



Ministry of Sport of the Russian Federation



Russian University of Sport «GTSOLIFK»

MODERN UNIVERSITY SPORT SCIENCE

Materials of the XVIII Annual International Conference
for Students and Young Researchers



Moscow, 15-16 May, 2024

UDC 796

ISBN 978-5-6050448-1-9

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Publication of scientific abstracts. The XVIII Annual International Conference for Students and Young Researchers «Modern University Sport Science», RUS «GTSOLIFK» – M., 2024 – 704 p.

This publication contains abstracts of The XVIII Annual International Conference for Students and Young Researchers “Modern University Sport Science” 15-16 May, 2024.

This book of abstracts considers issues of Theory and Methods of Physical Education; Physical Education and sports for All; Physical Education & Rehabilitation and Adapted Sports; Biomechanics, Sport physiology, Sport medicine; Sport Psychology; Sport and Society; Sport Management, Marketing & Sport Media; Sport Methodology & Comparative Study in Sport and Physical Education; Issues of the Modern Olympic Movement, Tourism and is intended for the scientists conducting research in physical education and sport, lecturers of Higher Educational Establishments, students, post-graduates, coaches and athletes.

*The abstracts are published as they have been submitted by authors.

ISBN 978-5-6050448-1-9

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Ключевые слова: плавание, физическая подготовленность, силовая подготовленность, функциональные петли TRX

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UDC 616.711-077.55:572.08-053

COMPARATIVE CHARACTERISTICS OF PHYSICAL DEVELOPMENT INDICATORS OF BOYS 12 YEARS OLD WITH DIFFERENT DEGREES OF SPINAL DEFORMITY

Popitich D.V., s/s Gerasevich A.N.

Abstract. *The article presents a study of the physical development indicators of 12-year-old boys with poor posture and different degrees of scoliosis. A comprehensive measurement of body parameters was carried out using anthropometric, caliperometric and bioimpedancemetric indicators. The results obtained were compared with indicators of healthy children. Adaptive activity of the boys' body was discovered which manifested itself to a greater extent with an increase in the degree of spinal deformity.*

Keywords: *poor posture, scoliosis, physical development, deformation, spine, anthropometry, caliperometry, bioimpedansometry*

Introduction. In the modern world, the problems of poor posture and scoliosis in children and adolescents are becoming increasingly relevant due to the passive lifestyle of the younger generation. Research shows that such disorders cause serious changes in the working of various organs and systems of the body [5, 8, 9].

Poor posture leads to significant disturbances in the morphology and function of the circulatory organs [2]. Heart disorders are associated with altered gas exchange conditions in scoliosis [4]. Due to respiratory failure and alveolar hypoventilation, a lack of oxygen appears in the body, which is compensated by an increase in cardiac blood output. Such compensation phenomena cause an increase in arterial-pulmonary pressure, overload of the right ventricle, which leads to the development of chronic cor pulmonale [5].

The progression of the disease and complex multi-axial deformation of the spine inevitably leads to changes in the shape of the ribs and the chest as a whole

(costal hump), disruption of the normal relative position of the chest organs and disturbances in the functional of state of the respiratory system [1].

In functional terms the problem of scoliosis comes down to the development of respiratory failure in patients and subsequently – circulatory failure [6].

Studies in children with scoliosis show lower levels of heart rate variability compared to healthy. This is due to lower levels of parasympathetic activity and higher levels of sympathetic activity in the autonomic nervous system (ANS). This may be due to unbalanced muscle tension and spinal curvature in scoliosis affecting the regulation of the ANS [7].

Physical education is an integral part of the educational process at school especially important for children with poor posture and scoliosis. Considering that properly organized classes of physical exercise can help to correct these problems. Conducting research in schoolchildren with these health issues becomes a necessity.

Control the state of the body, including such indicators as integral body dimensions, caliperometry and bioimpedancemetry is important in this process.

The purpose of the work was to study the level of integral body indicators, caliperometry and bioimpedansometry indicators in 12-year-old boys with varying degrees of spinal deformity and their comparative characteristics.

Methods. The study measured integral body dimensions (body weight and length, chest circumference during inhalation, exhalation and pause, as well as chest excursion), caliperometry indicators (fat skin folds in different parts of the body) and bioimpedansometry (percentage of fat and water in the body) in 12-year-old boys with poor posture and varying degrees of scoliosis.

Results. The tables show the average values of healthy 12-year-old boys and changes in physical development indicators of peers with poor posture and varying degrees of scoliosis compared to the average values (tables 1-3).

Table 1. – Average values integral body sizes and their differences in different groups of boys 12 years old

Groups of surveyed	Body weight, kg	Length, cm		Chest circumference, cm			Chest excursion, cm
		standing	sitting	pause	inhale	exhalation	
1	44,96 ±0,57	153,15 ±0,47	78,45 ±0,25	73,12 ±0,45	77,68 ±0,42	70,62 ±0,43	7,07 ±0,13
Differences in indicators compared to a group of healthy children							
1-2	-6,76	-2,88	-2,95	-5,35	-3,66	-4,28	+0,61
1-3	-1,13	+2,81	-1,14	-0,21	+0,29	-0,35	+0,63
Credibility criteria of differences							
t ₁₋₂	3,62	1,01	1,98	5,10	3,05	3,68	0,98
P ₁₋₂	0,001	–	–	0,001	0,01	0,001	–
t ₁₋₃	0,52	1,56	1,24	0,10	0,18	0,21	1,03
P ₁₋₃	–	–	–	–	–	–	–

Note (here and hereinafter). Groups of surveyed: 1 – healthy children; 2 – children with poor posture and grade I scoliosis; 3 – children with II–IV degrees of scoliosis; numbers with a “–” sign indicate a decrease in the value of the indicator, “+” indicate an increase

The results indicate a significant decrease indicators in body weight and chest circumference inhalation, exhalation and pause in children with the initial stage of the

disease in comparison with healthy children (table 1).

In terms of caliperometry indicators (thickness of fat skinfolds), there is also a pronounced decrease in indicators in 12-year-old boys at the initial stages of the disease in comparison with healthy peers ($P < 0.05-0.001$). In the group of boys with more severe spinal deformities fewer significant differences were noted. In addition, an increase in the thickness of the fat skinfolds was noted on the gastrocnemius muscle (table 2).

Table 2. – Average values of caliperometry indicators and their differences in different groups of 12-year-old boys

Groups of surveyed	Fat skinfolds, mm						
	triceps	biceps	at the angle of the scapula	stomach	iliac crest	calf muscle	sum of skin folds
1	15,57 ±0,44	9,48 ±0,37	12,19 ±0,63	15,68 ±0,67	16,12 ±0,74	14,90 ±0,43	83,88 ±2,90
Differences in indicators compared to a group of healthy children							
1-2	-2,45	-3,4	-4,89	-6,71	-9,1	-1,63	-29,22
1-3	+1,01	+0,46	-2,47	+0,43	-3,55	+4,57	+0,21
Credibility criteria of differences							
t ₁₋₂	2,02	4,25	4,88	3,97	7,71	1,07	4,58
P ₁₋₂	0,05	0,001	0,001	0,001	0,001	–	0,001
t ₁₋₃	0,40	0,33	2,12	0,21	2,07	2,98	0,03
P ₁₋₃	–	–	0,05	–	0,05	0,01	–

Table 3. – Average values of bioimpedance measurements and their differences in different groups of 12-year-old boys

Groups of surveyed	Fat, %	Water, %
1	13,91 ±0,33	65,22 ±0,25
Differences in indicators compared to a group of healthy children		
1-2	-2,28	+1,88
1-3	-1,1	+0,06
Credibility criteria of differences		
t ₁₋₂	1,72	3,65
P ₁₋₂	–	0,001
t ₁₋₃	1,24	0,09
P ₁₋₃	–	–

According to bioimpedance indicators a significant increase in the percentage of water was obtained in the group of children with postural disorders and grade I scoliosis in comparison with healthy children.

It is assumed that the body of 12-year-old boys exhibits a high adaptive ability to the emerging spinal deformities due to postural disorders and scoliosis. This is reflected in a decrease in the number of significant differences in children with more pronounced deformities of the spinal column in comparison with the results of boys with less pronounced deformities.

Conclusions. Thus, when comparing the results of 12-year-old boys with the initial stages of spinal deformity with healthy children in terms of integral body dimensions, caliperometry and bioimpedansometry, 11 significant differences were found ($P < 0.05-0.001$). There are six significant differences in fat skinfolds indicators, four in integral of body indicators and one on the percentage of water in the body. The values of all indicators were less than those of healthy children. At the same time in children with more severe spinal deformities only 3 significant differences were found in comparison with healthy children ($P < 0.05-0.001$), all of them in terms of fat skinfolds indicators. The results obtained probably indicate a fairly high adaptive ability of the boys' body in relation to the emerging spinal deformities. This is reflected in a decrease in the number of significant differences in children with a more pronounced degree of spinal column deformity in comparison with the results of boys with less pronounced deformities.

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**СРАВНИТЕЛЬНАЯ ХАРАКТЕРИСТИКА ПОКАЗАТЕЛЕЙ ФИЗИЧЕСКОГО РАЗВИТИЯ
МАЛЬЧИКОВ 12 ЛЕТ С РАЗЛИЧНЫМИ СТЕПЕНЯМИ ДЕФОРМАЦИИ ПОЗВОНОЧНИКА**

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Аннотация. В статье представлено исследование показателей физического развития мальчиков 12 лет с нарушением осанки и разными степенями сколиоза. Проведено комплексное измерение параметров тела с использованием антропометрических, калиперометрических и биоимпедансометрических показателей. Проведено сравнение полученных результатов с показателями здоровых детей. Обнаружена адаптивная активность организма мальчиков, в большей мере проявляющаяся с увеличением степени деформации позвоночника.

Ключевые слова: нарушение осанки, сколиоз, физическое развитие, деформация, позвоночник, антропометрия, калиперометрия, биоимпедансометрия

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UDC 796

COMPARATIVE ANALYSIS OF SPEED-STRENGTH ABILITIES OF FEMALE WTF TAEKWONDO ATHLETES OF VARIOUS SPORTS QUALIFICATIONS

Potapova K.A., Epov O.G.

Abstract. For achieving high athletic result in WTF taekwondo it is necessary to have a high level of speed-strength fitness of the knee flexor muscles. Testing was carried on the force-measuring complex “Biodex System PRO-4” to evaluate the speed-strength abilities of the knee extensor and flexor muscles of female WTF taekwondo athletes of various sports qualifications.