Psychophysiological peculiarities of adolescent athletes of different sports specialization

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Abstract

Objective of the study was to identify the psychophysiological characteristics of adolescent athletes of various sports specializations.

Methods and structure of the study. The scientific work was attended by 144 athletes involved in the sports sections of the city of Kirov: boxing, sambo, swimming, rugby and hockey. The psychophysiological status of young athletes was assessed using the psychophysiological testing device UPFT-1/30 - "Psychophysiologist". Based on the performed tests (tapping test, simple visual-motor reaction and reaction to a moving object), the functional state of the nervous system of the studied contingent was assessed.

Results and conclusions. Most adolescent athletes (with the exception of swimmers) have low stability of reactions and, as a result, a low ability to regulate processes in the nervous system. An assessment of the values of the reaction to a moving object (RMO) showed that, judging by the balance coefficient in most of the children we studied, the processes of inhibition prevail over the processes of excitation. The exception was sambists, in whom excitation prevailed over inhibition, i.e. they had more lead reactions than lag reactions. Consequently, sambo classes develop a strategy of anticipation in young athletes. Thus, the specificity of practicing different sports not only imposes certain requirements on the psychophysiological state of a young athlete, but also, in turn, influences this state in one way or another.

Keywords: *psychophysiological characteristics, adolescent athletes.*

Introduction. The specifics of training young athletes in different types of sports specialization imposes certain requirements on them in the development of psychophysiological qualities that would allow them to be successful in this sport [1, 2]. The main parameters characterizing the psychophysiological status of an athlete are indicators of the functional state of the nervous system, since they are the basis for the successful implementation of motor activity [1, 3]. This is especially true in adolescence, when there is a rapid development of most physical abilities and motor qualities [4, 5, 6].

It should be noted that there are no age standards for psychophysiological parameters for children of different ages, genders and sports specializations, which greatly complicates the ability to characterize various aspects of their psychophysiological processes that directly affect the solution of tasks [1].

Objective of the study was to identify the psychophysiological characteristics of adolescent athletes of various sports specializations.

Methods and structure of the study. The study was conducted in the 2018-2019 academic year, it was attended by teenage athletes aged 13-15 who were engaged in boxing (30 boys), sambo (30 boys), swimming (33 boys), rugby (26 boys) and hockey (25 boys) in sports schools in Kirov. The work was organized on the resource base to conduct research on the morpho-functional state of people involved in physical culture and sports at the Vyatka State University in the morning, with the consent of the parents and the coach, in compliance with the principles of unity of requirements and confidentiality. Mathematical processing of the results of the study was carried out using Microsoft Excel 2003 software, the significance of differences in indicators was determined using Student's t test (t).

The assessment of the psychophysiological status of adolescent athletes was carried out using the psychophysiological testing device UPFT-1/30 - "PSYCHOPHYSIOLOGIST" of the research and production and design company "Medicom MTD", Taganrog, and included an assessment of a number of psychomotor indicators: A) Assessment of the strength of nervous processes by measuring the dynamics of the rate of movements of the subject's hand, which was carried out using the express method "Tapping test"; B) Assessment of the functional state of the central nervous system according to the parameters of a simple visual-motor reaction (SVMR), which characterizes the level of activation of the central nervous system; C) Evaluation of the athlete's ability to adequately perceive changes in space-time events, as well as individual characteristics of the organization of the nervous system in terms of the speed and accuracy of response to a moving object, namely the balance of the nervous system in terms of the degree of balance of excitation and inhibition processes, which were carried out according to the parameters of the reaction to a moving object (RMO).

In most works on the physiology of sports, a tapping test is used to assess the properties of the nervous system of athletes [1, 7]. In psychophysiological science, the ability to perform actions at the fastest pace is regarded as an indicator of speed (quickness) and, according to A.A. Ukhtomsky, the number of movements that a living system performs per unit time serves as a characteristic of its lability, and this, in turn, characterizes the resistance of young athletes to monotonous activity [2, 4]. The tapping test is performed continuously for 30 seconds, first with the right hand and then with the left. This time is divided into 6 stages of 5 seconds, each of which fixes the duration of the time intervals between beats and the number of beats at each stage. On their basis, the indices of the efficiency of the nervous system (EfI), the strength index of the nervous system (SI), and the endurance index of the nervous system (EI) are calculated [7].

Results of the study and their discussion. It was shown that sambo wrestlers had the highest work efficiency, their frequency of strikes in 5 s was 6.24±0.07 times, and hockey players were the least (5.60±0.11 times, $p \leq 0.05$) (Table 1). Based on the results obtained, sambists (1.02±0.003) and hockey players (1.03±0.009) had the greatest strength of the nervous system, i.e. the players of these sports were more able to withstand intense and prolonged competitive and training loads, in addition, they needed less time to recover from such loads (Table 1). The nervous systems of sambists (0.91±0.007) and rugby players (0.91±0.022) had the highest endurance, while this indicator was the lowest among hockey players (0.86±0.009, $p \leq 0.05$, Table 1). Thus, the sambists studied by us had better work efficiency, strength and endurance of nervous processes, which allows them to successfully cope with training and competitive tasks.

When studying the indicators of a simple visual-motor reaction, it can be seen that the absolute reaction

Table 1. *Indicators characterizing the properties of the nervous system according to the tapping test in adolescent athletes involved in various sports, M±m*

Type of sport	Average beat frequency (number):		Amount of strokes (number)		Efficiency index	Strength index	Endurance index
	Right	Левая	Right	Левая			
Boxing n=30	5,71±0,09	4,94±0,07	171,2±2,64	148,2±2,38	5,71±0,09	0,98±0,009	0,86±0,006
Sambo n=30	6,24±0,07	5,49±0,05	187,2±2,12	164,6±1,50	6,24±0,07	1,02±0,003	0,91±0,007
Swimming n=33	5,97±0,03	5,09±0,06	178,9±1,02	153,0±1,79	5,97±0,03	1,00±0,004	0,88±0,004
Rugby n=26	5,67±0,18	5,08±0,12	170,0±5,40	152,1±3,49	5,67±0,18	1,00±0,024	0,91±0,022
Hockey n=25	5,60±0,11	4,82±0,12	168,1±3,43	144,8±3,74	5,60±0,11	1,03±0,009	0,86±0,009
p<0,05	S-B, Sw, R, H; Sw-B, H	S-B, Sw, R, H; Sw-H	S-B, Sw, R, H; Sw-B, H	S-B, Sw, R, H	S-B, Sw, R, H; Sw-B, H	B-S, Sw, H; Sw-S, H	B-S, SW, R; S-Sw, H; H-Sw, R

Note: Here and in Table 2, 3 - differences between sports are significant S - sambo, B - boxing, Sw - swimmers, R - rugby, H - hockey).

Table 2. *Indicators of a simple visual-motor reaction in adolescent athletes involved in various sports, M±m*

Type of sport	ART (ms)	RMS RT (ms)	Me (ms)	Mo (ms)	AMo (%)	min RT (ms)	max RT (ms)
Boxing n=30	244,2±0,68	75,7±2,18	223,0±0,68	71,2±1,26	25,3±0,33	159,2±0,49	612,5±21,34
Sambo n=30	240,6±2,73	92,3±5,35	225,8±3,56	60,4±3,56	24,9±0,97	156,4±5,73	749,5±53,49
Swimming n=33	227,7±2,22	53,0±2,58	215,5±1,61	68,3±1,68	31,1±0,57	160,4±0,69	493,5±22,32
Rugby n=26	270,4±8,00	81,7±11,47	248,7±6,07	91,7±6,48	24,7±1,41	169,5±7,79	548,0±53,32
Hockey n=25	273,1±7,58	86,4±8,59	248,4±7,01	93,5±9,33	29,8±1,52	181,0±8,73	548,4±45,64
p<0,05	B, S-R, H; Sw-S, B, R, H	B-S; SW-B, S, R, H	B, S, Sw-R,H; Sw-S, B	S-B, Sw; B,S, Sw-R, H	B, S, R-Sw, H	H-B, S, Sw	B-Sw; S-B, Sw, R, H

Note: - ART - average reaction time, RMS RT - rms reaction time, Me - median, Mo - mode, AMo - mode amplitude, min RT - minimum reaction time, max RT - maximum reaction time.

time and the standard deviation of the reaction time were significantly less in swimmers (Table 2), which indicates the stability of their response to loads, unlike representatives of other sports specializations. Our results are consistent with the data of S.V. Kondratovich (2017), who studied 12-13-year-old football players [1]. However, according to her data, the spread of reaction time from minimum to maximum values lies in the range of approximately 50 to 70 ms. Whereas for our athletes it varies from 300 to 500 ms, i.e. for our athletes, regardless of sports specialization, the value of the maximum values of reaction time is much higher than that of athletes from Yekaterinburg. At the same time, the minimum values of the reaction time of athletes from Kirov and Yekaterinburg are practically the same. All this points to the low stability of the ongoing reactions in the adolescent athletes we studied and, as a result, to the low ability to regulate processes in the nervous system.

The indicator of reaction to a moving object (RMO) is informative for determining the individual characteristics of the organization of the athlete's nervous system. The assessment of the values of this test showed that, judging by the balance coefficient in most of the adolescent athletes we studied, inhibition processes prevail over excitation processes, the exception was sambo wrestlers, in whom excitation processes predominate (Table 3).

When distributing athletes within the studied sports groups according to the predominance of excitation, inhibition and balance processes, they found that excitation processes prevailed in 50.0±9.45% of samb-

Table 3. *Indicators of reaction to a moving object in adolescent athletes involved in various sports, M±m*

Type of sport	Number of normal reactions (number)	Percentage of normal reactions (%)	Average time it takes for a real reaction to deviate from an ideal one (ms)	RMS from ideal RT (ms)	RMO coefficient	Balance coefficient
Boxing n=30	20,5±0,36	58,3±1,03	46,8±0,70	71,5±1,06	1,17±0,03	1,32±0,04
Sambo n=30	19,1±0,53	54,9±1,58	44,6±0,74	73,1±1,49	0,83±0,06	0,82±0,06
Swimming n=33	18,8±0,53	53,7±1,50	52,0±1,29	79,6±1,88	1,39±0,05	1,28±0,06
Rugby n=26	19,5±0,82	55,6±2,34	44,9±1,68	70,0±3,27	1,17±0,16	1,40±0,32
Hockeyn=25	18,2±0,53	52,0±1,49	51,24±1,35	74,9±2,74	1,64±0,16	1,95±0,32
p<0,05	B-S, Sw, H	B-Sw, H	B, S-Sw, H; B-S	Sw-B, S, R	B,S-Sw, H; B-S	S-B, Sw, H; Sw-H

Note: - RMS from ideal RT - standard deviation from the ideal reaction time, RMO coefficient - coefficient of reaction to a moving object.

ists. In the representatives of other sports, inhibition processes prevailed: in 57.1±9.04% of boxers, in 63.6±8.38% of swimmers, in 46.2±9.78% of rugby players and in 56.0±9.93 % hockey players. Thus, in the sambo wrestlers we studied, the number of lead reactions was greater than the number of delay reactions, i.e. This sport develops a strategy of advancing in young athletes. Attention is drawn to the results of swimmers, among whom there were no athletes with a balance of nervous processes, while in representatives of other sports their percentage did not differ significantly and varied from 23% to 28%. Consequently, swimming does not contribute to the development of the balance of nervous processes.

Conclusion. The data obtained indicate the presence of features in the psychophysiological parameters of adolescent athletes aged 13-15 years of various sports specializations. The most significant differences were found in sambo wrestlers, who have high work efficiency, strength and endurance of the nervous system, and a predominance of excitation processes. The implementation of such studies not only allows expanding the database of psychophysiological characteristics of athletes of different ages, genders and sports specializations, but also helps the coaching staff to individualize the approach to athletes, which will directly affect the quality of the training process.

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