20 seconds. Based on the obtained values of vital lung capacity and body weight, the vital index (ml/kg), which characterizes the state of the respiratory system and is one of the health indicators, was calculated.

Stange's test (breath-holding test). The child was offered to take a full breath and exhale after 3–5 minutes of rest in a sitting position, and then inhale again (80–90 % of the maximum) and hold the breath for the maximum possible time. Thus, the maximum possible time of respiratory arrest after a deep breath was determined.

Genchi's test (breath-holding test). The child was also asked to take a full exhale and inhale after 3–5 minutes of rest in a sitting position, and then exhale again and hold the breath. This test determined the maximum possible time of respiratory arrest on exhalation.

To study the psycho-emotional state of the studied children, we used the Well-being, Activity, Mood (WAM) questionnaire [11]. Significant differences between the studied groups of children with complex developmental disorders and their peers were observed mainly on the scale of activity and mood at all ages.

Methods of descriptive statistics and testing of statistical hypotheses (t-test for dependent and independent data) were used to compare the results of the study. The reliability level $p=95\%$ (significance level $\alpha=0.05$) was used to determine significant differences between the samples. In the case where the calculated value of the criterion did not exceed the critical level of significance of 0.05, the differences were considered statistically insignificant and indicated in the tables as ($p > 0.05$), if the calculated value of the criterion exceeded the critical value at the significance level of 0.05 – this indicated the presence of statistically significant differences ($p < 0.05$).

Results of the study and their discussion. A retrospective analysis of medical records of primary school children with complex developmental disorders showed that all children had certain comorbidities. It was found that girls with complex developmental disorders had cases of a combination of two or more diseases.

The structure of concomitant diseases in 7-year-old girls with complex developmental disorders was dominated by diseases of the musculoskeletal system, connective tissue (58 %) and respiratory organs (33 %); in 8-year-old girls, diseases of the eye and its appendages, as well as the circulatory system accounted for 30 %, respiratory, digestive, endocrine and urinary systems – 15 %. The largest share among somatic diseases in 9-year-old girls were the diseases of the musculoskeletal system and connective tissue, eye and its appendages (42 %), in 10, 11, 12 years old – the corresponding diseases were 35 %, 33 % and 23 %.

The structure of concomitant diseases in 7-year-old boys with complex developmental disorders was dominated by diseases of the musculoskeletal system and skin diseases (25 %); in 8-year-old boys – diseases of the digestive system (23 %); in 9-year-old boys – diseases of the eye and its appendages, respiratory organs, musculoskeletal system (27 %); in 10 and 11-year-old boys – musculoskeletal system (36 %) and (30 %), respectively; in 12-year-olds-circulatory system (45 %); in 13-, 14- and 15-year-old boys – respiratory organs 25 %, 30 % and 33 %.

The conducted study of physical development of primary school children allowed to reveal the insufficiency of the functional capabilities of the respiratory and circulatory system, which indicates a decrease in resistance to the development of hypoxic conditions in boys and girls with complex developmental disorders of all age groups. The results of the study of functional parameters in girls of primary school age are presented in table 1.

Analysis of clinical data allowed us to establish that all parameters were significantly better in girls who did not have complex developmental disorders. The results of girls with complex developmental disorders had certain features. The obtained reduced values of the Stange's test – by 10.09 seconds ($p < 0.001$), Genchi's test – by 4.98 seconds ($p < 0.001$) in girls of primary school age testified to the reduced possibility of resistance of the respiratory center to hypoxia, as well as low endurance of the respiratory system.

Table 1

Comparison of functional parameters in girls of primary school age with complex developmental disorders and girls of the same age without developmental disabilities (M±m)

Parameters	7-8 years old		Student's t-test	9-10 years old		Student's t-test
	1	2		1	2	
Vital index (%)	1	55.57±2.07	4.16 p<0.001	1	62.57±2.07	7.82 p<0.001
	2	40.20±3.06		2	44.20±1.11	
Strength index (%)	1	55.22±1.46	7.02 p<0.001	1	60.93±1.89	7.67 p<0.001
	2	41.11±1.38		2	43.10±1.35	
Stange's test (seconds)	1	45.21±1.19	5.67 p<0.001	1	50.22±2.87	3.92 p<0.01
	2	35.12±1.32		2	38.12±1.13	
Genchi's test (seconds)	1	17.21±0.82	4.29 p<0.001	1	20.22±1.54	2.16 p<0.05
	2	12.23±0.82		2	15.13±1.77	
Ruffier's test (c.u.)	1	6.23±0.98	4.55 p<0.001	1	7.12±3.87	3.04 p<0.01
	2	13.21±1.18		2	14.01±1.28	
Skibinski's index (c.u.)	1	12.21±0.79	4.78 p<0.001	1	15.35±1.17	4.42 p<0.001
	2	8.29±0.22		2	8.19±1.12	
Heart rate (per 1 min.)	1	89.21±5.19	0.01 p>0.05	1	86.22±4.87	0.03 p>0.05
	2	89.34±5.31		2	86.00±4.00	
ABP (systolic)	1	104.21±3.22	1.36 p>0.05	1	108.22±4.54	1.21 p>0.05
	2	98.11±3.11		2	100.11±4.93	
ABP (diastolic)	1	66.23±3.98	0.06 p>0.05	1	67.12±3.87	0.16 p>0.05
	2	65.89±3.94		2	66.23±3.91	

Note: 1– parameters of girls of the same age without complex developmental disorders (CG); 2 – parameters of girls with complex developmental disorders (EG); n=number of girls in the respective group

According to the results of the analysis of the mean values of the Skibinski's index (reduced by 6.04 c.u. (p<0.001)), the presence of a satisfactory state of the cardio-respiratory system was established. This is due to the lower resistance of the respiratory center to hypoxia and reduced adaptive capacity of the external respiratory system in girls of primary school age with complex developmental disorders.

The results of the study of functional parameters in boys of primary school age differed slightly from those of girls and had their own specific picture (table 2).

Table 2

Comparison of functional parameters of primary school-age boys with complex developmental disorders with boys of the same age who do not have complex developmental disorders (M±m)

Parameters	7-8 years old		Student's t-test	9-10 years old		Student's t-test
	1	2		1	2	
Vital index (%)	1	57.56±2.07	4.15 p<0.001	1	62.67±2.17	6.93 p<0.001
	2	42.20±3.06		2	45.23±1.15	
Strength Index (%)	1	59.22±1.46	8.01 p<0.001	1	60.93±1.39	8.19 p<0.001
	2	43.11±1.38		2	45.10±1.34	
Stange's test (seconds)	1	42.21±1.19	5.11 p<0.001	1	52.22±1.17	8.66 p<0.001
	2	33.12±1.32		2	38.12±1.13	
Genchi's test (seconds)	1	18.21±0.82	6.01 p<0.001	1	20.22±1.14	3.71 p<0.01
	2	11.23±0.82		2	15.19±0.73	
Ruffier's test (c.u.)	1	6.43±0.98	4.57 p<0.001	1	7.12±1.27	4.82 p<0.001
	2	13.44±1.18		2	14.01±0.65	
Skibinski's index (c.u.)	1	14.21±1.19	4.21 p<0.001	1	15.35±1.57	4.53 p<0.001
	2	8.55±0.62		2	8.20±0.16	
Heart rate (per 1 min.)	1	88.41±5.19	0.01 p>0.05	1	85.22±2.73	0.25 p>0.05
	2	88.34±5.31		2	84.34±2.13	
ABP (systolic)	1	105.21±2.21	2.05 p<0.05	1	108.00±2.41	2.91 p<0.01
	2	98.91±2.17		2	98.10±2.39	
ABP (diastolic)	1	67.23±3.95	0.22 p>0.05	1	69.20±2.41	1.03 p>0.05
	2	65.99±3.91		2	65.21±3.01	

Note: 1– parameters of boys of the same age without complex developmental disorders (CG); 2 – parameters of boys with complex developmental disorders (EG); n=number of boys in the respective group

Analyzing the functional status of boys of primary school age with complex disorders, it was also found that the parameters differed significantly from the results of the survey of children of the same age without developmental disorders.

Low values of the vital index in boys of primary school age with complex developmental disorders (by 15.36 % ($p < 0.001$)), indicated the presence of a sparing type of breathing, a low amplitude of chest movements, as well as insufficiently trained respiratory muscles, which requires the inclusion of special breathing exercises in the technology of correctional and health-improving work aimed at improving the functional state of the external respiratory system.

Reduced values of the Skibinski's index (by 6.04 c.u. ($p < 0.001$)) and Ruffier's index (by 8.10 c.u. ($p < 0.001$)) indicated insufficient functional capabilities of the respiratory and circulatory system, and therefore a decrease in resistance to the development of hypoxic conditions in boys with complex developmental disorders. Detailed distribution of the examined children of primary school age according

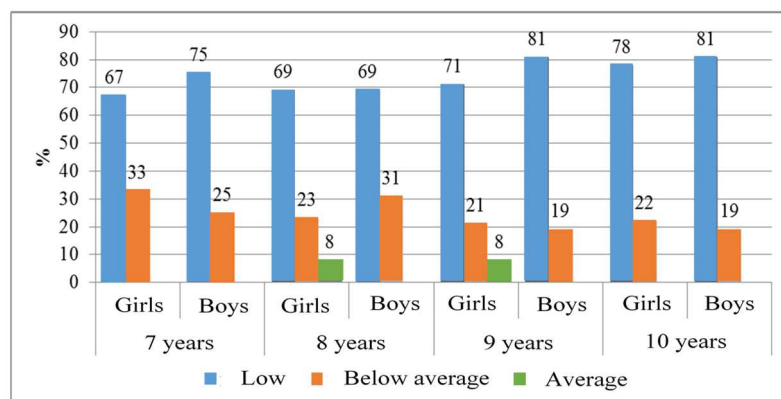


Fig. 1. Distribution of primary school-age children with complex developmental disorders by the physical health level

to the level of physical health according to the method of G.L. Apanasenko is presented in fig. 1.

A rapid assessment of physical health has shown that students with severe developmental disorders are characterized mainly by low and below-average levels of physical health. The worst result was found in boys aged 9-10 years (81 %). Along with this, 8 % of girls aged 8-9 had an average level of physical health.

In addition, the results of the physical health assessment were compared with the analysis of the established parameters of the psycho-emotional state of the studied category of children. This allowed us to establish that 7-year-old girls with complex developmental disorders compared to their peers had significantly lower activity and mood indices by 1.69 points ($p < 0.001$) and by 2.84 points ($p < 0.001$); 8-year-olds – by 2.19 points ($p < 0.01$) and by 2.53 points ($p < 0.01$); 9-year-olds – by 1.09 points ($p < 0.05$) and by 2.84 points ($p < 0.01$); for 10-year-olds – by 0.99 points ($p < 0.01$) and by 3.23 points ($p < 0.001$), respectively. Girls of primary school age with complex developmental disorders were characterized by depression, gloom, excitement, tension, distraction, more often complained of malaise, loss of appetite, headache compared to their peers.

The surveyed 7-year-old boys with complex developmental disorders compared to their peers also showed significantly lower activity and mood parameters by 2.06 points ($p < 0.01$) and by 1.95 points ($p < 0.01$), respectively; 8-year-olds – by 2.13 points ($p < 0.001$) and by 2.84 points ($p < 0.001$); 9-year-olds – by 1.81 points ($p < 0.01$) and by 2.88 points ($p < 0.01$); 10-year-olds – by 2.01 points ($p < 0.01$) and by 2.69 points ($p < 0.001$), respectively.

Boys of primary school age with complex developmental disorders were characterized by passivity, sedentary, agitation, exhaustion, frustration compared to their peers.

Therefore, the practical significance of the obtained results is to take into account the data on the features of functional, physical and psycho-emotional development of children of primary school age with complex developmental disorders in the development of a complex, differentiated, multifactorial system of correctional and health-improving work with children of this category.

Thus, the results of the study mainly confirmed and expanded the conclusions of A. Dushka [7] on the need to create a system of medical and pedagogical measures, educational and rehabilitation areas based on special techniques and methods of correctional work, taking into account the individual potential of the child.

In addition, the results correlated with the studies of V. Syniov [15], V. Zasenko and A. Kolupayeva [8], to study the structure of combined disorders, its comprehensive diagnosis and further prediction of compensatory capabilities of children with sensorineural hearing loss in combination with a mild degree of mental retardation.

The conclusions of K. Kozlova [9] on the scientific research of new areas of health effects on the physical and psychological state were supplemented by ideas about the components and methods of assessing the level of functional development. Without denying in general the definition given by the researcher, in the context of our research the concept of "recovery" is considered as a set of measures aimed at maintaining the physical health of the individual, its balance at the physiological and psychological levels.

Since the study included an interdisciplinary approach to the study of general patterns of development of children with complex disorders, its results expanded in the direction of scientific understanding of the structure of a combined defect, the presence of comorbidities, the impact of a complex

disorder not only on the clinical picture of the functional level, but also on the physical and psycho-emotional state in particular. The described influence is proved by the comparative analysis of the above-mentioned indicators of children of primary school age with complex developmental disorders and children of the same age with normative development.

Conclusions

1. The key markers of physiological development of children with complex disorders were determined: reduction of resistance of the respiratory center to hypoxia – by 9.59 seconds ($p < 0.001$) in comparison with children without developmental disorders; low endurance of the respiratory system – by 5.98 seconds ($p < 0.001$); a decrease in the vital index – by 15.37 % ($p < 0.001$); strength index – by 15.11 % ($p < 0.001$).

2. The main results of the study of psycho-emotional development of children with complex developmental disorders indicate significantly lower parameters of activity and mood by 1.69 points ($p < 0.001$) and 2.84 points ($p < 0.001$); in 8-year-olds – by 2.19 points ($p < 0.01$) and 2.53 points ($p < 0.01$); in 9-year-olds – by 1.09 points ($p < 0.05$) and by 2.84 points ($p < 0.01$); in 10-year-olds – by 0.99 points ($p < 0.01$) and by 3.23 points ($p < 0.001$), respectively, compared to peers who do not have complex disorders.

3. The peculiarities of the individual condition of children with complex developmental disorders, which mainly indicate the presence of a sparing type of breathing, low amplitude of chest movements, as well as insufficient training of the respiratory muscles, which requires the inclusion of special breathing exercises in the technology of correctional and health-improving work aimed at improving the functional state of the external respiratory system.

We see the prospect of further research in the development of a correctional and health program for children with complex developmental disorders, taking into account the results of a comprehensive diagnosis of their individual characteristics.

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