



# Physical fitness and morphofunctional status of boys aged 6-8 years

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Dr. Biol. **T.F. Abramova**<sup>1</sup>

PhD **T.M. Nikitina**<sup>1</sup>

**A.V. Polfuntikova**<sup>1</sup>

<sup>1</sup>Federal Scientific Center of Physical Culture and Sport (VNIIFK), Moscow

Corresponding author: volodchenkova.e.n@vniifk.ru

## Abstract

**Objective of the study** was to identify the relationship between the morphofunctional status and physical fitness in modern boys aged 6-8 years.

**Methods and structure of the study.** The work used standardized methods for assessing physical development and physical fitness. Morphofunctional status was determined using the methods of anthropometry, caliperometry, spirometry, pulsometry and tonometry [1,4]. Physical fitness was assessed based on the results of test tasks, used in the field of physical education and VFSK "GTO": 30 m run; shuttle run, 3 10 m (s); 6-minute run (m); standing long jump with two legs (cm); standing forward bend (flexibility, cm); carpal dynamometry, flexion and extension of the arms in an emphasis lying on the floor, lifting the torso into a sitting position from a supine position in 1 min [2,3].

**Results and conclusions.** Based on a comparative analysis of the level and pace of morphofunctional development and preparedness, it was revealed that the indicators of morphofunctional status and physical fitness differ significantly among boys aged 6 and 7, 7 and 8; the greatest increase in physical fitness with the priority of speed-strength qualities and endurance is typical for the period from 6 to 7 years, with a decrease in rates in the period from 7 to 8 years on average twice against the background of relatively uniform and lower rates of annual changes in morphological and functional indicators. The results obtained indicate that the standards of physical fitness for boys of age groups of 6, 7 and 8 years old, characterized by normal physical development, should be developed for each age group, taking into account the greatest coverage of territorial variability.

**Keywords:** *physical fitness, physical development, boys, 6-8 years old.*

**Introduction.** Improving the physical fitness of children is one of the main tasks of the state in the field of physical culture and sports. The leading tools for assessing the physical fitness of children aged 6 to 8 years are regulatory requirements that differ in the systems of categorical assessments and the list of tests in the practice of physical education and the GTO complex (I stage), which generally updates the development of a unified assessment system [2-3, 6].

The development of physical fitness standards for children of senior preschool and primary school age obviously faces the heterochrony of the processes of growth and functional development as the basis for the development and manifestation of physical qualities [7].

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ion and extension of the arms in an emphasis lying on the floor, lifting the torso into a sitting position from a supine position in 1 min [2, 3].

In order to determine the actual limits of the variability of the main physical qualities according to a single comprehensive program, 725 boys of 6-8 years old with different motor activity were examined (41.8% - athletes; game, cyclic, complex coordination sports and wrestling; experience of training - 0, 8-1.5 years old), living in the territories of the Central Federal District (Moscow, Yaroslavl), the North-Western Federal District (Saint Petersburg), the Southern Federal District (Volgograd), the North Caucasian Federal District (Stavropol Territory), Far Eastern Federal District (Khabarovsk), Far North (Yakutia, Churapcha village). The filling of the combined age groups is 226-250 people. The examinations were carried out with the consent of the parents.

**Results of the study and their discussion.** A preliminary analysis of the physical development of boys aged 6-8 showed that the age-territorial variability of

indicators has a mosaic character, determined, among other things, by chance and a small number of samples. However, the data obtained for all the considered subjects of the Russian Federation are characterized by average values of total body sizes, with individual variability from low to high in accordance with the unified interregional standards for the physical development of children and adolescents [5]. In this regard, the combined age groups were considered as a model of the variability of the indicators of the physical development of boys aged 6-8, potentially reflecting the variability of the development of physical fitness.

Analysis of the data of the generalized groups of boys showed for the most part a statistically significant and regular age-related change in the indicators of morphofunctional development and readiness (Table 1). Attention is drawn to the growth rates of indicators of various properties. In the period from 6 to 7 years, indicators of physical development on average increase by 4.6%, physical fitness - by 14.0%; the highest growth rates are characteristic of body

**Table 1.** Morphofunctional status, physical fitness of boys aged 6-8 and the level of statistical significance of intergroup differences

Index	6 years (n=226)		7 years (n=249)		8 years (n=250)		t- Student's criterion*		
	X	V,%	X	V,%	X	V,%	6-7	7-8	6-8
<b>Morphofunctional status</b>									
Body length, cm	118,3	4,40	123,8	4,38	129,9	5,00	-11,30	-11,37	-21,32
Body weight, kg	21,6	14,95	24,5	16,78	28,1	21,42	-8,58	-7,66	-14,43
BMI, kg/m <sup>2</sup>	15,4	10,32	16,0	11,81	16,6	14,64	-3,71	-3,05	-6,30
Chest girth, cm	58,0	5,66	60,4	6,66	63,0	8,63	-6,99	-6,09	-12,00
Muscle mass,%	41,5	8,96	41,9	9,16	43,2	9,75	-1,00	-3,69	-4,58
Fat mass, %	14,8	37,36	15,0	34,13	17,2	41,34	-0,45	-3,94	-4,07
VC, l	1,3	23,85	1,5	26,00	1,7	28,82	-4,50	-5,28	-9,36
Heart rate, beats/min	92,7	14,48	88,7	14,86	86,1	15,12	3,12	2,20	5,24
ADS, mm Hg Art.	101,0	10,29	104,1	12,11	104,2	9,78	-2,82	-0,14	-3,33
ADD, mm Hg Art.	64,8	14,77	66,9	18,27	66,5	12,38	-2,12	0,50	-2,08
<b>Physical fitness</b>									
30 m, s	7,7	11,56	7,0	11,71	6,8	11,91	6,27	2,68	8,79
shuttle run 3×10m, s	11,1	10,90	10,3	10,00	9,9	10,40	7,26	4,91	11,90
Standing long jump, cm	111	15,86	123	14,15	130	13,62	-7,28	-4,81	-11,85
Flexion and extension of the arms in emphasis lying on the floor, quantity	11,2	80,63	13,5	70,30	14,0	70,86	-2,06	-0,36	-2,31
Raising the body from a supine position, quantity	18,5	63,62	23,2	47,07	26,0	42,73	-3,42	-2,21	-5,32
Brush strength, kg	7,0	34,57	8,4	34,64	9,9	29,49	-5,30	-5,28	-10,69
Brush strength, %	32,2	32,02	34,5	30,67	35,6	28,40	-2,13	-1,13	-3,30
6-minute run, m	752	25,94	877	19,49	974	15,83	-6,59	-6,17	-12,67
Standing forward bend, cm	3,2	150,63	3,5	158,29	3,4	177,65	-0,69	0,20	-0,44

-  $p=0.05$  with  $t$ -test = 1.96



**Table 2.** Factor structure of the complex of indicators of the morphofunctional status and physical fitness of boys aged 6-8 years with different physical activity

6 years		7 years		8 years	
<b>1st factor</b>					
30 m run	-.868	Running 6 minutes	-.870	Body mass	.912
Lifting the torso	.860	30 m run	.835	Chest girth	.821
Flexion and extension of the arms in the lying position	.840	long jump	-.820	BMI	.738
Shuttle run	-.780	Shuttle run	.799	Body length	.720
Running 6 minutes	.779	Lifting the torso	-.781	-	-
-	-	-	-	-	-
Percentage of total variance	20,0	23,0		21,0	
<b>2nd factor</b>					
Body mass	.950	Body mass	.971	Lifting the torso	-.842
Chest girth	.830	Chest girth	.872	long jump	-.786
Body length	.762	BMI	.840	Running 6 minutes	-.750
BMI	.700	Body length, cm	.676	Flexion and extension of the arms in the lying position	-.688
Percentage of total variance	17,7	18,1		18,8	
<b>3rd factor</b>					
Brush strength, kg	.932	Brush strength, kg	.941	Brush strength, kg	.916
Brush strength, %	.907	Brush strength, %	.824	Brush strength, %	.822
-	-	Flexion and extension of the arms in the lying position	.702	Fat mass, %	-.776
Percentage of total variance	14,3	15,8		18,5	
<b>4th factor</b>					
ADS	-.921	heart rate	-.760	ADS	.861
ADD	-.908	Fat mass, %	.706	ADD	.855
Percentage of total variance	10.6	10.7		10.9	
<b>5th factor</b>					
Standing forward bend	-.781	ADS	.929	Standing forward bend	-.806
heart rate	-.701	ADD	.864	-	-
Percentage of total variance	10.5	10.4		7,1	

weight (13.4%), indicators of strength fitness of the muscles of the trunk and arms (20.1-25.4%), endurance (16.6%); the smallest - for muscle and fat mass (1.0-1.4%).

In the period from 7 to 8 years, the rate of change in morphological and functional indicators, on average, slightly increases to 5.5%; indicators of physical fitness more than double (up to 6.7%) reduce the pace of development; the highest growth rates are typical for body weight (14.7%), hand strength (20.0%) and endurance in a 6-minute run (11.8%), as well as for fat mass (14.7%); the smallest, in some cases negative, changes are characteristic of flexibility (-2.9%); indicators of heart rate and blood pressure (-2.9-0.1%). The limits of variability (V, %) of morphological and functional indicators increase at the age of 6 to 8 years, most of the physical fitness indicators decrease.

The relationship between indicators of morphofunctional status and physical fitness in groups of

boys aged 6-8 was assessed based on the results of factor analysis (Table 2). In each of the groups, five factors were identified that describe 72.1-78.0% of the total variance. The first factors with the largest percentage of the total variance in the 6 and 7 year old groups reveal the priority of the variability of physical fitness, in the 8 year old group - the total body size; at the age of 6, the leading indicators are the manifestations of speed and strength readiness of the muscles of the trunk and the girdle of the upper extremities; at 7 years old - endurance, speed and strength training of leg muscles. The second factors, on the contrary, in groups of 6 and 7 years old combine indicators of total body size with a general priority of the significance of body weight; in the 8-year-old group - a set of indicators of physical fitness: speed-strength fitness of the muscles of the trunk and legs, endurance. The content of three to five factors in all age groups demonstrates relatively autonomous variability in hand strength and



flexibility; BP and heart rate.

The processes of growth, functional formation and development of the physical qualities of boys in the period from 6 to 8 years are characterized by age heterochrony due to endogenous and exogenous factors, including the passage of the first half-growth jump, age-related features of quantitative and differentiation changes, differences in the means and methods of physical education in preschool institutions and elementary grades of school institutions [7].

**Conclusions.** Indicators of morphofunctional status and physical fitness are statistically significantly different in boys aged 6, 7 and 8, they change heterochronously. Annual changes in morphological and functional indicators are relatively uniform in the period from 6 to 8 years, indicators of physical fitness increase most pronouncedly in the period from 6 to 7 years, with a decrease in the growth rate by half in the period from 7 to 8 years.

Age characteristics of indicators of morphofunctional status and physical qualities in boys in the period from 6 to 8 years are relatively independent. Hand strength, flexibility, blood pressure and heart rate are characterized by autonomous variability.

Physical fitness standards for boys of age groups of 6, 7 and 8 years, characterized by a normal course of physical development, should be developed for each age group, taking into account the greatest coverage of territorial variability.

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