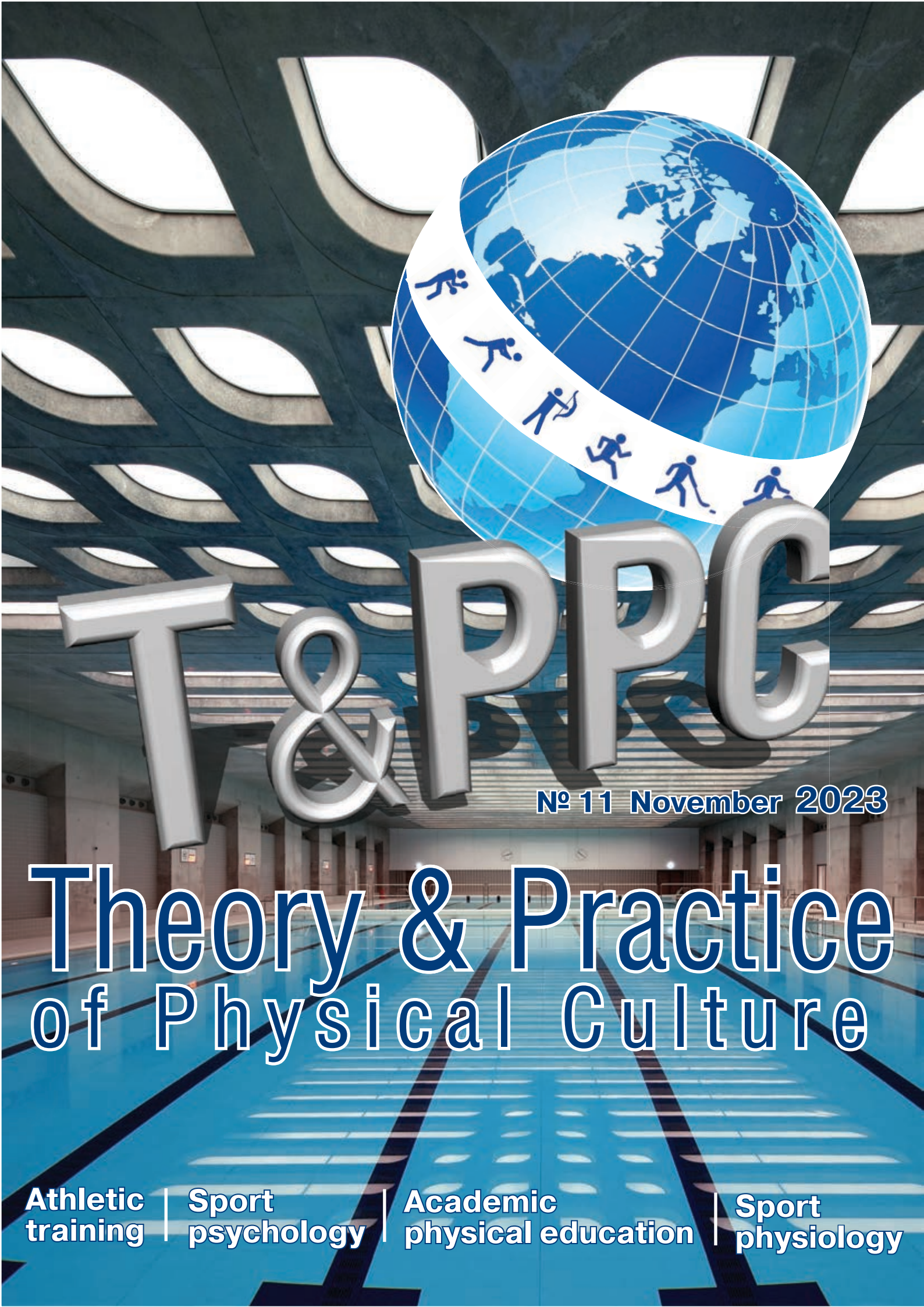

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Theory & Practice of Physical Culture

Athletic training | Sport psychology | Academic physical education | Sport physiology

Implementation of the sportization methodology in the project activities of Moscow schools

In March 2022, the project "Sports class in Moscow school" was launched in Moscow. The project unites teachers, students, parents, representatives of municipal institutions as participants of polysubject management in solving the tasks of introducing schoolchildren to a healthy lifestyle, increasing motor activity, familiarization with the basics of sports training, professional orientation in the field of physical culture and sports.

In the context of the methodology of sportization of school physical education, the Project allows expanding the boundaries of students' sports activities through participation in municipal, regional and All-Russian competitions.

The theoretical and scientific foundation for the construction of sportized physical education is formed by using the training opportunities. Modernizing physical education based on the principles of sportization, it is important to take into account the quality of mastering the values of sports culture by students. In the conditions of individual and collective forms of classes, models of sports rivalry and cooperation are created. The process of sportization of physical education is presented as a territory of active socialization of students, where the skills of achieving an honest victory or loss are instilled, serving as a lesson for future sports victories. The main principle of sportization is a free and conscious choice of a type of sport or a form of physical culture and sports activity for students, depending on their physical conditions and preferences.

It is assumed that as a result of the Project implementation, it will become possible and real to teach the subject "Physical Culture", orienting the educational process on the introduction of new technologies and innovative approaches to teaching motor actions and the development of physical qualities. Opportunities are being created for schoolchildren to get acquainted with the basics of sports culture. In the process of sports activity with a competitive basis, the tasks of personal development, moral and volitional, moral education and physical training, health promotion, social adaptation, communication, tolerant communication and socialization will be solved.

An important result of the Project is the prospect of replicating methodological materials for use at the regional and institutional levels.

At the level of the education system, the results of the Project implementation should be significant changes in the program and methodological support of physical education in general education institutions and physical culture and sports disciplines of universities and additional education.

For the successful implementation of the Project "Sports class in Moscow school" through the prism of the methodology of sportization, it is necessary to organize advanced training and retraining of teachers in physical culture in the direction of mastering the technology of sportized physical education of schoolchildren of general education institutions.

Within the framework of the Project, the principles of sportization of physical education are aimed at continuity and integration of regular and extracurricular activities, basic and additional education. Sportization technologies make it possible to fully utilize the socio-cultural potential of sports activities and its integrative impact on the comprehensive development of children and youth in the education system. The social significance of the Project is expressed in the creation of a sports vertical for the formation of professional orientation of students to acquire knowledge and develop competencies in the field of physical culture and sports.

We invite scientists to publish the results of scientific research aimed at finding and studying the value meanings of physical culture and sports.

Editor-in-Chief of TPPC, Honored Worker of Physical Culture of the Russian Federation
Dr. Hab., Professor L.I. Lubysheva

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Theory and Practice of Physical Culture

Contents

Russian beach volleyball at the olympic games: results, problems, prospects

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Abstract

Objective of the study was to assess the quality of performance of competitive actions by players of the best 16 men's and women's teams participating in the Olympic beach volleyball tournaments in the program of the XXXII Olympic Games of 2021 in Tokyo (Japan).

Results and conclusions. The ranked values of the performance of players in performing offensive strikes, blocking and serves, given in the illustrations, make it possible to identify their average group values, which are conditional guidelines for Russian athletes and athletes preparing to participate in the XXXIII Olympic Games of 2024 in Paris (France) and others major international beach volleyball competitions. Recommendations and wishes developed based on the results of the study to athletes and coaches aim them at specific actions that will help improve the quality of pre-Olympic preparation processes in beach volleyball.

Keywords: *beach volleyball, Olympic Games, quality of game actions.*

Introduction. Beach volleyball continues to develop successfully both on the international stage and in our country. One of the manifestations of this development is the successful performance of Russian teams at major competitions - championships and championships of Europe, the world, stages and finals of the World Tour (we are sure that the politicized exclusion of Russian athletes from international competitions is a temporary phenomenon [2-4].

The greatest international success of Russian beach volleyball players is the silver medal won at the 2021 Olympic Games in Tokyo (Japan) by the team of Krasilnikov V. - Stoyanovsky O.

Objective of the study was to assess the quality of performance of competitive actions by players of the best 16 men's and women's teams participating in the Olympic beach volleyball tournaments in the program of the XXXII Olympic Games of 2021 in Tokyo (Japan).

Methods and structure of the study. To achieve the intended goal of the study and solve the assigned problems, research methods were used such as the study and analysis of special scientific and methodological literature, as well as Olympic newsletters, pedagogical observation, video recording of game actions and their processing using Data Volley Sistem 2 technology, methods of mathematical statistics [1].

The research was carried out in July-August 2021 during the beach volleyball tournament as part of the XXXII Olympic Games in Tokyo (Japan).

Results of the study and discussion. Table 1 presents individually ranked information characterizing the effectiveness of the attacking and defensive competitive actions of the players of the best 16 teams of the men's Olympic beach volleyball tournament in Tokyo 2021.

As follows from Table 1, the players of the best 16 teams (out of 24 participating) of the Olympic beach volleyball tournament in Tokyo 2021 played from three to six matches, totaling from seven to fifteen games with the average group values of these indicators be-

Table 1. *Quality of competitive actions of athletes participating in the Olympic beach volleyball tournament in Tokyo 2021 (n=32 people)*

Rank	Surname	Country	Olympic Games result (medal, place)	Played		Number of won			Sum of points	Number of points per game
				Matches	Parties	Forward strikes	Blocking	Innings		
1	2	3	4	5	6	7	8	9	10	11
1	Mol	NOR	gold	6	13	105	33	6	144	11
2	Younousse	QAT	bronze	6	13	91	24	3	118	9
3	Krasilnikov	ROC	silver	6	15	110	0	5	115	8
4	Stoyanovskiy	ROC	silver	6	15	78	24	6	108	7
5	Alison	BRA		5	11	73	28	5	106	10
6	Herrera Allepuz	ESP		5	11	95	4	4	103	9
7	Nicolai	ITA		5	12	60	23	6	89	7
8	Gaxiola	MEX		4	10	81	2	5	88	9
9	Plavins	UVT	4	5	13	82	1	4	87	7
10	Kantor	POL		4	10	72	10	2	84	8
11	Evandro	BRA		4	10	58	15	10	83	8
12	Thole	GER		5	12	69	12	2	83	7
13	E. Grimalt	CHI		5	11	76	1	3	80	7
14	Dalhausser	USA		4	11	56	19	4	79	7
15	Gerson	SUI		4	9	74	0	3	77	9
16	Lupo	ITA		5	12	75	0	1	76	6
17	Semenov	ROC	9	5	10	42	22	11	75	8
18	Leshukov	ROC	9	5	10	71	1	0	72	7
19	Tijan	QAT	bronze	6	13	67	1	3	71	5
20	Brouwer	NED		4	8	66	0	3	69	9
21	Bryl	POL		4	9	48	18	3	69	8
22	Lucena	USA		4	11	67	1	1	69	6
23	McHugh	AUS		3	7	59	4	5	68	10
24	Wickler	GER		5	12	58	0	9	67	6
25	Gavira Collado	ESP		5	11	49	7	10	66	6
26	Heidrich	SUI		4	9	50	11	4	65	7
27	Bruno Schmidt	BRA		4	10	58	0	6	64	6
28	Toes	LAT	4	5	13	47	16	0	63	5
29	Alvaro	BRA		5	11	54	1	4	59	5
30	Fijalek	POL		4	9	52	0	5	57	6
31	Bourne	USA		4	9	51	0	5	56	6
32	Gibb	USA		4	9	44	8	4	56	6
	M			4,7	10,9	66,8	8,9	4,4	80,2	7,3
	±m			0,14	0,34	3,08	1,82	0,48	3,67	0,28

ing respectively 4.73±0.14 matches and 10.9±0.34 games.

The number of offensive shots won by players ranged from 42 to 110, effective blocks performed by athletes performing blocking functions in teams - from 10 to 33 (players who performed the functions of blocking defenders in their teams did not perform blocking or blocked extremely rarely - 1-2 times in all games), innings won - from 0 to 33. The average group values of these criteria were 66.8±3.08 offensive strikes, 8.9±1.82 blocks and 4.4±0.48 serves.

The total points scored by beach volleyball players ranged from 56 to 144 per tournament and from 5 to 11 per game, with the average group values of these criteria being, respectively, 80.2±3.67 points per tournament and 7.3 ±0.28 points per game.

The positions of Russian beach volleyball players (highlighted in grey) competing under the flag of the Olympic Committee (ROC) basically corresponded to the places taken at the Olympic tournament.

Silver medalists V. Krasilnikov and O. Stoyanovsky had the third and fourth individual ratings, respectively,

and K. Semenov and I. Leshukov, who took 9th team place, had 17th - 18th individual ratings, respectively.

As positive aspects of the competitive preparedness of Russians, it should be noted the leadership of V. Krasilnikov in the number of offensive hits won at the tournament (110), the leadership of K. Semenov in the number of innings won during the tournament (11) and the third-fourth individual ranking of O. Stoyanovsky in the number of innings won during the tournament blocking.

The disadvantages of the competitive activity of Russian beach volleyball players include the 31-32nd individual rating of I. Leshukov in terms of the number of innings won during the Olympic tournament (0), as well as the 17-18th individual ratings of the sum of points for K. Semenov and I. Leshukov (75 and 72), almost two times inferior to those of the leaders of the Olympic tournament (144 and 118).

The ranked performance of attacking and defensive actions of beach volleyball players representing

Table 2. *Quality of competitive actions of athletes participating in the Olympic beach volleyball tournament in Tokyo 2021 (n=32 people)*

Rank	Surname	Country	Played		Number of won			Sum of points	Number of points per game
			Matches	Matches	Forward strikes	Blocking	Innings		
1	2	3	4	5	6	7	8	9	10
1	Graudina	LAT	7	18	98	18	22	138	8
2	Clancy	AUS	7	16	111	14	12	137	9
3	Verge-Depre	SUI	7	17	127	2	7	136	8
4	April	USA	7	15	113	0	15	128	9
5	Heidrich	SUI	7	17	70	20	20	110	6
6	Brandie	CAN	5	13	79	14	9	102	8
7	Pavan	CAN	5	11	72	25	4	101	9
8	Klineman	USA	7	15	68	21	11	100	7
9	Claes	USA	4	11	81	11	6	98	9
10	Kravcenoka	LAT	7	18	84	0	10	94	5
11	Rebecca	BRA	5	13	79	0	13	92	7
12	Ana Patricia	BRA	5	13	59	28	1	88	7
13	Fernandez Steiner	ESP	5	11	68	15	4	87	8
14	Makroguzova	ROC	4	10	62	17	7	86	9
15	Artacho del Solar	AUS	7	16	71	0	13	84	5
16	X. X. Wang	CHN	4	9	62	14	6	82	9
17	Bansley	CAN	5	13	75	0	4	79	6
18	Lidy	CUB	5	10	59	8	10	77	8
19	Agatha	BRA	4	9	66	7	3	76	8
20	Kozuch	GER	4	12	60	11	4	75	6
21	Meppelink	NED	3	9	54	11	3	68	8
22	Wang	CHN	4	9	52	13	2	67	7
23	Melissa	CAN	5	11	57	0	8	65	6
24	Betschart	SUI	3	11	59	0	2	61	6
25	Ludwig	GER	4	12	53	1	7	61	5
26	Huberli	SUI	3	11	48	5	6	59	5
27	Stam	NED	4	8	43	15	0	58	7
28	Keizer	NED	3	9	52	0	6	58	6
29	Duda	BRA	4	9	45	1	8	54	6
30	Xia	CHN	4	9	48	0	6	54	6
31	Sude	GER	3	7	42	5	4	51	7
32	Murakami	JPN	3	9	44	0	7	51	6
	M		4,81	11,91	67,53	8,63	7,50	83,66	7,06
	±m		0,26	0,56	3,77	1,52	0,91	4,61	0,24
34	Kholomina	ROC	4	10	44	0	3	47	5

the best 16 teams of the Olympic tournament in Tokyo 2021 is presented in table. 2.

As follows from Table 2, beach volleyball players from the 16 best teams participating in the Olympic tournament in Tokyo 2021 played from three to seven games, totaling 8-18 games with the average group values of these indicators being 4, respectively .8±0.26 games and 11.9±0.56 games.

Individual fluctuations in the number of offensive hits won during the tournament were recorded in the range from 43 to 127, effective blocks performed by athletes who specialized in this element of the game in their teams - from 11 to 28, effective serves - from zero to 22's. The group average values of these indicators were, respectively, 67.5±3.77 offensive strikes, 8.6±1.52 blocks and 7.5±0.91 serves.

Changes in the individual values of the sum of points for the three analyzed game elements scored during the tournament were identified in the range from 51 points to 138 points scored in one game - from 5 to 9-12 points, with the average group values of these criteria, components 83.7±4.61 and 7.1±0.24 points, respectively.

The individual values of Russian N. Makroguzova (14th individual rating) basically corresponded to the team's ninth place at the Olympics. The positive aspects of this athlete's competitive preparedness include the fact that she entered the top-6 beach volleyball players of the Olympic tournament in performing effective blocks (17), as well as in the number of points scored in one game (9).

The relatively unsuccessful (9th place) performance of the Russian women's beach volleyball team at the Olympic tournament in Tokyo 2021 is apparently largely due to the fact that Makroguzova K.'s teammate Kholomina S. was unable to show her best qualities in a tense competitive environment, as evidenced by her 34th individual rating and competitive performance in performing the analyzed indicators, which is inferior to the group average.

Conclusions. For Russian beach volleyball players and female volleyball players preparing for the Olympic Games and other major international competitions in this sport, it is advisable to:

a) it is advisable to maintain and develop performing skills that correspond to the recorded individual ratings of the best players of the beach volleyball tournament in the program of the XXXII Olympic Games in Tokyo 2021;

b) reduce the identified intra-team difference in the quality of competitive actions from 18-20 to 5-7 rating units;

c) pay increased attention to improving the quality of performance of those competitive actions for which performance has been identified that is inferior to the rating of the top-20 players of the Olympic tournament in Tokyo 2021.

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Relationship of speed-strength and anthropometric indicators of highly qualified football players 16-17 years of different roles

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Abstract

Objective of the study was to determine the relationship between the anthropometric and speed-strength characteristics of football players in laboratory and field conditions to identify differences in these indicators relative to their role.

Methods and structure of the study. An examination of the players of the Russian youth football team aged 16-17 years was carried out. In laboratory conditions, the players' body composition, isometric strength of the hip adductor and abductor muscles were measured; the strength of the extensor muscles of the leg joints when performing an upward jump with the arm squatting on the belt; hamstring strength in eccentric, yielding, mode. 6 hours later, during an evening training session, the players performed 10, 20 and 30 m runs and a standing long jump.

Results and conclusions. As a result of the experiment, a profile of speed-strength readiness of highly qualified football players aged 16-17 years was obtained. Sports selection of taller, heavier players under 17 years of age, and generally better physically fit, may have an advantage in the short term, but in the long term there is a risk of weeding out talented.

Keywords: *anthropometry, speed, strength, height, weight, football, preparedness.*

Introduction. A player's speed and strength abilities are one of the most important components that determine success in football. Players perform high-intensity technical and tactical actions associated with the manifestation of speed-strength abilities at distances from 5 to 20 m, less often up to 30-40 m, and fight for the ball in the air, performing powerful jumps. At the same time, the characteristics of football players of different roles can vary significantly. For example, body length and weight are closely related to physical performance in children and young people [1] and are factors determining results in sprinting [2-5]. In many studies, the authors draw conclusions about the presence of a positive, linear relationship between weight-height and speed-strength indicators in football players of different ages [1-5], however, in the available sources there is no data on the presence of the same relationship between players of youth national teams. Therefore, testing in the practice of training football players is an important link in the selection of players, planning and management of the training process.

Objective of the study was to determine the relationship between the anthropometric and speed-strength characteristics of football players in laboratory and field conditions to identify differences in these indicators relative to their role.

Methods and structure of the study. A study was carried out on 19 players of the Russian youth football team in the laboratory of the scientific direction Interdisciplinary Sports Research of the Sirius University of Science and Technology and in natural conditions at a football stadium with artificial turf. The average age of the players is 16.6±0.3 years, height – 181.4±6.4 cm, body weight – 71.1±7.0 kg, muscle component – 37.2±3.7 kg or 52, 4±1.4%, fat com-

ponent – 5.7±1.9 kg or 8.0±2.4%. Body composition measurements were taken in the morning fasting on the Inbody 770 analyzer. Isometric strength of the hip adductors and abductors was determined on the Vald ForceFrame. Leg extensor muscle strength was assessed during a squat jump using Vald ForceDesk dual force platforms. The Vald NordBord system was used to assess hamstring muscle strength in the eccentric yielding mode. Four repetitions of each test exercise were performed. 6 hours later, in the evening training, after warming up, the players ran 10, 20 and 30 m, the results were recorded by the Witty timing system (Microgate, Italy) with an accuracy of 0.001 seconds and a standing long jump. Three repetitions of each exercise were performed. To calculate the correlation coefficients between indicators and the reliability of differences between roles, nonparametric statistics methods were used: Spearman's correlation coefficient and the Kruskal-Wallis test in the Statistica 10.0 program.

Results of the study and discussion. All players were divided into roles: GK - goalkeeper, CD - central defender, FD - flank defender, CMF - central midfielder, FMF- flank midfielder, F - forward. Goalkeepers and central defenders turned out to be the tallest, while central midfielders and forwards were the least tall (Table 1). Goalkeepers are characterized by the largest body mass values, while full-backs, central midfielders and forwards have the smallest.

The greatest muscle mass is observed in flank defenders, the least - in central midfielders. The greatest lean muscle mass of the legs was found in goalkeepers, the smallest - in central midfielders. The identified differences characterize the preparedness profile of football players in relation to their playing role and are comparable with literature data [5]. Goalkeepers have the greatest strength and speed of muscle contraction, including performing exercises in the form of bending forward and high jump, standing long jump (Tables 2 and 3).

Whereas in the 10, 20 and 30 m sprint races, goalkeepers are not inferior to field players. Central midfielders are characterized by the lowest values of strength and speed of contraction of the leg muscles, the same applies to the standing long jump, running 10, 20 and 30 m; players also have an asymmetry in

Table 1. *Indicators of anthropometric study of football players*

Role	Height, Cm	Body weight, kg	Fat component,%	Muscle component, %	Lean muscle mass of legs, kg
GK	190,1±1,3$#§¶	81,2±5,1$#§¶	10,0±2,1$§	51,2±1,2	23,8±0,7$#§¶
CD	187,0±1,8$#§¶	74,4±6,9	8,5±1,2	52,3±0,8	22,3±1,6#¶
FD	180,7±7,6	68,4±7,6	5,2±2,8	54,0±1,5*#•	21,1±2,4
CMF	176,2±6,0	66,9±3,8	10,0±2,4$§	51,0±1,5	18,8±1,5
FMF	180,7±2,7	71,6±5,1	6,4±1,5	53,5±0,6*#•¶	21,0±0,9#
F	176,8±5,4	67,4±8,5	8,4±0,9	52,1±0,4	19,0±2,1

*Significance of differences at p<0.05. * - more than CD; $ - more than FD; # - more than CMF; § - more than FMF, ¶ - more than F; •- more than GK*

Table 2. *Assessment of speed-strength abilities of the muscles of the lower extremities of football players*

Role	Jump height, cm	Power when jumping, W/kg	Max strength of two legs (N), bending	Max strength (N), abduction	Max strength (N), adduction
GK	42,5±4,7*¶	52,8±0,6¶	776 ±22#§	850±111#	826±19
CD	34,6±1,4	49,7±2,3	746±137	747±117	780±153
FD	35,8±4,0	49,8±4,7	742±214	723±127	759±99
CMF	34,6±3,5	51,3±4,4	636±53	661±56	722±145
FMF	36,9±4,5	54,0±4,5	713±40	772±97#	816±66
F	36,4±2,9	47,6±4,4	674±161	677±103	842±170

*Data are presented as mean and standard deviation. Significance of differences at p<0.05. * – more than CD; $ - more than FD; # – more than CMF; § – more than FMF, ¶ – more than F.*

Table 3. *Assessment of speed-strength abilities of football players when performing pedagogical tests*

Role	Standing long jump, cm	10 m from standstill, s	20 m from standstill, s	30 m from standstill, s
GK	275±4,2*$#§¶	1,77±0,09	3,10±0,15	4,17±0,07
F	246±8,4	1,86±0,04	3,17±0,06*	4,31±0,12*
FD	251±4,4	1,82±0,08	3,07±0,12	4,23±0,10
FMF	249±9,3	1,79±0,05	3,07±0,07	4,23±0,12
CD	254±9,0	1,82±0,08	3,07±0,06	4,22±0,02
CMF	240±10,9	1,85±0,08	3,15±0,11	4,30±0,14

*Data are presented as mean and standard deviation. Significance of differences at p<0.05. * – more than CD; $ – more than FD; # – more than CMF; § – more than FMF, ¶ – more than F.*

Indicators	Anthropometry					Jump		Max. strength of two legs (N)		
	Height, cm	Weight, kg	Fat, kg	Muscles, kg	Lean muscle mass of legs, kg	Height, cm	W, W/kg	Nordic tilt	abduction	adduction
Standing long jump, cm	0,69	0,74	0,23	0,76	0,76	0,77	0,54	0,53	0,63	0,58
10 meters from a standstill, time, s	-0,58	-0,24	0,21	-0,32	-0,53	-0,35	-0,37	-0,09	-0,32	0,00
20 meters from a standstill, time, s	-0,54	-0,18	0,47	-0,34	-0,56	-0,23	-0,33	-0,29	-0,35	-0,07
30 meters from a standstill, time, s	-0,66	-0,42	0,27	-0,55	-0,68	-0,54	-0,50	-0,34	-0,45	-0,22

Figure 1. *Correlation analysis of indicators characterizing the anthropometric and speed-strength abilities of football players*

the strength of the muscles responsible for hip adduction and abduction, as well as low strength levels when performing the exercise - bending forward. Flank players are characterized by some of the highest rates of muscle speed-strength abilities, however, in flank midfielders it is worth noting the asymmetry of the muscles responsible for abducting and adducting the hip in the direction of reducing the strength of the hip abductor muscles. Attackers have low values of strength and speed of muscle contraction, in particular in the high jump, standing long jump, sprint, and in the strength of the hip adductor muscles compared to the hip abductor muscles.

To study the dependencies between the studied indicators, a correlation analysis was carried out (Figure 1).

It was revealed that tall football players with greater body mass and lean muscle mass in their legs demonstrate better results in long jump and sprint. Obviously, this is due to the earlier physical development of players compared to their peers, since it was previously established that in football players under 17 years of age, body length and weight have a great influence on physical fitness indicators [1]. After this age, the contribution of the training process itself to the players' preparedness increases.

Conclusions. As a result of the study, a profile of speed-strength readiness of highly qualified football players aged 16-17 years was obtained. Athletic selection of taller, heavier under-17 footballers, and generally better fit, may have an advantage in the

short term, but in the long term there is a risk of weeding out talented players who are lagging behind in their maturation.

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Current problems of technical training of young ski racers in Russia

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Abstract

Objective of the study was to analyze the kinematics of skating ski moves of young cross-country skiers and determine ways to optimize the technical training of athletes.

Methods and structure of the study. At the Russian Youth Cross-Country Championships, video footage of skating movements on the slopes and on the flat was taken. The biomechanical characteristics of the skating movements of boys aged 14-16 years were calculated in the Dartfish Pro program and compared with the indicators of the strongest ski racers in the world.

Results and conclusions. The data obtained made it possible to identify the main technical mistakes of young athletes and suggest ways to improve long-term technical training. The reason for the majority of technical errors among young men is an insufficient level of coordination abilities, in particular, balance, the ability to accurately and timely dose efforts, timely change the mode of muscle operation depending on external conditions, as well as low core stability. It is proposed to change approaches to training children, starting from the initial training stage, to place emphasis on creating a broad foundation of motor skills that allow not only to master a biomechanically advantageous structure of movements, but also to develop the ability to timely vary the magnitude, direction and duration of efforts.

Keywords: *cross-country skiing, young ski racers, highly qualified ski racers, technical training, skating, video analysis, biomechanical characteristics.*

Introduction. One of the important components of the training process of highly qualified cross-country skiers is technical training [1]. Effective, stable and economical skiing technique allows one to show high results at the international level and realize the athlete's motor potential in the conditions of major competitions [3]. At the same time, young athletes who join the Russian cross-country skiing teams often have two main problems in technical training: improperly formed motor skills and the inability to change the structure of movements depending on changing external and internal conditions. And if in most cases coaches and specialists manage to solve the first problem, although this requires significant effort and time, then it is almost impossible to predict and create the most beneficial regime of muscle effort in the upcoming races, since competitive conditions change unpredictably.

To improve the technical training system for young cross-country skiers, it is necessary to formulate requirements for skiing technique in accordance with the modern realities of cross-country skiing [2].

Objective of the study was to identify the features of the kinematics of skating ski moves of young cross-country skiers and determine ways to optimize the technical training of athletes.

Methods and structure of the study. In the winter season 2021-2022. Video filming of the skating

skiing technique of young ski racers aged 14-16 years was made at the Russian Championship, as well as video filming of the movements of the strongest skiers in the world at the stages of the World Cup, which took place during the same period. The conditions for video filming were standard: a Sony HDR-CX 730 EV video camera was installed motionless perpendicular to the ski track so that at least 3 cycles of movements were captured in the frame. The second video camera was used to film "with wiring" for visual analysis of the equipment in the frontal plane. The resulting video recordings were processed in the Dartfish Pro program, and the kinematic indicators of the best young and adult athletes at each distance were determined. On the flat sections of the competitive distances, the characteristics of the simultaneous one-step skating (SOSS) moves were determined, and on the hills - the simultaneous two-step skating (STSS) moves. Statistical data processing was performed in the RStudio program. The hypothesis about the significance of intergroup differences was tested using the nonparametric Mann–Whitney test.

Results of the study and discussion. Three groups of indicators in skating skiing in boys and men were analyzed: tempo-rhythm characteristics (tempo of movements, cycle time, duration of the push-off and rolling phases), angular values of the key moments of the stroke cycle and angular velocities of movement in the joints.

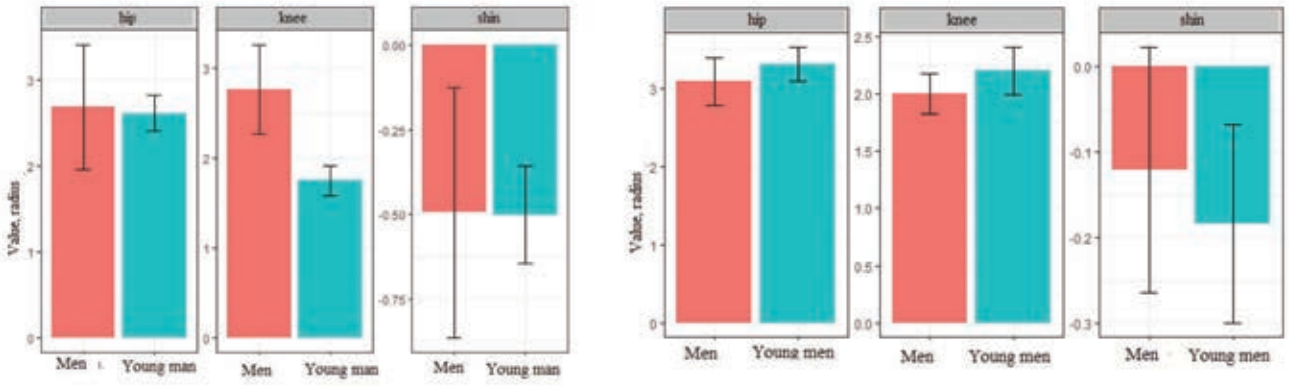
Analysis of tempo-rhythm characteristics (Table 1) shows that when moving with a simultaneous one-step move on the plain, the strongest riders performed a faster take-off and a longer sit-down. In all cases, the moment of sitting down was considered to be the position of the skiers in which the knees were aligned (located in the same transverse plane). Adult highly skilled skiers simultaneously perform a lunge of the fly leg and active extension of the supporting leg, and

Table 1. Comparison of tempo-rhythm characteristics of skating moves of young and adult cross-country skiers

Move	Indicators	Boys, n=50	Men, n=18	Statistical significance of differences, p
SOSS	Movement rate, cycle/min	62,51±4,03	63,68±3,44	>0,05
	Repulsion time, s	0,30±0,05	0,23±0,02	**<0,01**
	Time of squatting, s	0,15±0,04	0,19±0,02	**<0,01**
STSS	Movement rate, cycle/min	58,28±4,79	54,8±4,24	**<0,05**
	Repulsion time, s	0,28±0,04	0,30±0,05	>0,05
	Time of squatting, s	0,27±0,04	0,28±0,03	>0,05

Table 2. SOSS angular characteristics of young and adult cross-country skiers, (degrees, $\bar{X}$ ±σ)

Moment of the ski cycle	Angular characteristics	Boys, n=50	Men, n=18	Statistical significance of differences, p
Supporting leg at the moment of placing the poles	Shin tilt	71,89±5,11	75,87±6,83	**<0,05**
	Knee	138,81±8,3	138,31±8,39	>0,05
	Hip	118,55±6,02	121,38±8,39	>0,05
	Torso tilt	50,96±4,13	50,75±3,74	>0,05
Supporting leg at the moment of squatting	Shin tilt	68,90±4,7	69,63±6,03	>0,05
	Knee	121,68±6,22	113,78±8,41	**<0,001**
	Hip	94,62±7,55	94,52±11,58	>0,05
	Torso tilt	41,60±4,78	39,22±3,01	**<0,05**
The pushing leg at the end of the push-off	Shin tilt	60,01±8,4	63,19±7,61	**<0,05**
	Knee	150,89±7,38	149,78±8,51	>0,05
	Hip	138,75±11,47	129,37±21,62	>0,05
	Torso tilt	48,70±4,71	48,29±5,73	>0,05



Angular velocities of repulsion in SOSS (left) and STSS (right)

Table 3. STSS angular characteristics of young and adult cross-country skiers, (degrees, $\bar{X}$ ±σ)

Moment of the ski cycle	Angular characteristics	Boys, n=50	Men, n=18	Statistical significance of differences, p
Supporting leg at the moment of placing the poles	Shin tilt	69,01±5,55	66,24±5,47	>0,05
	Knee	120,08±9,80	117,88±5,40	>0,05
	Hip	91,78±8,51	94,07±5,31	>0,05
	Torso tilt	52,4±5,05	53,82±3,66	>0,05
Supporting leg at the moment of squatting	Shin tilt	59,06±3,96	56,96±2,23	**<0,05**
	Knee	117,13±6,93	116,27±4,87	>0,05
	Hip	84,61±6,94	94,26±3,57	**<0,001**
	Torso tilt	39,66±5,08	45,68±3,44	>0,05
The pushing leg at the end of the push-off	Shin tilt	56,13±6,64	54,98±5,93	>0,05
	Knee	152,62±11,43	150,89±4,67	>0,05
	Hip	138,11±12,47	147,37±7,45	**<0,01**
	Torso tilt	57,06±5,36	59,84±3,51	**<0,05**

young men, starting a step, continue to bend the supporting leg for some time, which leads to an increase in the duration of the take-off period and a shortening of the step length.

When moving with a simultaneous two-step skating move on an incline, the majority of young skiers did not make such technical errors, and the duration of the sit-up and take-off did not have statistically significant differences with the indicators of men (p>0.05). Analyzing the angular indicators, it should be noted that the absolute values of the joint angles largely depend on the speed of movement, the applied effort, relief, morphological indicators and physical capabilities of the athletes. Thus, during tactical accelerations, the values of the ankle, knee and hip joints decrease, and with uniform economical movement, they increase. This does not allow researchers to determine universal model indicators and creates difficulties in kinematic analysis, however, measuring and comparing the values of joint angles makes it possible to determine their optimal ratio, and most importantly, provides a tool for the coach to help explain to the athlete what exactly needs to be changed in the technique.

Reducing the angle of inclination of the shin at the moment of placing the poles allows young men to bring the projection of the center of gravity closer to the foot of the supporting leg and may be a sign of economization of technique (Table 2). A smaller angle in the knee joint in adult athletes during a squat indicates preparation for an active push-off. Young athletes compensate for insufficient flexion of the supporting leg by tilting the torso. A smaller angle of inclination of the shin at the moment of completion of the push may indicate a prolonged push-off.

When moving on a climb with a simultaneous two-step stroke, the strongest skiers, at the moment of squatting, more actively tilt their shins forward, which allows them to shift their pelvis forward (Table 3). The technique of young men is characterized by a large amplitude of body swaying, which is manifested in an excessive decrease in the angle of the hip joint and the angle of inclination of the body. Statistically significant differences in these indicators indicate insufficient stabilization of the trunk muscles, especially against the background of fatigue.

In competitive conditions, it is impossible to measure dynamic characteristics, however, the angular velocities of movement in the joints make it possible to indirectly judge the applied force. Measurement of the average angular velocities of repulsion (see figure) showed that statistically significant differences between the indicators of the two groups of athletes were determined only in the speed of knee extension in a simultaneous one-step stroke ($p<0.001$).

Conclusions. The study of the kinematics of ski moves of young cross-country skiers revealed the following features:

- when moving with a simultaneous one-step skating stroke on the plain, in comparison with adult qualified skiers, young men make a long push-off - 0.30±0.05 s and a quick sit-down - 0.15±0.4 s. During the sit-up, young racers demonstrate larger angles in the knee joint - 121.68±6.24° compared to the strongest athletes (113.78±8.41°);

- when moving with a simultaneous two-step skating stroke on the rise, at the moment of sitting down, the young men do not actively tilt the lower leg - 59.06 ± 3.96°, which is accompanied by excessive flexion in the hip joint - 84.61 ± 6.94° and tilt of the body - 39.66 ± 5 .08°.

The data obtained allow us to assert that in the technical training of young ski racers it is possible to focus on the criteria for the effectiveness of skiing, developed for adult athletes. The reason for the majority of technical errors among young men is an insufficient level of coordination abilities, in particular, balance, the ability to accurately and timely dose efforts, timely change the mode of muscle operation depending on external conditions, as well as low core stability.

It is necessary to change approaches to training children, starting from the initial training stage, to place emphasis on creating a broad foundation of motor skills that allow not only to master a biomechanically advantageous structure of movements, but also to develop the ability to timely vary the magnitude, direction and duration of efforts.

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Increasing the performance of swimmers specializing in sprinting and middle distances, under different recovery modes

UDC 796

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Abstract

Objective of the study was to increase the performance of highly qualified swimmers at distances from 50 to 400 m in the absence, practically, of additional by-products of glycolytic metabolism.

Methods and structure of the study. 28 highly qualified swimmers specializing in sprint and middle distances took part in the experiment. The difference between the subjects of the control and experimental groups was in the modes of recovery after intensive covering of distances. Athletes in the control group used a passive rest mode, and swimmers in the experimental group used swimming in an aerobic mode, without changing the method of movement.

Results and conclusions. The advantage of the active recovery mode in terms of lactate concentration upon completion of intensive distance covering and its utilization during the recovery period was recorded.

Keywords: *highly qualified swimmers, lactate concentration, recovery mode, performance, competitive activity.*

Introduction. One of the ways to increase performance at medium and partly short distances, according to the authors of research works, is to ensure the energy metabolism of competitive activity, which increases the oxidative capacity of energy supply to the muscles and muscle groups performing the movement [3, 7]

This problem is primarily associated with limited formation of lactic acid (lactate) in muscles during glycolytic resynthesis of adenosine triphosphate (ATP). Lactate, by acidifying the blood, limits the intensity of metabolic processes that carry out motor activity [5, 8, 9].

Therefore, the issue of increasing lactate utilization or, which is clear, decreasing the concentration of lactic acid in the blood directly in the process of performing working motor actions is on the agenda.

Since at the moment it is not possible to obtain data on the degree of lactate utilization at the time of performing working movements, an indirect indicator characterizing this phenomenon, in our opinion and other researchers, is the degree of intensity of lactate utilization in the first minutes of recovery (rest) after performing a load of a glycolytic nature [4, 6, 10].

Objective of the study was to increase the performance of highly qualified swimmers at distances from 100 to 400 m while increasing lactate utilization.

Methods and structure of the study. The following were used in the work: physiological and biochemical control, assessment of lactate concentration in the blood); temporary indicators of distance swimming; methods of mathematical statistics.

The pedagogical experiment involved 28 highly qualified swimmers specializing in one or more distances of 50, 100, 200 and 400 meters in various swimming methods. The experiment lasted about 5 months. The subjects were divided into two groups, equal in number and equivalent in terms of results at distances, indicators of general and special physical fitness.

All control tests were carried out at the beginning and at the end of the pedagogical experiment. The aerobic threshold, like the anaerobic threshold for athletes, was determined by performing the 5x200 m test with a stepwise increasing speed of overcoming 200-meter distances, up to the maximum possible result on the final repetition. At the completion of each 200-meter

segment, the level of lactate concentration in the blood was measured at the 3rd minute of rest. The break between swims was determined by the restoration of heart rate (HR) to the initial level (after warm-up). Based on the results of 200-meter segments and the concentration of lactic acid, graphs of lactate curves were determined for each athlete, with the help of which the values of aerobic and anaerobic thresholds were determined at the level of 2 and 4 mmol/l.

As an integral indicator, the subjects swam their competitive distances, recording the temporary result and the concentration of lactic acid in the blood at the 3rd minute of recovery. A 4 x 50 m test with a 15-second rest interval was also used to determine the results of the first and second half of the test and the total time to overcome the segments. The concentration of lactic acid in the blood in this test was determined at the end of the 1st, 3rd, 5th, 7th and 9th minutes of recovery. Heart rate was recorded in the first seconds after the tests were completed.

The specialized training regime for athletes, aimed at increasing speed endurance, consisted of covering distances mainly of a glycolytic nature. Their number of repetitions was regulated by a decrease in performance when covering the distance again by an amount within 1.8-2.5% of the best result in a given series. Rest between distances was determined by restoring heart rate to the warm-up level. Depending on the length of the distance and the stage of the experiment, the rest interval ranged from 45 s to 5 minutes. Training loads according to this algorithm were used 2-3 times a week.

The difference between the training regimes between the swimmers from the CG and the EG was that in the swimmers from the CG, recovery was carried out mainly in a passive mode in the absence of purposeful motor actions. Whereas the athletes from the EG, during the period between intensive overcoming training distances, used swimming in the same way in an aerobic mode as recovery. As their training increased, their swimming speed in the aerobic zone increased.

Results of the study and discussion. As a result of performing training loads, swimmers of the control and experimental groups showed improved performance at distances from 50 meters to 400 meters. At the same time, with an increase in the length of the distance, the advantage in increasing the performance of athletes from the EG relative to swimmers from the CG increased. Thus, with insignificant differences ($p>0.05$) in the time indicators for overcoming distances of 100, 200 and 400 meters at the beginning of the experiment, upon its completion, the results of the subjects from the EG and CG were fixed at the level: at the 100-meter distance - 55.42±0, 62 s and 56.68±0.58 s; at a distance of 200 meters – 124.30±1.15 s and 127.23±1.08 s; at a distance of 400 meters – 264.29±1.61 s and 268.12±1.55 s, respectively, with a significant difference in all cases ($p<0.05$).

The exception was overcoming a distance of 50 meters, at which the difference between the swimmers of the CG and the EG turned out to be unreliable ($p>0.05$) with a slight advantage in the average time of the swimmers of the CG. The results at this distance at the end of the experiment were 26.29±0.43 s and 26.33±0.34 s for athletes from the CG and EG, respectively.

Thus, the advantage of using alternating exercises in the training process, the energy supply of which is carried out mainly by the glycolytic route, with extensive aerobic exercises in the same method of swimming, is justified by the results obtained in the study for swimmers specializing in distances of 100, 200 and 400 meters.

Note that in swimmers from the EG, lactate utilization increased after completing all tested distances (from 50 to 400 meters). Moreover, in the first minutes after finishing at these distances, the difference in the level of lactate concentration in relation to the initial data at the beginning of the experiment was expressed by a difference in unreliable values ($p>0.05$).

In athletes from the CG, on the contrary, in the third minute after the finish at all tested distances, a significant increase in lactate concentration was found ($p<0.05$) at the end of the experiment relative to the corresponding data at its initial stage. There was no progress in lactic acid utilization at the end of the experiment. So, for example, at the 9th minute of recovery in swimmers from the CG at the end of the experiment, relative to the data at its beginning, the concentration of lactate in the blood was: at a distance of 50 meters - 3.5 ± 0.3 mmol/l and 3.3 ± 02 ($p> 0.05$); at a distance of 100 meters – 4.9±0.3 and 3.5±0.2 ($p<0.05$); at a distance of 200 meters – 5.6±0.3 and 5.1±0.2 ($p<0.05$); at a distance of 400 meters – 4.4±0.3 and 3.5±0.2 ($p<0.05$), respectively.

A significant indicator recorded in the experiment among athletes from the EG is a positive change in the level of the anaerobic threshold during training. This, judging by the work of scientists, is one of the most important facts in the progressive implementation of

the training process. Since an athlete at a higher level of the anaerobic threshold is able to achieve higher speeds along the distance without additional formation of by-products of blood acidification during glycolytic metabolism [10, 9, etc.].

Based on research works devoted to self-regulation and control of physiological functions during the performance of motor actions [1, etc.], we come to the conclusion that there is an increase in lactate utilization at the time of performing the exercise itself in the case when there is a reliably significant increase in performance, which was recorded in athletes from the EG on tested distances, without a significant additional increase in blood lactate concentration at the end of the exercise. This phenomenon is closely related to the intensity of lactate utilization during the recovery period upon completion of distances covered at the maximum possible speed, which is indirectly confirmed by the results of the study.

Considering the results obtained by the CG athletes who used passive rest between intense swimming distances, at distances from 50 to 400 meters, in conjunction with the value of lactate concentration at the 3rd minute of recovery, we come to the conclusion about the dominant role of increasing the concentration of lactic acid in improving their performance. On the one hand, this direction of the training process, as evidenced by the results obtained, is not effective enough in comparison with the results recorded among swimmers from the EG. On the other hand, increasing the concentration of lactate in the blood has significant limitations from a physiological point of view. In addition, as mentioned above, an increase in the concentration of lactate in the blood negatively affects the metabolism of energy supply to muscle activity.

Conclusions. It was revealed that the use of swimming in aerobic mode as a recovery in the coordination structure of the main exercise in between performing series of intense swimming of a glycolytic orientation leads to an increase in the effectiveness of overcoming distances of 50, 100, 200 and 400 meters by the main method of swimming in the absence of an additional increase in the concentration of lactate in the blood. At the same time, lactate utilization increases during the recovery period up to the 9th minute.

A significantly smaller increase in performance at the same distances was recorded than in point 1 with a significant increase in lactate concentration in the case of using passive rest in series of intense glycolytic exercises. The intensity of lactate utilization practically remains unchanged relative to the initial level at the beginning of the pedagogical experiment.

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Morphofunctional characteristics of highly sports qualified badminton players

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Abstract

Objective of the study was to identify the morphofunctional characteristics of successful highly qualified badminton players with a high competitive rating, performing in men's singles.

Methods and structure of the study. The survey involved 14 athletes - badminton players - highly qualified men with a high rating in the Russian Federation, regularly participating in prestigious competitions with high sporting results. For a comparative analysis, anthropometric indicators of 248 healthy untrained men, aged 19-23 years, living in Moscow, were used.

Results and conclusions. It has been established that the weight and height parameters of badminton players with a high rating in badminton in the Russian Federation do not differ from those of badminton players with high ratings in the BWF. When studying the girth dimensions of the body of badminton players, an asymmetry was noted in the girth sizes of the extremities of the playing arms and legs, more pronounced in the girth sizes of large muscle masses of the shoulder and thigh. When performing the Romberg test with the leg fixed on the knee, athletes showed high results in vertical stability. The results of badminton players performing the Ruffier test indicate the dominance of a satisfactory test result, which indicates the need to develop aerobic endurance when practicing badminton.

Keywords: *badminton, morphofunctional state, asymmetry of the girth dimensions of the limbs of playing arms and legs, Romberg test by limiting the area of support, Yarotsky test, performance indicators of the cardiovascular system, Ruffier test, aerobic endurance.*

Introduction. Studying the characteristics of the morphofunctional characteristics of highly qualified athletes who perform effectively in competitions is a priority task of sports physiology. A successful badminton athlete needs to accurately determine in a short period of time the direction of the shuttlecock's flight, its meeting point with the rocket, quickly move to take a comfortable position, strike taking into account the angle and trajectory of the shuttlecock's flight, monitor the opponent's reaction and take an advantageous position on the court [1, 3, 4]. To successfully carry out such actions, a badminton athlete must have a whole arsenal of distinctive morphofunctional characteristics and physical qualities that allow him to successfully perform in competitions [8]. The literature describes a few similar studies devoted to revealing the genetic characteristics of successful male badminton athletes, highly qualified athletes with a high rating in the BWF [6, 9]. Despite the growing popularity of badminton in the Russian Federation, the process of sports selection of productive, highly qualified badminton players who are successful in competitions based on the characteristics of morphofunctional status needs to highlight criteria for morphofunctional characteristics and scientific justification, which determines the relevance of the area under study.

Objective of the study was to identify the morphofunctional characteristics of successful highly qualified badminton players with a high competitive rating, performing in men's singles.

Methods and structure of the study. The morphofunctional status of badminton athletes included measuring the height (cm) and weight (kg) of athletes carried out in the morning from 7.00 to 7.15 using medical scales with a stadiometer MIDL MP 300 VDA (50/100; R) XM7 (40x50) "Health". Body mass index (BMI) (Quetelet-2) was calculated using the formula BMI = m/h2, where m - body weight, h - height. The state of vertical stability was assessed based on the results of Yarotsky and Romberg functional tests (3rd version of the test with limited support area - fixing the leg on the knee) [7]. To assess hemodynamic parameters at rest and after exercise, a semi-automatic Omron S1 tonometer was used to determine systolic blood pressure (SBP), diastolic blood pressure (DBP) and heart rate (HR). The parameters were determined arithmetically using the following formulas: 1. pulse pressure (PP) mm Hg. Art. = SBP-DBP; 2. average hemodynamic pressure (AHP) mmHg Art.= DBP+PP/3; 3. systolic volume (SV) ml = {(101 + 0.5*PP) – (0.6*DBP)} – 0.6*A (Starr formula) [1, p. 105]; 4. minute blood volume (MBV) l/min = SV×HR [1, 2, 8].

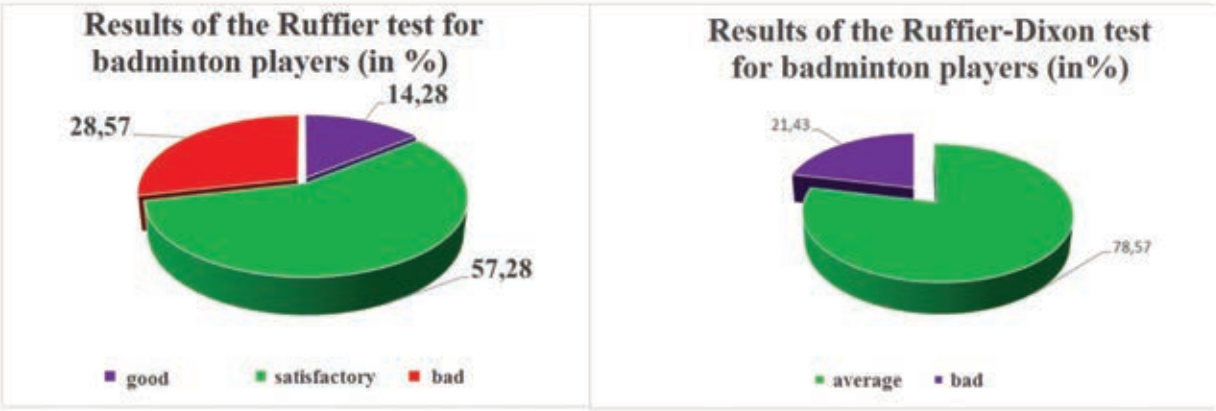
The survey involved 14 athletes - badminton players - highly qualified men with a high rating in the Russian Federation, regularly participating in prestigious competitions with high sporting results. Average age: 21.35 ±3.29 years; The average badminton experience was: 12.57±3.61 years; volume of training load in hours per week: 22.14±1.79. Collecting a sports history, questioning, survey and conversation were carried out in person/in absentia format. Badminton players signed a protocol of voluntary informed consent for physiological testing. For a comparative analysis, we used anthropometric indicators of healthy untrained men of 248 people, aged 19-23 years, living in Moscow, which were provided by M.A. Negasheva, Doctor of Biological Sciences, Professor of the Department of Anthropology, Faculty of Biology, Moscow State University. [5].

Results of the study and discussion. As the survey results showed, in men's singles the following morphofunctional characteristics of successful badminton players were noted: average height – 180.35±5.86 (cm); minimum height – 171 (cm), maximum height 190 (cm); average weight: 73.07±6.40 (kg); BMI ranges from 20.57 to 23.67. Data on the morphofunctional characteristics of successful Russian badminton players of high qualification were compared with data on the weight and height parameters of badminton players with a high world rating in men's doubles [9, 10]. It was revealed that Russian successful badminton players who successfully perform in men's singles do not differ in height and weight from badminton players with a high rating in the BWF.

Comparing the data of weight-height parameters with the average values of the weight-height status of healthy untrained men from 17 to 23 years old, examined in Moscow (2022) and Kazan (2018-2020) [5, 6], it was found that the height values successful, highly qualified badminton players are on average 5.35 -3.65 cm higher in comparison with population growth data in the Russian Federation. When compared with healthy untrained men in terms of weight, badminton athletes are lighter on average by 0.93 kg

Data on hemodynamic characteristics and respiratory reserves of badminton players in a state of conditional rest

Name	HR, rate bpm	SBP, mm Hg. Art.	DBP, mm Hg. Art.	PP, mm Hg. Art.	AHP mm Hg. Art.	SV, ml	MBV, ml	Stange test, s	Genche's test, s
A	60	116	78	38	90,7	54,2	3253,2	63	52
B	54	126	81	45	96,0	56,3	3039,7	60	51
C	72	119	82	37	94,3	51,4	3700,8	59	48
D	66	122	85	37	97,3	50,9	3360,1	73	61
E	60	118	80	38	92,7	48,8	2928,6	61	50
F	60	120	77	43	91,3	56,9	3412,8	73	59
G	66	125	83	42	97,0	54,1	3573,2	63	50
H	72	121	79	42	93,0	57,6	4150,1	64	52
J	66	117	80	37	92,3	54,4	3588,4	72	58
K	60	120	78	42	92,0	57,0	3419,4	67	55
L	60	124	83	41	96,7	53,0	3179,4	56	45
M	66	125	81	44	95,7	57,0	3760,0	67	51
N	60	121	79	42	93,0	50,9	3055,8	52	46
O	66	117	76	41	89,7	56,4	3720,4	71	60
Aver. valuex±σ	63,4±5,1	120,7±4,1	80,1±2,5	40,6±2,7	93,7±2,5	54,2±2,8	3438,7±336,6	65,4±6,5	52,7±2,5



Results of assessing the physical performance of badminton athletes by performing the Ruffier and Ruffier-Dixon functional tests (in %).

(comparison with data according to T.V. Prokopchuk, A.U. Kadyrov (2020) or in comparison with data from M.A. Negasheva et al. (2018), their weight values correspond to the low weight norm of healthy untrained men [5]; according to the indicator BMI among badminton players ranged from 20.57 to 23.67, which is less than the average values for the population in the Russian Federation up to 0.99 [6].

It is believed that physique has little effect on the athletic performance of badminton players [9], however, the data obtained clarify that male badminton players with a high rating in the Russian Federation have above average height and below average weight in comparison with the population of healthy untrained men in the Russian Federation.

Noteworthy is the identification of asymmetry in the girth dimensions of the limbs in favor of the playing arms and legs of badminton players at the stage of high qualification. Our results of testing the girth sizes of the extremities of the right and left arms and legs revealed the most pronounced asymmetry of the girth of the hips and shoulders, where there was significant difference in the difference between the right and left sizes of the girths of the thigh and shoulder ($p < 0.05$); to a lesser extent, differences in the girths of the lower leg and forearms.

The level of development of coordination abilities plays a dominant role in the success of badminton athletes, which directly affects the accuracy and speed of the athlete's movements. In our study, the vestibular stability of athletes was determined by the indicators of functional tests: "Stability in the Romberg pose" (the 3rd version of the test with a decrease in the support area was performed with the leg fixed on the knee) and the Yarotsky test for assessing a person's dynamic stability.

As the results showed, highly qualified badminton players have excellent results in performing a simple test "Stability in the Romberg Pose", which evaluates vestibular stability. For comparison, the results of trained athletes in the "Stability in the Romberg pose" test from 100 to 120 s [7]. The results of vertical stability in the Yarotsky position among badminton players were: 66.86±10.11, which is slightly reduced in comparison with the standards of athletes (90 and > s) [7].

The level of development of the athletes' functional fitness was assessed by the hemodynamic characteristics of SBP, DBP, PP, AHP, HR, MBV, SV, which is presented in the table.

All examined badminton players have a fairly high functional readiness according to the results of the Stange test (the norm for trained ones is 60-120 s) and Genche [7]. At rest, all the examined athletes showed a predominance of parasympathetic vagal influences, which is reflected by: heart rate = 63.42 ± 5.1 (bpm) and a tendency towards hypotension according to SBP values = 119.7 ± 4.19 (mm Hg. Art.), which reflects the prevalence of vagal influence and the development of athletes' fitness.

The assessment of the physical performance of athletes was carried out based on the results of the dynamic test of Ruffier and Ruffier-Dixon. It is noted that for the vast majority of badminton players, the results of the Ruffier and Ruffier-Dixon test emphasize satisfactory and average indicators of physical performance of athletes, while a third of badminton players show poor physical performance (see figure) [7].

Conclusions. As shown by the results of a morphofunctional examination, badminton athletes performing in the men's singles category must have above average height and low weight, good vestibular stability and functional readiness of the cardiovascular system and satisfactory results of physical performance in the Ruffier test, which dictates the need for the mandatory inclusion of physical exercises, developing aerobic endurance in the training process. Perhaps the insufficient level of development of aerobic endurance does not allow our badminton players to occupy leading places in the rankings in the BWF. The priority for achieving high sports results among badminton players is the development of speed and coordination abilities, as well as general and special endurance.

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Increasing the efficiency of attacking strike after a negative receipt of the ball in volleyball

UDC 796.015

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Abstract

Objective of the study was to develop means to increase the efficiency of the attacking blow after a negative ball reception among qualified volleyball play-ers.

Methods and structure of the study. The pedagogical experiment involved a survey of trainers and pedagogical observation using the Data Volley computer program.

Results and conclusions. It was revealed that it is advisable to include spe-cially designed exercises in the training process of qualified volleyball players to improve attacking actions after a negative ball reception. It was experimentally established that the effectiveness of an attacking blow after a negative reception of the ball increased (before the experiment 25.6 ± 6.9%, after 41.7 ± 7.9%), which made it possible to increase the effectiveness of all attacking blows during competitive activity (before the experiment 46.6±4.6%, after 51.0±4.2%).

Keywords: *volleyball, means of the training process, attacking blow, negative technique, increasing the efficiency of the attack.*

Introduction. Modern volleyball is characterized by a highly situational nature of the game in conditions of a lack of time to assess, solve and perform tactical and technical problems [1]. During the game, situations of negative ball reception increasingly arise, in which the set player finds himself in a disadvantageous position for organizing combination play. The quality of positive ball reception from a serve should be no lower than 65-75% [3]. The efficiency of receiving serve, even by libero players, is no more than 64.8%. The efficiency of receiving the opponent's attacking blows in women's teams of masters is in the range of 30-37%, in men's – no more than 38.5% [1].

Attacking players of the second pace (diagonal players and finishers) are forced to make attacking strikes in an organized group block without proper preparation, which involves 2-3 steps for a run-up and jump, visual control of the ball and peripheral vision control of the net and blocking players. The success of attacking strikes in emerging non-standard situations depends on the development of physical abilities (motor potential), ensuring the effectiveness and reliability of the technical and tactical actions of volleyball players in competitive gaming activities (in particular, the speed of a single movement, the ability to differentiate muscle effort and the ability to rearrange movement). It has been experimentally proven that athletes of different specializations demonstrate the ability to relax according to the relaxation coefficient: the higher the coefficient, the sooner the muscles relax and are less susceptible to injury due to lack of recovery or the occurrence of additional effort from the participation of antagonist muscles [2].

Objective of the study was to develop means to increase the efficiency of the attacking blow after a negative ball reception among qualified volleyball players.

Methods and structure of the study. The pedagogical experiment involved a survey of trainers and pedagogical observation using the Data Volley computer program.

22 volleyball coaches from different cities of Russia took part in the survey and answered questionnaire questions related to the research problem.

To determine the indicators of the effectiveness of an attacking strike after a negative reception of the ball by attacking players of the second pace, pedagogical observation was carried out using video recordings of games of qualified volleyball players and the use of the Data Volley computer program. The following characteristics of ball reception were taken into account: the distance of the ball from the zone of the setting player, the height of reception, the speed of finishing the ball, which made it possible to determine the quality of each ball reception in accordance with the varieties - from the program manual (Table 1). The flight trajectories of the ball after a positive and negative reception are presented in a computer image. The effectiveness of an attacking strike for qualified players in competitive activities was calculated.

The study involved 6 qualified volleyball players-finisher from St. Petersburg, with the first adult category and a Candidate Master of Sports.

At the first stage, a survey of coaches was conducted, pedagogical observation was carried out, and tools were developed aimed at improving the individual technical and tactical actions of volleyball players in attack after a negative reception of the ball. At the second stage of the study, during a sequential pedagogical experiment, the effectiveness of the developed tools was checked.

Results of the study and discussion. Indicators of the effectiveness of performing all attacking strikes (46.6%) and attacking strikes after a negative ball reception (25.6%) were calculated for qualified volleyball players during the first round of the St. Petersburg Championship among men's volleyball teams. The results confirmed the relevance of the ongoing research.

Options for the trajectory of the ball after receiving a serve based on the Data Volley computer program

Table 1. *Designation of types of game situations for receiving the ball in the Data Volley computer program*

Symbols	Characteristics of receiving the ball in volleyball
R=	The ball is lost
R/	Passing the ball or receiving the ball without attacking
R-	Reception of the ball is 4 m away from the net and beyond, beyond the side lines, low ball trajectory
R!	Reception of the ball is 2.5 - 3.5 m away from the net
R+	Reception of the ball is 1 - 2.5 m away from the net
R#	Reception of the ball is 0 - 1 m away from the net (perfect finishing), jumping pass to the setter with the possibility of a discount

Table 2. *Results of pedagogical observation of the competitive activity of qualified volleyball players*

Indicators	Before experiment	After experiment	Conclusion about the difference
Efficiency of all offensive strikes (%)	46,6±4,6	51,0±4,2	p≤0,05
The effectiveness of offensive strikes after a negative ball reception (%)	25,6±6,9	41,7±7,9	p≤0,05
R/ (%)	13,8±9,02	37,5±15,4	p≥0,05
R- (%)	37,1±11,8	46,3±6,2	p≥0,05
R! (%)	34,8±10,5	41,6±8,7	p≥0,05

During the survey, it was revealed that only 5% of volleyball coaches regularly use exercises to improve an attacking strike after a negative ball reception, very rarely used by 46% of respondents, and not included in the training process by 49% of respondents. The majority of coaches (71%) noted the strong influence of the effectiveness of the offensive strike after a negative ball reception on the overall effectiveness of the players' attacking actions. The coaches agreed that it is possible to increase the effectiveness of an attacking strike after a negative ball reception by using special means that develop physical qualities and improve individual technical and tactical actions. Taking into account the types of game situations for receiving the ball and the recommendations made, three blocks of exercises were developed and introduced into the training process:

Block 1. Exercises of associated influence, developing physical abilities (speed and coordination abilities), and at the same time, improving the technique of attacking actions against a passing ball.

Block 2. Exercises that improve technical and tactical actions when performing attacking shots from advanced passes (2.5 - 3.5 m from the net) in difficult conditions.

Block 3. Exercises that improve technical and tactical transition actions from defense to attack, performing an offensive strike after a negative reception of the ball to the center of the playing court.

The exercises were performed in the main part of the training sessions. The blocks alternated every two training sessions. After the pedagogical experiment, in the second round of the St. Petersburg Championship, the indicators of negative ball reception and the effectiveness of serves were analyzed and compared with those demonstrated in the first round (Table 2).

Before the experiment, the effectiveness of the attacking blow after a negative technique was 21% less than in other situations of competitive activity of qualified volleyball players. During the study, statistically significant differences were obtained in the indicators of technical and tactical actions before and after the experiment. The effectiveness of all attacking shots of volleyball players in the game increased by 4.6%, and the increase in the efficiency of attacking shots after a negative ball reception was 16.1%. The changes that have occurred are based on an increase in characteristics under the codes: "R/" - by 23.7%; "R-" – by 9.2%, and "R!" – by 6.8%, which are combined into a single indicator of the effectiveness of an attacking strike after a negative ball reception, which has a significant difference at p≤0.05.

Conclusions. The effectiveness of an attacking blow after a negative technique has a high impact on the overall result of attacking actions - this is the opinion of 71% of surveyed volleyball coaches. Its increase can be achieved through the use of developed means in the form of blocks of special exercises (by more than 16%).

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Relationship of physical fitness profile and the number of technical error at the stages of ski training among high class skiers with different training load structures

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Abstract

Objective of the study was to assess the relationship between the profile of physical fitness and the number of technical errors made when passing training routes at the stages of ski training by high-class skiers who have a different structure of training loads at the stage of physical training.

Methods and structure of the study. Loads during two macrocycles (104 weeks) in eight adult men and five women of different ski specializations for 84 indicators were recorded daily. Testing was carried out according to the program of staged examinations of Russian national teams on 91 indicators - in May, July and October.

Results and conclusions. In the group of alpine skiers with a larger proportion ($p<0.05$) of low- and high-intensity aerobic exercise, but a smaller proportion of glycolytic-oriented means, athletes had better VO2max and anaerobic threshold indicators, while they made fewer technical errors when passing training routes, especially during the second half of the ski training stage.

High aerobic performance may be one of the factors that increases the efficiency of technical training by skiers in conditions of accumulation of fatigue during daily training sessions at the stage of ski training.

Keywords: *ratio of training loads, physical fitness profile,* $VO_{2max.}$

Introduction. The sports performance of high-class alpine skiers is largely determined by the effectiveness of the training process at the stages of ski training before the start of the competitive period [1]. The criterion for the effectiveness of ski training is the number of technical errors made by high-class skiers during training sessions on slopes of the required technical complexity: it is believed that the fewer errors, the more successful the process of technical improvement is [2].

The problem is to determine the training factors and structure of preparedness that would ensure the optimal readiness of skiers to solve the problems of technical and physical training directly at the stage of improving sports and technical skills (ski training).

When conducting this study, it was assumed that the ratio of aerobic and anaerobic training loads at the stage of physical training will have a direct impact on the dynamics of physical fitness indicators in the macrocycle and on the progress of technical improvement (the number of technical errors when passing training routes) at the stage of ski training.

Objective of the study was to assess the relationship between the profile of physical fitness and the number of technical errors made when passing training routes at the stages of ski training by high-class skiers who have a different structure of training loads at the stage of physical training.

Methods and structure of the study. 13 high-class alpine skiers took part in the scientific work (M – (n=8), age 28.8±6.1; weight 82.0±5.9; body length 178.7±4.5; F – (n =5) age 22.0±3.1; weight 66.7±9.7; body length 166.3±3.9), specializing in various disciplines of alpine skiing. Training loads during a central-

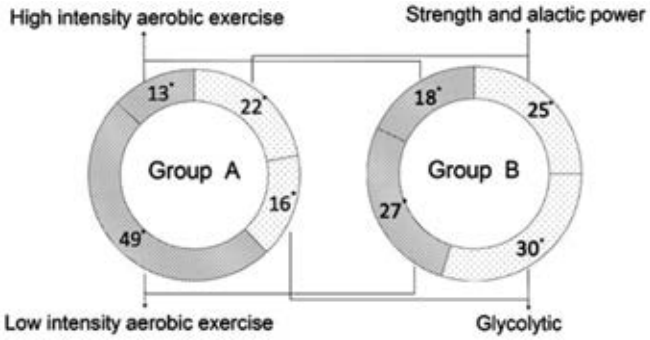


*Figure 1. Ratio (%) of loads by direction at the stage of physical training in two groups of high-class skiers on average for two control seasons. Note. * – differences between groups at p<0.05.*

ized form of training for 84 indicators were recorded daily for two year-long macrocycles in the following areas: "strength and alactic power" (strength exercises of varying intensity, cycling and running accelerations up to 40 s, jumping); "glycolysis" (long periods and complex coordination complexes 60-240 s with near-maximal and maximum intensity); "low intensity aerobic" (1-2 "zones"), "high intensity aerobic" (3-4 "zones").

Physical fitness testing was carried out three times: in May, July and October according to the program of staged comprehensive examinations (SCE), adopted for members of the sports team of the Russian Federation in alpine skiing according to 91 indicators, including, among others: maximum dynamic strength of the leg muscles on Hardware and software Biodex complex, as well as maximum alactic power (MAP), anaerobic threshold (AnT) and Maximum oxygen consumption (MOC) when tested on a bicycle ergometer.

The number of technical errors during the passage of training slopes was recorded by a qualified employee of a comprehensive scientific group at all ski training events in the period from July to October. Load, testing and error rates were averaged over both seasons. The significance of differences between group means of unrelated samples was determined using the Mann-Whitney test; related samples were determined by the Wilcoxon t-test.

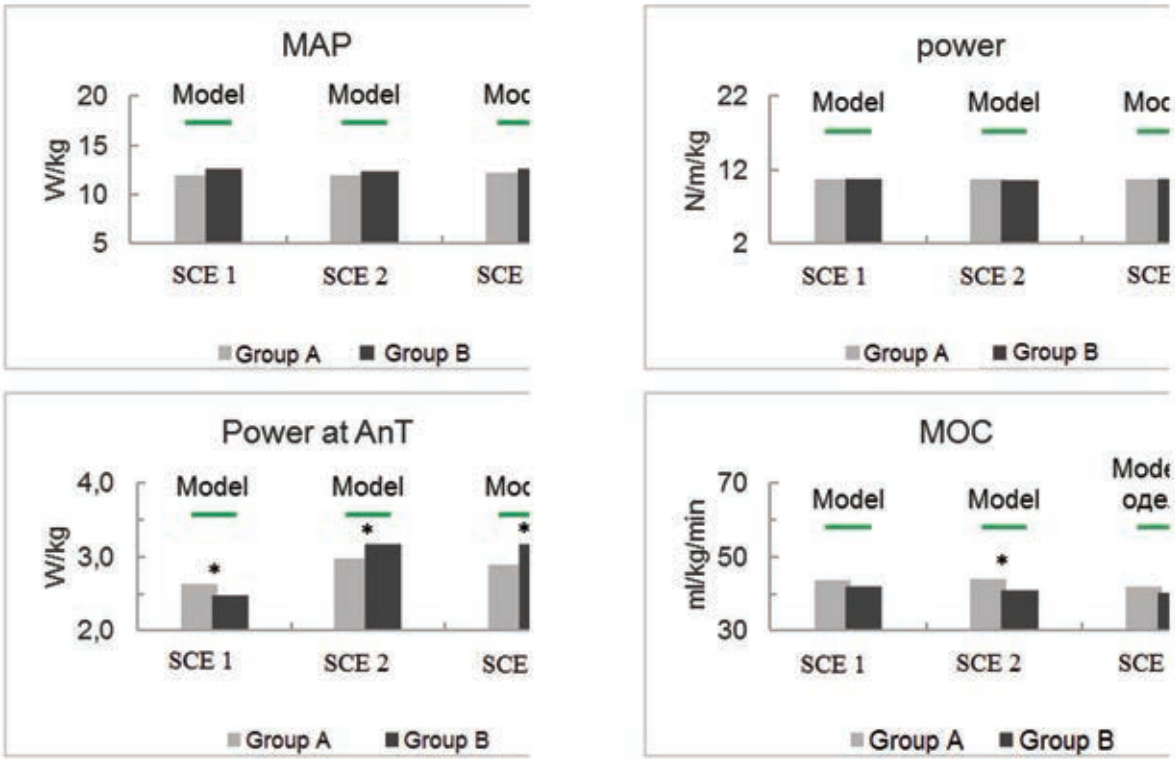


Figure 2. The relationship between the magnitude and dynamics of physical fitness indicators during staged comprehensive examinations (SCE) in May (SCE 1), July (SCE2) and October (SCE 3) in two groups of skiers, differing in load structure

Note: * – differences between groups at p<0.05; MAP – maximum alactic power; AnT – anaerobic threshold; MOC (VO_{2max}) – maximum oxygen consumption when tested on a bicycle ergometer.

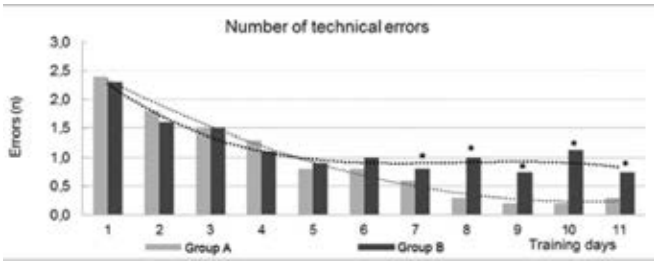
Results of the study and discussion. According to the recording of training loads, the subjects were divided into two groups according to the criterion of the ratio of aerobic and anaerobic loads. The final ratio of load volumes at the stage of physical training is presented in Figure 1.

Athletes in group A had a larger ($p<0.05$) volume of low- and high-intensity aerobic training, but a smaller volume of "glycolytic" training.

Figure 2 shows the relationship between the magnitude and dynamics of MAP, AnT and MOC, demonstrated by high-class skiers of two groups in May, July and October.

The groups did not differ in the size and dynamics of MAP. Both groups improved AnT ($p<0.05$) during the physical training stage; in group B the increase was higher ($p<0.05$); in addition, alpine skiers and group A had greater AnT values after the ski training stage. Group A had a greater initial VO2max and VO2max after the ski training phase.

Figure 3 shows the average dynamics of technical errors in groups A and B by days of ski training at all



training events at which control was carried out.

Figure 3. The average number of technical errors in groups of skiers A and B by day, recorded in July-October at all training events of the stages of ski training during two control seasons.

Note. * – differences between groups at $p<0.05$.

Athletes of group A had, on average, a smaller ($p<0.05$) number of technical errors on days 7–11 and on average for all stages of ski training.

Conclusions. It was found that in two groups of athletes training under similar conditions of centralized training, a larger proportion of high and low intensity aerobic exercise with a smaller proportion of glycolytic work, as well as with the same ratio of strength and alactic training volumes, allows athletes, on average, to have more high rates of aerobic performance before the start of the ski training stage and maintain such characteristics until the start of the competitive period. In addition, the structure of loads with a large aerobic component and higher aerobic power are probably factors that allow the GVK to make fewer technical errors when working on the track, especially in the second half of the ski stages of sports training.

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Features of the stroke in the process of integrating physical and technical training of crawler swimmers at the stage of improving sportsmanship

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Abstract

Objective of the study was to identify the features of changes in stroke characteristics in the process of integrating the technical and physical training of swimmers at the stage of improving sportsmanship.

Methods and structure of the study. The three-year experiment involved 45 swimmers of the stage of improving sportsmanship, who qualified as candidates for master of sports of Russia and made up the experimental (EG) and control groups (CG). The training programs in the experimental group included modified load options, specially selected exercises that simultaneously affected the parameters of physical and technical readiness, which are leading in the formation of maximum swimming speed. The training plans of the athletes in the control groups were carried out in accordance with the regulations of the Federal Standard of Sports Training for the sport – "swimming". The work used methods of computer video analysis of swimmer movements, analysis of intra-cycle swimming speed, dynamic parameters of swimming technique, testing, and mathematical statistics.

Results and conclusions. Significant differences were revealed in 24 out of 30 parameters of stroke movements in athletes from the EG and CG, indicating pronounced positive changes in the stroke in athletes from the EG. At the same time, differences were established in the mechanism of formation of stroke power in the propulsive phases - pulling up and pushing off. The use of special exercises in training programs for swimmers at the stage of improving sportsmanship, aimed at developing the strength component of swimming technique in the context of integrating means of physical and technical training, leads to characteristic changes in the structure of the stroke. The identified differences in the indicators of strength, speed and power of the stroke in its propulsive phases among swimmers from the EG and CG ensure a significant increase in the maximum swimming speed in athletes of the first group compared to the second.

Keywords: *integration, technical and physical training, crawler swimmers, stage of improving sportsmanship, training tools, stroke characteristics.*

Introduction. The stage of improving sportsmanship is characterized as a period of athletes mastering the loads characteristic of modern elite sports and maintaining a high level of physical, technical, tactical, and psychological preparedness [3-5]. At this stage of sports training, the share of general physical training is reduced (to 12-25%) and the percentage of special physical training is increased (to 40-52%). At the same time, only 15-20% of the total volume is allocated for technical training, which, in our opinion, is extremely small to ensure a high level of sportsmanship among swimmers [1, 2]. It is at the stage of sports improvement that swimmers reach the maximum volume of swimming - about 3000 km per year [6]. As we approach the maximum values of the total volume of loads, the task of optimizing training means, primarily through their integration, becomes acute.

As is known, the effectiveness of a swimming technique is determined by the propelling or propulsive force that the swimmer creates during the stroke, while minimizing the resistance forces acting on the body [4]. Research on increasing swimming speed

has shown that the highest pulling forces are achieved by the arms when swimming at maximum speed [7]. Previously, in our works [1, 2], devoted to the integral training of swimmers, statistical ROC analysis was used, which determined the most specific kinematic and dynamic parameters of the stroke, the change of which leads to a change in the maximum swimming speed. It should be noted that according to ROC analysis, stroke indicators identified as significant also have high sensitivity, that is, they are subject to change. On the other hand, their specificity makes it possible to select associated means on land and in water that have an accentuated effect on biomechanical parameters and increase the efficiency of the stroke.

Objective of the study was to identify the features of changes in stroke characteristics in the process of integrating the technical and physical training of swimmers at the stage of improving sportsmanship.

Methods and structure of the study. The three-year experiment involved 45 swimmers at the stage of improving sportsmanship, qualified as candidates for Master of Sports of Russia - 20 in the experimental group and 25 in the control group. The work used methods of computer video analysis of the swimmer's stroke movements, analysis of intra-cycle swimming speed, dynamic parameters of the stroke, testing, and mathematical statistics.

The training programs in the experimental group included modified load options, specially selected exercises that simultaneously affected the parameters of physical and technical training, which are leading in the formation of maximum swimming speed.

To improve physical qualities and technical readiness in the gym and in the water, exercises with similar characteristics and direction of impact were used: with the StretchCordz Modular Set device of varying rigidity on land and in water, using blades of different sizes, various options for coordinating rowing movements with varying intensity and weights, using KINESIS, VASA Ergometer, VASA Trainer simulators. At the considered stage of preparation, the work was focused (taking into account the results of the ROC analysis) on increasing the power and strength of the stroke in the push-off phase, reducing the tempo of movements on land and water, reducing the speed and acceleration of the hand in the pull-up phase. It should be noted that at this stage of preparation, the "step length" parameter showed high specificity. In this regard, exercises on land and in water were selected to optimize the pace-step ratio.

The training plans of the athletes in the control groups were carried out in accordance with the regulations of the Federal Standard of Sports Training for the sport "swimming".

Results of the study and discussion. A comparative analysis of the results obtained during three years of preparation at the stage of improving sportsmanship revealed the characteristic features of the kinematic and dynamic parameters of the stroke, in particular, the heterogeneity of the dynamics of its individual parameters among athletes from the EG and CG. It should be noted that the main factors in the formation of the propulsive phases of the stroke are indicators of the strength and speed of wrist movement. They also determine the power of the stroke as a derivative indicator of strength and speed. In this sense, the power indicator can be equal for different multiplier values (for example, speed is higher and strength is lower and vice versa). Thus, in the first year of preparation at the stage of improving sportsmanship in the CG, the increase in the stroke force indicator in the grip phase (non-propulsive) was almost the same as in the EG (2.5% in the CG and 2.6% in the EG), and in the pull-up (propulsive) phase, the stroke force of swimmers from the EG increased by 31.5%, and in the CG, on the contrary, decreased by 34%. By the second year of training, the increase in strength among swimmers from the EG decreased and amounted to only 5%, and by the end of the third year – 4%, which can be explained by the "law of the initial level". At the same time, the indicator of stroke strength in the catching phase by the end of the third year of training among athletes from the EG and CG was practically no different (table).

The stroke power in the pull-up phase of athletes from the CG increased by 12.7% in the first year, and in the EG - by 5%, and then the trend of changes during the second and third years of training was maintained. The observed decrease in the increase in the stroke power indicator in the pull-up phase in swimmers from the EG occurred against the background of an increase in stroke strength, and in the CG – in the speed of wrist movement (table).

In the repulsion phase (propulsive) in the athletes from the CG, stroke strength indicators in the first year showed a slight increase, and in the EG, the force applied by the hand to the water flow increased by 18.3% compared to the initial data. However, further, due to a sharp increase in the speed of wrist movement among swimmers from the EG (in the first year by 13.6%, in

Indicators of the dynamic and kinematic structure of the stroke among athletes at the stage of improving sportsmanship at the end of the third year of training ($\bar{x}\pm\delta$)

Indicators	EG (n=20)	CG (n=25)	Mann-Whitney statistics U	p
Dynamic stroke parameters				
Strength (capture phase), N	198,3±8,174	198,416±8,157	227,0	>0,05
Power (capture phase), Watt	229,381±30,873	227,26±30,482	225,0	>0,05
Strength (pull-up phase), N	391,25±6,576	145,76±11,406	0,0	<0,001
Power (pull-up phase), Watt	160,983±10,135	101,556±10,747	0,0	<0,001
Force (repulsion phase), N	248,85±17,181	228,8±27,876	80,0	<0,001
Power (repulsion phase), Watt	839,675±239,39	298,584±42,696	3,0	<0,001
Power avg. (on land), Watt	218,123±7,847	206,948±8,095	87,0	<0,001
Power min. (on land), Watt	192,815±3,724	186,228±4,465	66,5	<0,001
Power max. (on land), Watt	243,43±12,232	227,668±11,902	90,0	<0,001
Kinematic parameters of the stroke				
Speed in the capture phase, m/s	1,153±0,117	1,141±0,107	217,5	>0,05
Speed in the pull-up phase, m/s	0,412±0,026	0,698±0,061	500,0	<0,001
Speed in the repulsion phase, m/s	3,328±0,779	1,305±0,077	0,0	<0,001
Pace in water, movements/min	58,62±4,233	68,139±4,942	459,0	<0,001
Pace on land, movements/min	60,01±4,605	71,002±6,609	451,0	<0,001
Cycle time, s	1,403±0,117	1,269±0,136	105,5	<0,001
Stroke time, s	1,176±0,129	1,039±0,121	118,5	<0,01
Brush depth, cm	55,08±4,984	53,042±3,796	178,5	>0,05
Trajectory length in the capture phase, m	0,441±0,05	0,428±0,031	206,5	>0,05
Trajectory length in the pulling phase, m	0,946±0,046	0,974±0,279	123,0	<0,01
Trajectory length in the repulsion phase, m	0,76±0,078	0,668±0,058	72,5	<0,001
“Step”length, m	2,026±0,182	1,815±0,099	96,5	<0,001
Speed avg. per cycle, m/s	2,603±0,43	2,014±0,194	65,5	<0,001
$ICS_{max.}$, m/s	1,693±0,069	1,632±0,053	107,5	<0,001
$ICS_{min.}$, m/s	1,303±0,109	1,197±0,066	118,5	<0,01
$ICS_{avg.}$, m/s	1,501±0,087	1,417±0,059	115,0	<0,01
Acceleration of the hand in the grip phase, m/s^2	1,766±0,899	1,76±0,672	202,5	>0,05
Acceleration of the hand in the pulling phase, m/s^2	-6,17±2,359	-3,776±2,186	381,0	<0,01
Acceleration of the hand in the repulsion phase, m/s^2	8,352±3,778	5,681±3,27	114,0	<0,01
Swimming speed max., m/s	2,095±0,114	1,86±0,057	0,0	<0,001
Test swimming speed, m/s	2,054±0,029	1,934±0,063	9,5	<0,001

the second - by 41.4% and in the third - by 30.1%), the increase in the power parameter of their stroke decreased and by the end of the third year of training, the increase was only 0.5% (in the CG – 14.4%). That is, in the swimmers of the EG, a reverse pattern of formation of the calculated stroke power indicator was observed in the push-off phase compared to the pull-up phase. The increase in stroke power in the take-off phase among swimmers from the EG increased in the first year by 34.7%, in the second year - by 51% and in the third year - by 31% (in the CG - in the first year a regression of the indicator by 30.7% was found, and in in the second and third years, the increase in the power parameter relative to the first year of preparation was

50% and 31.2%, respectively). When analyzing stroke power on land, the increase in indicators in the control and experimental groups was almost the same.

The stability of the technique can be judged by the indicators of intra-cycle swimming speed (ICS) [4]. The results obtained showed that the difference between the minimum and maximum values of the ICS in the EG by the end of the third year of training was 0.39 m/s, and in the CG – 0.44 m/s, that is, the ICS graph for swimmers from the EG was smoother than in the CG, which indicates a more stable and effective swimming technique (see table).

The use of special exercises on land and water had a positive effect on the swimming technique of athletes from the EG, compared to the CG. In particular, by the end of the third year of training, significant intergroup differences were revealed between swimmers from the EG and CG in terms of the power of wrist movement in the take-off phase (for swimmers from the EG the indicator was 280% higher than in the CG). It should be noted that the applied means of integrating physical and technical training at the stage of improving sportsmanship also led to a significant increase in the maximum swimming speed of athletes from the EG compared to the CG. Moreover, all the athletes from the EG fulfilled the standard of the Master of Sports of Russia and repeatedly became winners and prize-winners of All-Russian swimming competitions.

Conclusions. The use of special exercises in training programs for swimmers at the stage of improving sportsmanship, aimed at developing the strength component of swimming technique, in the context of integrating means of physical and technical training, leads to characteristic changes in the structure of the stroke. The identified differences in the indicators of strength, speed and power of the stroke in its propulsive phases among swimmers from the EG and CG ensure a significant increase in the maximum swimming speed in athletes of the first group compared to the second.

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Model of competitive activity of highly qualified decathlers

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Abstract

Objective of the study was to develop a model of competitive activity of highly qualified decathletes, to formulate a technology for managing the training process of track and field all-round athletes based on the model.

Methods and structure of the study. Instrumental research methods included analysis of documentary materials, video recording and video analysis, photodiode timing, and methods of mathematical statistics.

Results and conclusions. Based on a statistical analysis of indicators of competitive activity in certain types of decathlon of the world's leading all-around athletes, a model of competitive activity of highly qualified male all-around athletes was formed. The model allows, based on a comparison of an athlete's performance with model parameters, to analyze the results of a decathlete in individual events, to identify lagging and dominant types of an athlete. This creates opportunities for planning results in individual types of decathlon for the next macrocycle of training and, on this basis, programming the special training of a multi-athlete at the stages of the macrocycle.

Keywords: *athletics, all-around, modeling, control of competitive activity.*

Introduction. The current stage of development of the theory and methodology of sports is characterized by a transition to program-targeted planning of the training process using models that reflect the structure of competitive activity in the sport, the special physical, technical and tactical readiness of athletes for a specific sports result [4, 6]. The competitive model is one of the important components of program-targeted training planning. At the first stage, the training of male all-around athletes should be based on planning indicators in individual types of all-around for the result planned for the next macrocycle in the decathlon [1-4]. This requires the coach and athlete to make a thoughtful and reasonable forecast of results in certain types of all-around events for the next sports season [1, 3, 5, 7].

Objective of the study was to develop a model of competitive activity of highly qualified decathletes and, on its basis, to formulate a technology for managing the training process.

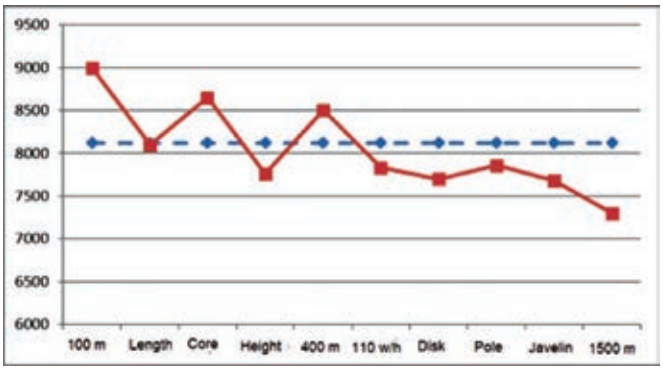
Methods and structure of the study. Instrumental research methods included analysis of documentary materials, video recording and video analysis of competitive activity (Dartfish software), BROWER photodiode chronometers, and methods of mathematical statistics. The study was carried out by employees of a comprehensive scientific group of the Russian national track and field athletics team (multi-event group) as part of the scientific and methodological support for the training of the country's leading all-around track and field athletes.

Results of the study and discussion. At the first stage of research, the task was set to develop an average model of competitive activity in men's all-around in the range of results of 7700-8700 points. This problem was solved by analyzing the results

in certain types of decathlon of the world's strongest all-around athletes based on performances at all World Championships in the period 1983-2019. For the analysis, the 10 best results of decathletes at each of the seventeen past World Championships in Athletics were taken (the sample included only the results of athletes who competed in all ten types of the all-around program).

The regression analysis of the performance indicators of athletes in individual types of decathlon, carried out at the next stage, allowed us to obtain regression equations on the basis of which model indicators in individual types of decathlon were calculated for a certain competitive result in the decathlon in the range of results of 7700-8700 points (Table 1).

The model of competitive activity can serve as the basis for managing the training process of multi-athletes at various stages of preparation. Using the example of competitive activity indicators in certain types of decathlon, the winner of the 2023 Russian All-Around Cup, International Master of Sports A. K-va, an analysis of competitive activity, the athlete's technical readiness is presented, and recommendations are given for managing the training process for the next stage of preparation. Lagging and strong types of athletes have been identified, limiting factors that hinder the growth of a decathlete's skill have been identified, and promising areas of training have been formed. The diagram shows indicators of an athlete's competitive activity in individual events relative to model parameters.



Indicators of competitive activity of Master of Sports K-va A. in certain types of all-around relative to the average statistical model for a result of 8119 points. in the decathlon (dashed line – model values; solid line – athlete's indicators)

Stage 1. Analysis of competitive results in certain types of decathlon. An athlete with a pronounced emphasis on the types of the first day of the decathlon (Fig. 1), the basis for success in which is the high level of development of the all-around speed abilities, which is manifested in the results of the 100 m and 400 m sprint, as well as in the long jump. The athlete's relatively lagging events in the decathlon are the events of the second day - long throws (discus and javelin), as well as the 1500-meter run.

Stage 2. Analysis of competitive activity in certain types of all-around. At this stage, based on the analysis of the indicators of the athlete's competitive activity using video analysis and photodiode timing, based on comparison with model indicators in certain types of all-around, conclusions are drawn about the effec-

Table 1. Model characteristics of competitive activity of all-around athletes in certain types of decathlon in the range of results of 7700-8700 points

Decathlon, points	Types of decathlon									
	100 m, s	Length, m	Core, m	Height, m	400 m, s	110 m with hurdles, s	Disk, m	Pole, m	Javelin, m	1500 m, s
7700	11,20	7,20	14,05	1,92	50,30	15,00	44,50	4,40	58,80	277,0
7800	11,16	7,24	14,19	1,93	50,08	14,91	44,70	4,47	59,45	276,5
7900	11,12	7,28	14,32	1,95	49,85	14,82	44,90	4,54	60,10	276,0
8000	11,07	7,32	14,46	1,96	49,60	14,73	45,10	4,61	60,75	275,5
8100	11,03	7,36	14,60	1,98	49,35	14,64	45,30	4,68	61,40	275,0
8200	10,99	7,40	14,73	1,99	49,10	14,55	45,50	4,75	62,05	274,5
8300	10,95	7,44	14,86	2,01	48,85	14,46	45,70	4,82	62,70	274,0
8400	10,91	7,48	15,00	2,02	48,60	14,37	45,90	4,89	63,35	273,5
8500	10,87	7,52	15,13	2,03	48,35	14,28	46,10	4,96	64,00	273,0
8600	10,83	7,56	15,26	2,04	48,10	14,19	46,30	5,03	64,65	272,5
8700	10,79	7,60	15,40	2,06	47,90	14,10	46,50	5,10	65,30	272,0

Table 2. Timing indicators for the 110 m hurdles race of decathlete A. K-va at the Russian All-Around Cup 2023

Competitive result, s	Before 1 bar	Before 2 bar	Before 3 bar	Before 4 bar	Before 5 bar	Before 6 bar	Before 7 bar	Before 8 bar	Before 9 bar	Before 10 bar	Finish
Time between barriers, s		1,16	1,12	1,10	1,10	1,10	1,10	1,13	1,14	1,15	1,42
	2,80	3,96	5,08	6,18	7,28	8,38	9,48	10,61	11,75	12,90	14,32

tiveness of the athlete's performance in all all-around disciplines. As an example, based on the analysis of hurdle running based on the timing indicators of sections of the hurdle distance and comparison with model indicators, a characteristic of the special preparedness of an athlete in the sixth event of the decathlon is given (Table 2).

Below is a step-by-step analysis of an athlete's competitive activity at a hurdle distance.

1. According to the model of the generalized characteristics of technical readiness in hurdle running (Kudu F., 1981), the normative indicator of the difference in results in the 110 m hurdle race and the 100 m sprint run for a result in the hurdle race of 14.32 s is 3.60 s. The all-around athlete has a difference in results of 3.67 s (100 m – 10.65 s, 110 m s/b – 14.32 s). This is slightly less than the standard indicator, which indicates a satisfactory level of hurdling technique.

2. Model of the starting run - 2.73 s for a given result in the hurdles (the athlete has a starting run of 2.80 s), i.e. below the model parameter.

3. Stability of overcoming inter-barrier sections (difference in time of the fastest and slowest of the nine inter-barrier sections). The athlete has this indicator - 0.06 s, which corresponds to the norm (normative indicator - less than 0.08 s).

4. Diagnosis of a failure at one or more barriers (standard – a drop in speed by 0.04 s relative to the previous inter-barrier section) – for the athlete this indicator corresponds to the norm (0.03 s), i.e., a relatively smooth passage of the distance without failures.

5. Diagnosis of special barrier endurance is characterized by maintaining speed until the last inter-barrier section (the normative indicator of the difference between the running time at the last inter-barrier section and the time of the best inter-barrier section is 0.06 s). The athlete has this indicator corresponding to the norm (0.06 s, A. L. Oganjanov, E. A. Morraru, 2022).

Thus, based on a video analysis of the competitive activity of an all-around athlete, it is concluded that the limiting factor that reduces the performance of an athlete's hurdle running is the starting segment before the first hurdle. In this regard, the athlete is rec-

Table 3. Indicators of technical readiness of all-around athlete A. K-va in the long jump at the Russian Cup 2023

No.	Parameters	A. K-ov 7,38 м	Model 7,50м
1	Actual jump length, m	7,49	7,50
2	Number of running steps	18	19
3	Speed on the penultimate 5m of the run, m/s	9,42	9,78
4	Speed during the last 5m of the run, m/s	9,67	9,83
5	Speed increase in the last section, m/s	0,25	0,05
6	Average tempo activity, w/s	4,21	4,28
7	Implementation coefficient of take-off speed, p.u.	0,774	0,760
8	Setting angle on repulsion, degrees	59,3	60,9
9	Angle of flexion in the knee joint in the push-off phase, degrees	137,7	139,4
10	Angle of flexion in the hip joint in the push-off phase, degrees	154,5	157,3
11	Angular movement of the supporting leg in repulsion, degrees	44,0	43,7
12	Landing efficiency coefficient, p.u.	7,6	8,5

ommended to work on improving the technique of the starting segment of the distance, as well as the emphasis in special physical training on speed-strength training, which largely determines the effectiveness of the starting run.

Stage 3. Analysis of technical readiness in technical all-around events. At the next stage, using the example of one of the technical all-around events (long jump), an analysis of the technical readiness of the all-around athlete in this event is carried out using video analysis and photodiode timing (Table 3). The athlete performs a jump at a speed that is "comfortable" for him, significantly inferior to the athlete's sprinting capabilities. The speed model in the last section is 97% of the athlete's sprint capabilities (A.L. Oganjanov, 2007), A. K-va's implementation rate in the run-up speed is only 94%, which is significantly lower than the model.

Thus, increasing the realization of speed capabilities in take-off speed is an important area of technical training in this jumping discipline. One of the reasons for low performance is the lack of activity in the first part of the run, focusing only on the final part of the run. The athlete is recommended to have a more uniform increase in speed in the final part when activating the initial and middle parts of the run, which is more typical for the modern promising "tempo" version of the run used by the strongest long jumpers.

Stage 4. Analysis of special physical preparedness, identification of lagging aspects of preparedness that limit the growth of performance. With a high level of development of sprinting qualities, which determines success in sprint distances, long jump, hurdles, the athlete needs to pay special attention in special physical training to improving special aerobic endurance (running 1500 m), speed-strength qualities (starting run, jumping events, throwing), strength training to improve performance in long throws.

Stage 5. Adjusting training, planning the training process for the next stage of preparation. Based on the analysis of the athlete's performance in certain types of the decathlon program, the identification of lagging and dominant types of the program, the analysis of competitive activity and technical readiness in certain types of decathlon, the strategy and tactics of step-by-step work on improving the all-around disciplines are determined, individual recommendations are developed for the athlete to improve the training process for the next preparation stage.

Conclusions. Based on a statistical analysis of indicators of competitive activity in certain types of decathlon of the world's leading all-around athletes, a model of competitive activity of highly qualified male all-around athletes was formed. The model allows, based on a comparison of an athlete's performance with model parameters, to analyze the results of a decathlete in individual events, to identify lagging and dominant types of an athlete. This creates opportunities for planning results in individual types of decathlon for the next macrocycle of training and, on this basis, programming the special training of a multi-athlete at the stages of the macrocycle.

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Formation of self-organization skills of future trainers based on a synergic approach

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Abstract

Objective of the study was to theoretically substantiate the formation of self-organization skills of future coaches based on a synergetic approach.

Methods and structure of the study. Analysis of the training process based on a synergetic approach is presented as a complexly organized system, within the framework of which conditions for self-learning, self-development, self-realization, etc. are created. Training during training becomes interactive, and the trainer-teacher and the student learn from each other.

Results and conclusions. Features of the activity of a teacher (trainer-teacher) within the framework of the synergetic approach are that he must:
- create a stimulating learning environment that will allow future trainers to develop their self-organization skills;
- use productive teaching methods that activate the participation of future trainers in the process of self-organization;
- act as a facilitator who supports and guides the process of self-organization of future trainers;
- take into account the individual needs and characteristics of each future coach in order to create a personalized training route;
- promote the development of reflection and self-esteem skills among future trainers;
- encourage cooperation and exchange of experience between students.

In technological and methodological terms, the synergetic approach involves a problem-oriented approach to the presentation of educational and training material, the use of so-called resonant teaching methods and their individual psychological and pedagogical support.

Keywords: *skills formation, self-organization, future trainers, synergetic approach.*

Introduction. The question of self-organization of future sports coaches implies consideration of how future coaches will be able to independently organize their work, develop professionally, and how they can achieve success in their coaching activities. This includes various aspects such as self-learning, self-development, self-realization, self-expression, self-knowledge, self-improvement and self-education through time management, through goal setting, training organization and communication with teammates.

When considering the self-organization of future coaches and the formation of their integral thinking, it is necessary to take into account various approaches to determining the essence and structure of self-organization. This will help create a comprehensive model that integrates various aspects and approaches, and will also facilitate adaptation to various training and competition conditions.

Objective of the study was to theoretically substantiate the formation of self-organization skills of future coaches based on a synergetic approach.

Methods and structure of the study. The research methodology is synergetics as a modern approach to scientific knowledge [1-5]. Analysis of

the training process based on this approach is presented as a complexly organized system. From this position, the training procedure becomes different, as well as the methods of communication between the training athlete and the coach-teacher: this is no longer the transfer of knowledge from one person to another, but the creation of conditions under which the processes of generating knowledge and skills by the students themselves become possible, their active and productive creativity in the training process. Training during training becomes interactive, and the trainer-teacher and the student learn from each other.

Results of the study and discussion. What are the features of a teacher's activity within the framework of a synergetic approach? In our opinion, it includes the following aspects:

1. Creating a stimulating environment: The teacher (trainer-teacher) must create a stimulating learning environment that will allow future trainers to develop their self-organization skills. This can be done through creating conditions for independent and exploratory learning, through providing access to resources and didactic technologies, as well as through support and motivation from the teacher.

2. Application of active learning methods. The teacher must use productive teaching methods that enhance the participation of future trainers in the process of self-organization. This can be group work, discussions, joint practice of practical tasks in the form of new sports techniques, role-playing games and other methods that promote active participation and independent thinking of students.

3. Facilitation of self-organization. The teacher should act as a facilitator who supports and guides the process of self-organization of future trainers. This should include assistance in setting goals, planning and organizing work, feedback and reflection, as well as support in overcoming difficulties and in developing the personal qualities of trainees.

4. Individualization of training. The teacher must take into account the individual needs and characteristics of each future coach in order to create a personalized training route. This may include adapting training materials and activities, accommodating a variety of learning (training) styles, and providing additional resources and support as needed.

5. Support reflection and self-esteem. The teacher should promote the development of reflection and self-esteem skills in future trainers. This will enable them to recognize their strengths and weaknesses, identify areas for improvement, and plan for their physical and professional improvement. The educator can provide one-on-one interviews, feedback, and reflective practices to help future coaches develop these skills.

6. Cooperation and exchange of experience. The teacher should encourage cooperation and exchange of experience between students. This may include organizing group projects, post-training discussions, and sharing views on best practices for training and athletic competition. Joint learning and exchange of experience contribute to the development of self-organization and the effective use of a synergistic approach.

In technological and methodological terms, the synergetic approach involves a problem-oriented approach to the presentation of educational and training material, the use of so-called resonant teaching methods (which are integrated and responsive in nature) and their individual psychological and pedagogical support.

Particular attention should be paid to actualizing the individual's need for self-realization through the definition of true sports goals and values, as well as physical development in accordance with these goals and values of creative potential. All this contributes to the adoption of a self-transformative goal. The stage of goal acceptance plays a key role in the self-organization system, since the entire process is aimed at achieving a person's goal, which he himself has realized. The goal cannot be imposed, it must be realized and accepted personally. After this, based on taking into account the internal and external conditions of self-transforming activity, the trainer-teacher begins to create a program of action and helps monitor its implementation. The optimal approach is to combine internal goals (coming from one's own development trends) with external goals. It is in relation to these goals that it is determined whether the subject of management will accept the goal as his own or whether he will be the object of control, forced to obey the goal accepted by other people.

First of all, it should be noted that the process of self-organization arises from the process of organization by creating complex open nonequilibrium connections within the elements of the didactic system. In this regard, it can be assumed that the self-organization skills of a sports personality will coincide with the personality organization skills, but will differ in the qualitative level of development.

A synergistic approach to education and training allows the trainer-teacher to develop and implement his own methodology and unique training style based on the basic principles of human science. Synergetics provides a framework (software platform) within which it is possible to integrate various methods and techniques, as well as take into account interaction and emergent properties in teaching and training.

Conclusions. In the context of the synergetic approach, the educational and training process is considered as a complex system that is self-organizing, open and nonlinear, and has all the relevant properties and principles of development. Our proposed didactic model of a synergistic approach to the process of teaching coaching at a university is based on the principles of self-organization, bifurcation development, synergy and integrativeness. It allows you to most fully and meaningfully reflect the essential properties of the subjects of learning, their relationship and order of functioning.

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Daniil Medvedev's serve and return stability average percents at tournaments in the period of 2019-2023

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Abstract
The relevance of the work lies in the study of some most important factors and aspects of the training and competition effectiveness, success and perfomance of any tennis player. In our article, we consider the dynamics of the changes in Daniil Medvedev's serve and return stability average indicators at the Grand Slam tournaments in the period of 2019-2023. Processing and analyzing the video materials of 81 matches, we obtained results that determined the dynamics of changes in serve and return stability average indicators for up to 5 years. To assess the dynamics of changes more objectively in Daniil Medvedev's serve and return stability indicators, we carried out a comparative analysis of the first serve and return winning points indicators.

Keywords: *indicators, stability, serve and return*

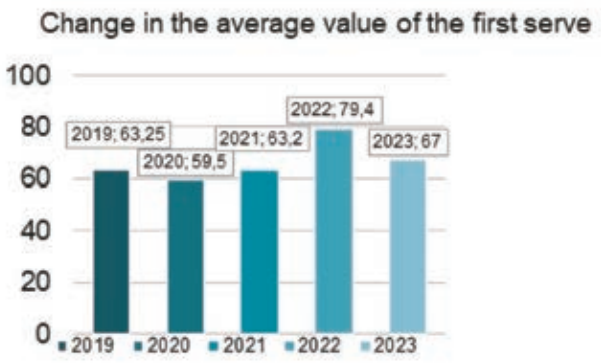
Introduction. Numerous studies of the tennis game show that all strokes are significant, but there are strokes, without which the game is fundamentally impossible. These are strokes such as serve and return. The aim of the study is to determine the dynamics of changes in Daniil Medvedev's serve and return stability indicators for up to five years.

The object of the study is the Daniil Medvedev's competitive activity at tournaments in the period of 2019-2023.

The subject of the study is Daniil Medvedev's serve and return stability indicators at tournaments in the period of 2019-2023. The objectives of the study are to analyze the statistical data, calculate the average value, and draw a conclusion about the change in the dynamics of serve and return stability indicators at the main tournaments of the annual cycle.

Methods and organization of the study. To solve the problem, the following methods were used: document analysis method, processing of statistical match protocols, pedagogical observation of the athlete during the Australian Open, Roland Garros, Wimbledon, US Open tournaments, analysis of video recordings, and methods of mathematical statistics.

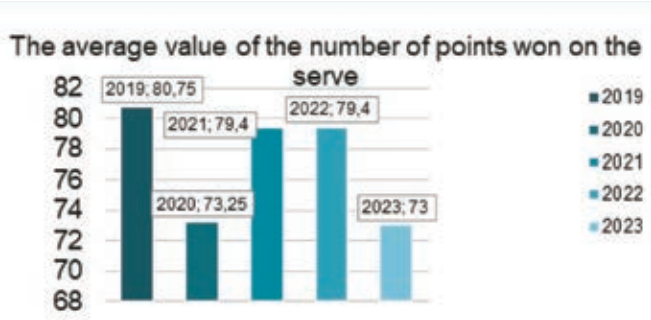
The study was carried out from 2019 to 2023. The obtained data is presented in the form of summary tables for use in further calculations.



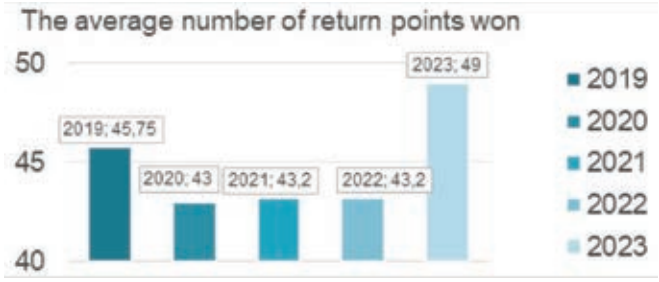
1. The average value at the Australian Open did not change much over five years, but a noticeable increase was shown in 2022.

The study results and discussion. The analysis of scientific and methodological literature, pedagogical observation and video analysis made it possible to identify the most significant features of serve and return at the Grand Slam tournaments.

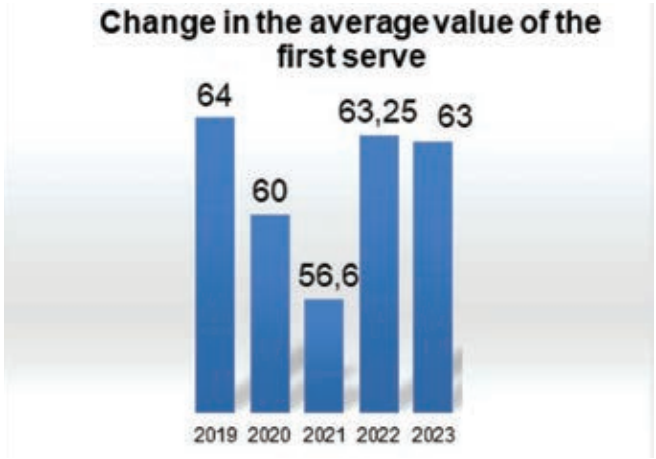
The chart shows that the first serve average ranges from 59.5 to 79.4. It can also be seen that the average from 2019 to 2021 is ±62.



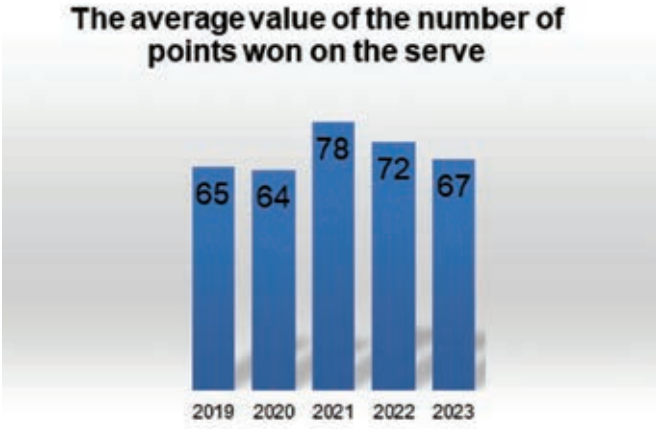
2. The average number of points won on first serve at the Australian Open fluctuated in a larger range than first serve hits.



3. The average number of return points won at the Australian Open decreased between 2019 and 2022, and in 2023 it turned out to be the most productive.

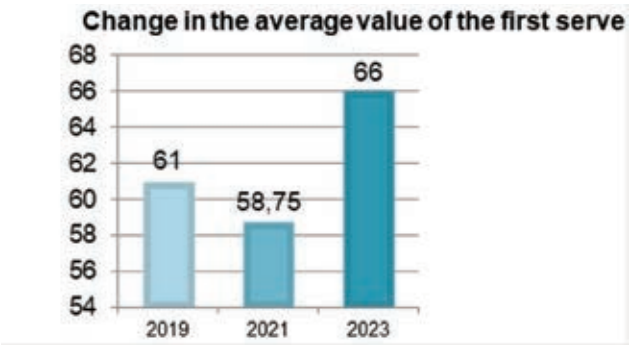


4. The average first serve hit at the Roland Garros has varied. For three years it decreased, but in 2022 it increased.



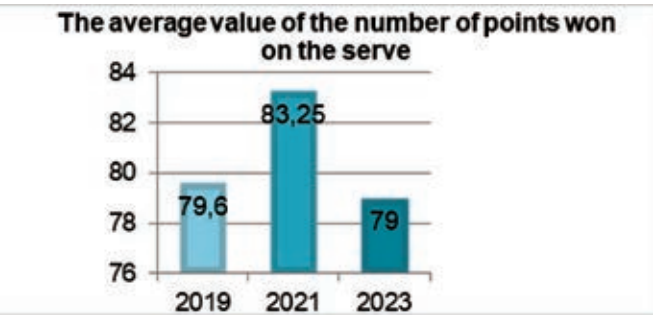
5. The average number of points won on first serve at the Roland Garros increased over three years, and then declined.

6. The average number of points won at a reception increased by several units, then a rather sharp decline was observed.



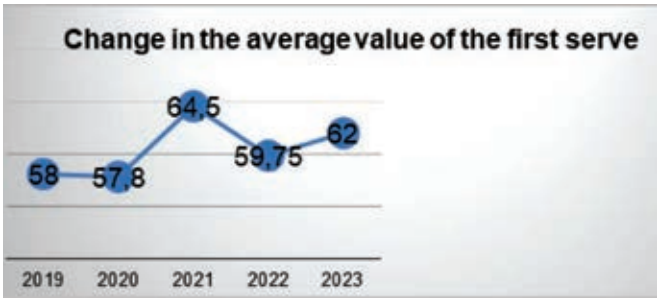
7. The average first serve hit at the Wimbledon tournament has been changing for two years (in 2020 the tournament was canceled due to the COVID, and in 2022 Daniil refused to participate) has been declining.

Thus, the graphical data helps to conclude that Daniil Medvedev shows the best statistics at the US Open tournament. But it is also worth remembering the psychological characteristics of the individual, his physical fitness at the time of each tournament. Daniil Medvedev demonstrated the peak of his form in 2021. This conclusion can be drawn thanks to the analysis of tournaments that we conducted.

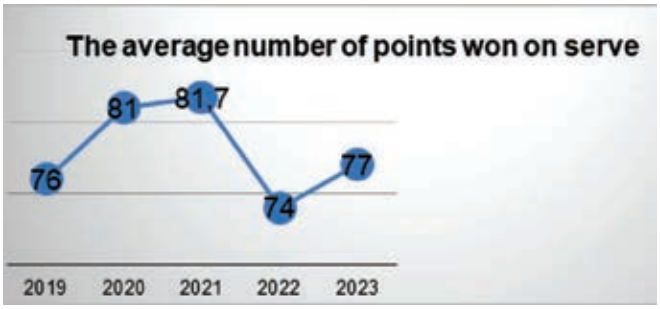


8. The average number of points won on first serve at the Wimbledon rose over two years and then fell sharply.

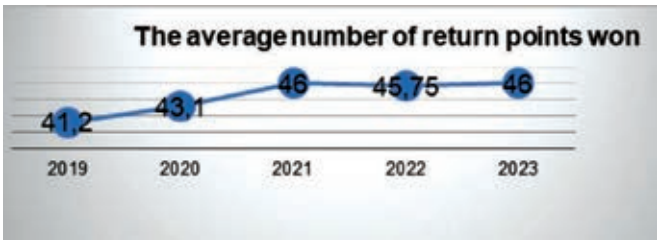
9. The average number of points won at the Wimbledon has increased over the two years.



10. The average first serve hit at the US Open increased over three years, but fell sharply in 2022.



11. The average number of points won on first serve at the US Open increased over three years and dropped quite a bit at the last tournament.



12. The average number of return points won at the US Open also increased over three years, and decreased in 2022.

Conclusion.

Based on the data presented in the tables, the following conclusions can be drawn:

- Average first serve hit rates range from 56.6 to 79.4 (best at the 2022 Australian Open). Daniil Medvedev demonstrates this criterion best at the Australian Open for the last 5 years.

- The average number of first serve points won varies from 64 to 81.7 (the best indicator was demonstrated in 2021 at the US Open). Over the past 5 years, this criterion has been best reflected at the US Open.

- The average number of points won at a reception varies from 36.3 to 49 (the best result for this indicator is in 2023 at the Australian Open). Over the past 5 years, this criterion has been best reflected at the US Open.

- The statistical data that is displayed in our work illustrates that Daniil Medvedev demonstrates more efficient and effective performance on hard surfaces. This is due to the features of his tennis playing style. Thus, based on the indicators we analyzed, Daniil Medvedev's victory at the US Open Grand Slam tournament is reflected.

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Substantiation of the model of formation of students' motivation for scientific activity in the conditions of a university of a physical education

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Abstract

Objective of the study was to theoretically substantiate and develop a model for the formation of motivation for research activities of students of physical education universities, to determine its prospects and operating conditions.

Methods and structure of the study. The logic of the study is based on activity-based (direction of the content of funds depending on priority professional tasks) and systemic approaches. The following was carried out: literature analysis, pedagogical observations, questionnaires, etc., which made it possible to theoretically substantiate and develop a model for the formation of student motivation for research activities.

Results and conclusions. A model for the formation of motivation for scientific activity of students of physical education universities has been theoretically substantiated and developed; the structure, purpose, objectives, operating conditions and prospects for its implementation in higher education institutions have been determined. The role of the student scientific association based on self-government is revealed and a step-by-step algorithm for attracting students to research activities is presented.

Keywords: *students, research activities, problems, motivation, model, prospects.*

Introduction. A large number of works by Russian scientists, especially in recent years, are devoted to various aspects of organizing students' research work, in particular, the formation of motivation for it [1, 2, 3, 5, etc.]. However, it should be noted that the effectiveness of this work is still low. The results of the authors' research indicate that students' competence in understanding science as a means of radically updating social reality, and, in particular, in its applied, professional aspect, is unsatisfactory, and many traditional forms of research work that have developed in university practice are not captivating [4, 6].

All this is confirmed by our pedagogical observations. It can be noted that this is influenced by various factors: insufficient technical equipment, high fees for scientific publications, organization of scientific work at the university, activity of teachers, lack of time for students, their motivation, etc. In universities, research work with students is mainly considered not as a process, but as a result, expressed in qualifying papers defended with "excellent" marks and published articles.

However, attention should be paid specifically to the process of scientific activity: preparation for competitions, conferences, communications with the supervisor, informing students about current projects, and most importantly, the formation of motivation, interest, and involvement of students in research and development activities (RA).

The above constituted the problem field of the research presented in this article.

Objective of the study was to theoretically substantiate and develop a model for the formation of motivation for research activities of students of physical

education universities, to determine its prospects and operating conditions.

Methods and structure of the study. The logic of the study is based on activity-based (direction of the content of funds depending on priority professional tasks) and systemic approaches. The following was carried out: literature analysis, pedagogical observations, questionnaires, etc., which made it possible to theoretically substantiate and develop a model for the formation of students' motivation for research activities. The search experiment made it possible to determine the prospects and conditions for its functioning.

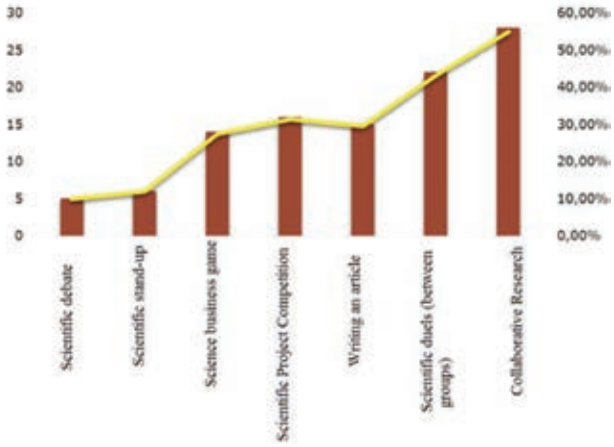
Results of the study and discussion. To achieve the stated goal of the study, a survey was conducted among undergraduate and graduate students of full-time and part-time studies at the Institute of Physical Culture and Sports of the Herzen State Pedagogical University of Russia.

The survey revealed that 49% of students consider scientific activity to be an important component of the professional training of a physical education specialist, 34% of students find it difficult to answer this question, and 17% consider scientific activity to be unimportant. When asked about the possibility of engaging in research activities at the institute, 38% of respondents responded that they did not rule it out. However, 41% of students found it difficult to answer, and 21% of respondents do not plan to engage in this activity. It should be noted that the attitude of students towards research and development activities is quite positive, but their activity and involvement is low. Also, during the survey, the reasons for the decrease in motivation for research activities at the university were identified and ranked based on the respondents' answers. As it turned out, the low assessment of most students about research activities is determined by the fact that there are few scientific events, they are not interesting and there is no motivation to participate in them. Determining ways to increase motivation for scientific activity, a list of scientific events was determined and a survey was conducted in which of them students would like to take part (Fig. 1).

As a result of the survey, it was determined that collaborative work in groups is the most attractive for students. In this regard, it should be noted that the various events presented in the list will also be of interest to students.

The survey made it possible to determine the factors of students' interest in other types and forms of research activities proposed by them. First of all, students believe that science should be modern, which means it is necessary to offer participation in interactive and online projects (28%). Off-site conferences and communication with other universities will certainly increase motivation (17%). Master's students in their responses note that the form of defending their final qualifying work should be changed (not many students write it within 2 years); perhaps it will be a long-term group project with some reporting and practical significance, as 16% of respondents answered. Also, 22% of respondents suggested creating scientific interest groups, which would be headed by a teacher passionate about science. Additional points for admission to master's and postgraduate programs will be a good motivation for scientific research, according to 25% of students.

Based on an analysis of scientific literature, taking into account the results of a survey of teachers, students, undergraduates, and graduate students of the institute, a model was developed for the formation of student motivation for research activities, where the main system-forming factor is the joint scientific activity of students on the basis of self-government. The structure of the model consisted of 3 blocks: "target", "organizational-content" and "resultative" (Fig. 2). The conceptual block includes goals, objectives and principles (general scientific and general methodological). The organizational and content block reveals a step-by-step algorithm for designing a program for attracting students to research activities. The developed "steps" indicate the sequence of actions when creating a student scientific community (club, association) based on self-government, developing an action plan and monitoring their implementation. The effective block consists of 3 performance indicators, which show an increase in the proportion of students



Forms of scientific events

involved in scientific activities, based on statistical data.

Along with improving the organization of scientific work at the Institute of Physical Culture and Sports, to test the effectiveness of the developed model based on a step-by-step algorithm, a student scientific club "ON START" was created in 2021 on the basis of self-government. Its goal was to attract students to scientific research, increase their methodological culture, interest in mutual scientific search for innovative independent forms and methods of research in the field of physical culture and sports. The scientific club has been actively working for two years; the performance indicators presented in the model for all three positions are increasing every year. The share of students involved in active research activities increased by 2.5 times by 2023. All this points to the correctly chosen path and the effectiveness of the developed model, which can still be improved in many ways.

Based on the research data obtained and the experimental work carried out over 3 years, it is possible to identify the conditions for the implementation and effective functioning of the presented model of developing students' motivation for research activities: organization of a student scientific club (community); variety of scientific events; selection of means and forms of activities for students, taking into account their interests, age and level of knowledge; monitoring the effectiveness of research activities among students; rewarding the best students based on individual and group performance.

Conclusions. Throughout the entire period of students' studies at a university, it is necessary to systematically and purposefully carry out scientific activities, create creative groups taking into account scientific interests, provide a research base, equip them with scientific work methods, create situations of success when introducing scientific results into practice, encourage the creative independence of researchers when solving practical problems. The creation of scientific student communities and associations allows students to conduct full-fledged scientific work, find like-minded people with whom they can interact and share the results of their research, thoughts and views.

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Formation of sociocultural identity of students of sports fields of training in the conditions of student communities in the aspect of sociological analysis

UDC 378.18.184

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Abstract

Objective of the study was to analyze the state and possible ways to solve the problem of forming the sociocultural identity of students in sports fields of study at pedagogical and non-pedagogical universities in the process of organizing and operating student communities.

Methods and structure of the study. An analysis of the theoretical aspects of the problem under study was carried out in different contexts; data was also collected and analyzed on an online platform using a questionnaire developed by the authors as a research tool.

Results and conclusions. Data were collected on the areas of activity, the involvement of students of higher educational institutions with a sports orientation of pedagogical and non-pedagogical training profiles in the organization and inclusion of them in various communities and associations, on the influence of these groups on the formation of sociocultural identity, values and norms of the future professional community, further self-determination and self-actualization in professions. The results of the study show the prevalence of negative trends in the student environment, insufficient organization and involvement of students in the activities of student communities and associations.

Keywords: *identity, sociocultural identity of students, higher education, student communities.*

Introduction. The processes of formation of sociocultural identity of student youth are considered by researchers in the context of various phenomena: the occurrence of identification processes among youth in the conditions of digitalization of higher education (A.A. Lisenkova [3]); radical breaks and incompatibility of guidelines create a crisis of sociocultural identification and socialization of the individual in the information world (T.V. Mikerina [4]); the need for integration in the process of professional training of students for the formation of subjective identity as the basis of professional motivation, self-determination and future self-actualization of the individual in the profession (G.K. Biserova [1]); the need to ensure "…sustainability and minimal variability of the cultural core…" of education in order to preserve the traditional guidelines of the sociocultural identity of young people (A.R. Guchetl [2]); ensuring trajectories for the formation of a student's sociocultural identity with the inclusion of all partners in university life should be carried out in several stages, taking into account social, professional, cultural, and ethnic characteristics (S.A. Chervinskaya [5], Belomestnova M.E., Ivanova I.Yu. [6]) and so on.

In the framework of this study, we are also interested in the following ideas of foreign authors: the need to develop models of human social identity that ensure high sustainability of the development of communities in which sociocultural identity should give a young person a sense of belonging and social support (Haslam et al. [11]); identifying circumstances that may be based on social identity to prevent conflicts in student communities (Tajfel et al. [12]); using the mechanisms

of sociocultural identity to build positive forms of social connections among students (S.A. Haslam et al. [10]). We also consider important for our research the ideas about the influence of social identity on a person's decision-making (Benjamin et al. [7]), on the perception of the world around him (Hackel et al. [9]), on attitudes towards other people depending on whether they belong to whether they belong to the same or a different group (Chkravarty & Fonseca [8]). In this article, these processes are examined in the context of the creation of student associations, which can be of decisive importance in identification processes and are capable of ensuring the effectiveness of the process of educational work at a university. We believe that resourcefulness in organizing communities and associations must also be drawn from the idea proposed by M.J.A. Wohl that group history is the cornerstone of social identity [13]. These facts must be taken into account in university communities in the process of implementing the process of educating students.

Objective of the study was to present the results of an empirical study and analyze the state of the problem of forming the sociocultural identity of university students in the process of organizing and operating student communities at the university.

Methods and structure of the study. The study was conducted using theoretical and empirical methods. The survey was conducted online on a voluntary basis. Each questionnaire consisted of 25 closed and open questions. The survey covered 167 1st-4th year undergraduate students at universities. Moscow, Chelyabinsk, Voronezh, Cherepovets, Lyubertsy. The student body was represented by the following groups of areas of training: physical education and sports - 57.1%; social sciences – 4%; education and pedagogical sciences – 38.9%.

The questionnaire included questions regarding the areas of work of student communities in universities, the involvement of students in their activities, the prevalence of negative phenomena among university students, sociocultural identity, etc.

Results of the study and discussion. We proposed questions regarding the shortcomings in the organization of certain aspects of university life. 11.5% noted problems with organizing student communities at universities. We believe that this percentage is quite significant and sometimes dangerous, since students' non-inclusion in prosocial associations can contribute to deformation of behavior, failure to form an adequate sociocultural identity, and other problems.

We also asked students whether they are members of any student communities at the university: 73.3% are not members of communities, only 26.7% are involved in the activities of various university associations, mainly scientific, volunteer organizations or student groups. A significant part of students are not involved in the activities of communities, which can contribute to the formation of passivity, indifference, inertia, and inaction among students. This thesis is confirmed by the results of answers to the question of which of the negative phenomena are most widespread among students (smoking and drinking alcohol 72.1% each, foul language - 60.7%; sexual promiscuity - 21.3%, violation of public order – 16.4%). These results prove the relevance and urgent need to solve the problem of forming the sociocultural identity of students at the university.

The students' answers to the question: "In what mood do you look to the future?" are interesting. 45.9% see their future with hope and optimism; 44.3% view it calmly, but without any special hopes or illusions; the answers "with anxiety and uncertainty", as well as "with fear and despair" each scored 4.9%. The inclusion of students in student communities can help reduce anxiety levels and provide some psychological protection.

The data obtained suggest that studying the process of forming the sociocultural identity of students will contribute to the development of a long-term strategy for the formation of a value-oriented worldview of all subjects and participants in the educational process at the university. At the same time, the positive experience of universities in organizing and involving students in communities requires discussion, systemic analysis and dissemination in the teaching environment.

Conclusions. The data obtained allow us to state that the problem of forming the sociocultural identity of students in universities has not been fully resolved at present, which makes it even more urgent to use the resource opportunities to involve students in university communities in full.

This study can contribute to theoretical, methodological and practical understanding of solving the problem of forming sociocultural identification in the process of creating and involving students in student associations. Further research is necessary to clarify and expand the list of means and opportunities, to determine the conditions under which the formation of

sociocultural identity of students in a university environment can occur.

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Overcoming contradictions in models of key competencies of the system of educational standards and KPI for fitness managers

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Abstract

Objective of the study was to identify a set of key competencies for fitness club managers, based on the practice of their work, in order to include them in educational programs of universities.

Methods and structure of the study. An analysis of normative and methodological literature devoted to the topic of determining and assessing the competencies of specialists employed in the fitness industry was carried out.

Results and conclusions. During the scientific work, professional competencies related to management, marketing, sales, personnel, and law were identified. To normalize, it is necessary to formulate a separate standard for a fitness club manager and, depending on the success of mastery, indicate the specialization in the diploma (manager-manager, manager-marketing, etc.). The relative importance of each aspect of these areas and the profit created by the manager was determined from the regression equation based on the results of testing 19 managers (R^2 = 0.97). It is recommended to match the time spent studying an aspect to its level of significance.

Keywords: *efficiency of fitness services, key competencies of a manager.*

Introduction. Visitors to fitness clubs are in direct contact with two categories of employees: managers and trainers (conducting group classes and personal training, selection of nutrition plans and sports activity regimens, etc.).

Objective of the study was to identify a set of key competencies for fitness club managers, based on the practice of their work, in order to include them in educational programs of universities.

Methods and structure of the study. An analysis of normative and methodological literature devoted to the topic of determining and assessing the competencies of specialists employed in the fitness industry was carried out.

Results of the study and discussion. According to professional standard 05.013 “Specialist in the promotion of fitness services,” labor functions are presented mixed for both the manager and the trainer of the fitness center. For example, the generalized labor function “organization and promotion of fitness services among the population” includes such labor functions as: involving the population in fitness classes (manager’s competence); formation of means for promoting fitness services and adapting the population to fitness classes (competence of a trainer); determination of the physical condition of the population using fitness testing methods (trainer competence); implementation of measures to motivate the population to engage in fitness (manager competence) [2].

Also, a partial description of the labor functions applicable to managers of fitness clubs can be found in the professional standards for managers in the field of information technology, in the professional standard for sales managers of information and communication systems and in the Federal State Educational Standard of Higher Education in the field of training 38.03.02 Management (bachelor’s level) [3, 4, 5].

Expert assessments made it possible to build a ranked list of competencies that determine the level of professionalism of a fitness club manager [1, p. 209]:

1) the ability to organize your work (time and process planning); the value of this competency (estimated as 27.4);

2) friendliness and the ability to build a communication process - the value of competence (18.1);

3) the skill of presenting various commercial offers of a fitness club is assessed at (18);

4) determination and ability to influence the client using psychology and logic - (16).

Educational deficiencies are compensated in educational centers as additional education (full-time, online). The Association of Fitness Professionals describes the training of a fitness club manager as the ability to set competent tasks, hire suitable specialists, adapt personnel, evaluate their work, motivate, and resolve conflicts in the team. The StartFit company, with the Russian Academy of Economy and the civil service under the President of the Russian Federation, is recruiting for the training course “Fitness Club Manager” in the disciplines of management, marketing, personnel management, sales, jurisprudence,

Table 1. *Generalized table of the experiment*

Section of work	Profit per 1 correct answer	Correlation with profit	FSES 49.03.01	FSES 38.03.02	Profstandart 05.013	Experts	Requirements employer	Article author test	Association Prof. Fitness	StartFit	Plekhanov RUE	Fitness Manager 2020
Management												
Development trends			-	-	+	-	+	-	+	+	-	+
Successful models			-	-	+	-	+	-	+	+	-	+
Gym Performance Assessment			-	-	-	-	+	-	-	+	+	+
Time management			-	-	-	+	+	-	+	+	+	+
Promotion of fitness services	52	0.2	-	-	+	+	+	+	-	+	-	+
Financial model			-	-	+	-	+	-	+	+	-	+
Efficiency and leadership			-	-	+	+	+	-	+	+	-	+
Marketing												
Metabolic portrait of the client			-	-	-	-	+	+	-	+	-	+
Logistics of client flows			-	-	+	+	+	+	-	+	-	+
Launch of new fitness programs			-	-	+	-	+	+	+	+	+	+
Marketing plan			-	-	-	-	+	-	+	+	+	+
Construction of a product line, price list	100,2	0,62	-	-	-	-	+	+	-	+	-	+
Staff												
Staff motivation			-	-	-	-	+	-	+	+	+	+
Employee KPIs			-	-	-	-	+	+	+	+	+	+
Team, personnel selection			-	-	-	-	+	-	+	+	+	+
Career			-	-	-	-	+	-	+	+	+	+
Sales												
Motivating clients to physical education classes	22,9	0,23	+	+	+	+	+	+	-	+	+	+
Selection of an adequate program to the client			-	-	-	+	+	+	-	+	-	+
Customer retention, understanding their expectations	37,5	0,22	-	-	-	+	+	+	-	+	+	+
Sales plan	81,3	0,21	-	-	-	-	+	+	-	+	+	+
Advertising, attracting clients, selling training on social networks	6,7	0,02	-	-	-	+	+	+	-	+	-	+
Fitness tours			-	-	-	-	+	-	-	+	-	+
Branding			-	-	-	-	+	+	-	+	-	+
Jurisprudence												
Legal regulation			+	+	-	-	+	-	+	+	-	+

Table 2. *Selection of questions for testing based on correlation with profit*

No.	Direction of questions	Question option		
		1	2	3
1	Advertising	0,63	0,02	0,48
2	Fitness services product promotion	-0,10	-0,23	-0,30
3	Logistics of client flows	0,51	-0,61	0,33
4	Working with clients	0,21	0,20	0,69
5	Selection of a trainer for a client	-0,004	-0,28	-0,41
6	Price list	0,61	-0,20	0,21
7	Understanding customer requirements for a fitness club	0,26	-0,1	0,05

efficiency and leadership, finance, career. Plekhanov Russian University of Economics teaches the program "Effective management of a fitness club: practice and action. The Higher School of Law and Administration teaches the Fitness Club Manager program. Stated topics: development trends, successful models of the fitness industry, logistics of client flows, legal regulation, building a product line for the target audience, branding, financial model, sales plan, employee KPIs, personnel selection, promotion of fitness services.

An important aspect of this issue is the KPI (Key Performance Indicators) of the fitness club manager. In the community of fitness entrepreneurs (https://fitbusiness.pro/), to assess the effectiveness of a fitness business, they recommend income per client, average class attendance, customer retention rate, profit, income per square meter, EBITDA (earnings less interest, depreciation, amortization). Naturally, these indicators usually become KPIs for managers. It is recommended to include in the KPIs an increase in the number of club members, an increase in citations/mentions of the club/club players on social networks, the degree of satisfaction and enthusiasm of spectators (customer retention), maximizing profits from the sale of rights and staff turnover.

According to A. Safronova [1], KPI is divided into:

- key financial indicators of the fitness club: gross revenue, net profit, income from the sale of cards, income from the sale of additional services, the share of additional services in income, card cost.

- marketing – costs of attracting a new client, return on investment, repeat card purchases

- sales – % of clients attracted by recommendation, % of complaints; share of customers who bought annual cards; share of card renewals; share of card returns

The opinions of the Federal State Educational Standard, various authors and the results of the work were summarized in table. 1. We have identified 5 independent sections of the work of a fitness club manager. To assess their impact on the final result of work, 19 managers of the fitness club "Ya-Fitness" (Ekaterinburg) were tested.

The original problem was the quality of the questions asked in the test. Therefore, at the preliminary stage, questions were selected whose answers were most adequate to the profit created by the manager (Table 2).

A total of 32 questions were generated, of which only 6 remained as a result of correlation and regression analysis:

1. Select the most effective block of fitness club advertising types.

2. Select, in your opinion, the most effective block of techniques for attracting customers that affect the growth of sales and traffic.

3. How would you respond to an objection from a potential client who states that a similar membership at a nearby club costs less?

4 What should a manager's script contain when working with a client?

5. What do you think determines the main aspect of the "survival" of business in the Russian Federation?

6. What factors influence the pricing of fitness club services?

Based on the survey results, a regression equation was generated.

The coefficient of determination of this technique was 0.97. We also derived a formula for calculating the performance of a fitness club manager depending on the specific weight and importance of each issue: $ = 306 +6.7×N(1)+22.9×N(2) + 37.5×N(3) + 63.7×N(4)+100.2×N(5) + 81 ,5×N(6), where $ is the manager's profit per month (thousand rubles), N(i) – number of correct answers to the relevant question.

Conclusions. Based on the results of reviewing regulatory documents (FSES), expert assessments, the content of additional education, and KPIs on the

competencies of fitness club managers, it turned out that there is a deep contradiction between the criteria of employers and the content of educational programs. Educational standards mix the training of a fitness club manager and a trainer, forming redundant competencies, are too general in nature and thereby leave the content of the educational program at the discretion of its leader. The contradiction cannot be overcome, since the fitness industry relies on education in the KPI topic, and education relies on the fitness industry. On the part of the latter, there is no clear, joint decision on KPIs, which makes it possible to build an additional education based on their own considerations.

For normalization you need:

- create a separate standard for a fitness club manager

- highlight the following topics among professional competencies: management, marketing, sales, personnel, law.

- depending on the success of mastering the diploma, indicate the specialization (manager-manager, manager-marketing, etc.)

During the study, it was possible to form a generalized opinion of various participants in the process of filling the educational process of a fitness manager. To assess the significance, a regression equation was formed linking the profit of the fitness salon and some of the indicators with a coefficient of determination of 0.97. This was achieved after a preliminary assessment of the adequacy of various test questions. The proportion of individual components in the regression shows the level of significance of various aspects of the 5 areas mentioned above, which tells us the approximate proportions in time and depth of issues studied by future fitness salon managers.

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Bioimpedance indicators of combat athletes depending on the somatotype

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Abstract

Objective of the study was to establish bioimpedansometric indicators of the body of combat athletes in Yakutia, depending on the somatotype according to the Ries-Eysenck index.

Methods and structure of the study. A total of 49 Yakutia combat athletes of high sports qualifications were examined. An anthropometric examination was carried out. Bioelectrical indicators and body components of athletes were determined by bioimpedansometry using the ABC-01 Medass apparatus. The protocols contained an assessment of fat mass, active cell mass, skeletal muscle mass, lean mass, active and reactive tissue resistance measured at a frequency of 5 and 50 kHz, as well as the phase angle. Body mass index was calculated. Somatotyping was carried out using the Ries-Eysenck index.

Results and conclusions. It has been determined that as the weight category increases, the value of the absolute, relative fat component and the absolute value of the musculoskeletal component of the body increases. Establishing the somatotypological and bioimpedance characteristics of an athlete will help to personalize training loads, reduce the risk of sports injury in order to achieve high sports results.

Keywords: *athletes, martial artists, Yakutia, somatotype, Ries-Eysenck index.*

Introduction. The use of an individual approach is an effective and targeted tool for the full realization of the morphofunctional capabilities of an athlete both at the training and competitive stages [2, 7]. One of the individual typological characteristics of a person is the determination of somatotype. To form a complete technical arsenal for a martial artist, it is necessary to take into account his somatotypological profile [6]. The organization of medical and biological support, based on individual somatotypological characteristics, is necessary to correct the training process, which will undoubtedly lead to high sports achievements and a reduction in sports injuries [1, 5].

Objective of the study was to establish bioimpedansometric indicators of the body of athletes - martial artists of Yakutia, depending on the somatotype according to the Ries-Eysenck index.

Methods and structure of the study. 49 martial artists from Yakutia training at the Republican Center for Sports Training of National Teams of the Republic of Sakha (Yakutia) were examined. The average age of the athletes is 21.32±3.47 years. All those examined were male. The level of qualification of the athletes varied from master of sports to international master of sports. The work was carried out after obtaining voluntary consent to participate in the study. Exclusion criteria were refusal to participate, exacerbation of chronic diseases and the presence of acute diseases at the time of the study.

Anthropometric parameters - body length and weight, waist and hip circumference were measured

using an anthropometer, floor scales and a measuring tape. Body mass index (BMI) was calculated. Somatotyping was carried out using the Reese-Eysenck index [3]. Bioelectric indicators and body components of athletes were determined by the bioimpedansometry (BIA) method using the ABC-01 Medass apparatus. BIA protocols contained an assessment of fat mass (FM), active cell mass (ACM), skeletal muscle mass (SMM), lean mass (LM), active (R5, R50) and reactive (Xc5, Xc50) tissue resistance measured at frequency 5 and 50 kHz, phase angle.

Statistical processing of the obtained material was carried out using the SPSS 22.0 application package. To describe the results obtained, the average value of the value (M) and the error of the average deviation of the value (m) were used. The normality of the distribution of characteristics was determined by the Kolmogorov-Smirnov method. The significance of intergroup differences was carried out using the Kruskal–Wallis H test, followed by pairwise comparisons using the Mann–Whitney U test. Differences were considered statistically significant at $p<0.05$.

Results of the study and discussion. Determination of the somatotypological profile of martial arts athletes according to the Rees-Eysenck index revealed that a significantly larger number of athletes belonged to the normosthenic type 57.1% (n=28). 28.6% (n=14) of athletes belonged to the asthenic type, 14.3% (n=7) belonged to the picnic type.

Analysis of anthropometric parameters of individuals with different body types identified significant somatotypological differences in body weight and BMI. The lowest body weight and BMI values were recorded in athletes with an asthenic somatotype (62.42±6.89 kg; 20.74±1.55 kg/m2). Body weight and BMI parameters in individuals with a normosthenic somatotype were equal to 67.03±10.68 kg and 22.48±1.93 kg/ m^2. Significantly higher rates ($p<0.001$) were found in individuals with a pyknic somatotype - 94.14±20.01 kg and 29.71±6.14 kg/m^2. The parameters of the bioelectrical indicators of the athletes' body, depending on the somatotype according to the Reese-Eysenck index, are presented in Table 1.

The average values of active (R50) and reactive (Xc50) tissue resistances at a frequency of 50 kHz in representatives of all somatotypes were within normal limits. Among the individuals we examined, these parameters were significantly lower in individuals with the pyknic somatotype when compared with the indicators of representatives of other somatotypes ($p<0.01$). Tissue reactance at a frequency of 5 kHz (Xc5) is significantly higher in individuals with an asthenic somatotype. It is known that the magnitude of reactance depends on the dynamics of muscle contractions of the individual.

Table 1. *Bioelectric indicators of athletes with different somatotypes according to the Ries-Eysenck index*

Parameters	Asthenic (n=14) 1	Normosthenic (n=28) 2	Picnical (n=7) 3	Reliability
R50, Ом	536,95±63,70	500,50±41,07	444,71±76,55	P_{1-3}=0,008
R5, Ом	559,21±98,73	559,82±77,96	503,71±97,0	-
Xc50, Ом	68,43±10,39	63,17±5,50	56,51±11,23	P_{1-3}=0,013
Xc5, Ом	212,81±175,40	82,47±115,68	69,0±108,62	P_{1-3}=0,032; P_{1-2}=0,021
Phase angle,°	7,26±0,58	7,21±0,47	7,22±0,53	-

Table 2. *Indicators of body components of athletes with different somatotypes according to the Ries-Eysenck index*

Parameters	Asthenic (n=14) 1	Normosthenic (n=28) 2	Picnical (n=7) 3	Reliability
FM, kg	8,44±3,10	10,37±5,19	24,54±8,89	P_{1-3}<0,001; P_{2-3}=0,002
FM, %	13,42±4,58	14,90±4,40	25,43±5,08	P_{1-3}=0,002; P_{2-3}=0,003
ACM, kg	32,01±3,63	33,56±4,01	41,24±7,19	P_{1-3}=0,004; P_{2-3}=0,025
ACM, %	51,34±2,90	50,36±3,13	44,25±3,96	P_{1-3}=0,003; P_{2-3}=0,007
SMM, kg	30,25±3,66	31,37±3,11	36,90±6,13	P_{1-3}=0,013
SMM, %	48,51±3,15	47,21±3,30	39,60±3,54	P_{1-3}=0,001; P_{2-3}=0,003
LM, kg	53,98±6,11	56,66±6,10	69,60±11,92	P_{1-3}=0,004; P_{2-3}=0,033
LM, %	86,57±4,58	85,09±4,40	74,57±5,08	P_{1-3}=0,002; P_{2-3}=0,003

Using individual parameters of the bioimpedance response to physical activity for a particular athlete, the reactance parameter can be used to individualize the norms of physical activity, which will reduce the risk of injury during training and competitions [4]. The average value of the phase angle in individuals with different somatotypes did not differ significantly. The body composition of athletes, determined by the BIA method, is presented in Table 2.

The absolute values of all body components are significantly lower in athletes with an asthenic somatotype. Analysis of relative indicators established that active cell mass, skeletal muscle mass, and lean mass are significantly greater in the same asthenics. Relative and absolute fat mass was significantly higher in picnics. It was determined that as the weight category increases, the value of the absolute and relative fat component increases from 8.44 to 24.54 kg and from 13.42 to 25.43%. The same dynamics were determined when assessing the absolute value of skeletal muscle mass (from 30.25 to 36.90 kg).

Conclusions. The somatotypological profile of highly qualified martial artists of Yakutia has been revealed. The dominant somatotype was the normosthenic type. Differences in body weight, BMI, bioelectrical parameters and body components were established depending on the somatotype. Establishing the somatotypological and bioimpedanceometric characteristics of an athlete will help to personalize training loads, reduce the risk of sports injury, to achieve high sports results.

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Comparative assessment of the strength and endurance of the respiratory muscles in skiers and wrestlers

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Abstract

Objective of the study was to compare the maximal inspiratory strength and endurance of inspiratory muscles in athletes engaged in different types wrestling and skiing.

Methods and structure of the study. The maximal inspiratory pressure (MIP) was measured in athletes of wrestlers and skiers, as well as in volunteers without special physical training before and after incremental cycling exercise "to exhaustion".

Results and conclusion. The highest values of the maximal inspiratory pressure were found in athletes of skiers (155.4±9.9 cm H_2O), whose training is aimed at developing the aerobic capabilities. At the same time, the strength of inspiratory muscles decreased both in the control group of subjects (by 12%), and in athletes-skiers (by 8%) and wrestlers (by 11%) after incremental cycling exercise "to exhaustion", which is probably due to the development of inspiratory muscles fatigue. Specific training of the respiratory muscles can be an effective method for the increase in strength and endurance in both wrestlers and skiers, as well as in healthy physically active people.

Keywords: *maximal inspiratory pressure, incremental exercise, respiratory muscle fatigue, wrestlers, skiers*

Introduction. The reserve capabilities of the human inspiratory muscles significantly exceed the requirements to ensure adequate gas exchange at rest and have a significant “margin of safety” to maintain high levels of pulmonary ventilation during heavy and prolonged physical exertion in accordance with the metabolic demands of the body [8]. However, with high-intensity and prolonged muscle loads, fatigue of the respiratory muscles may develop more, which may be one of the limiting links in achieving maximum sports results [2, 5, 12]. “Working hyperpnoea” is accompanied by a significant increase in the load on the athlete’s respiratory muscles, the work of breathing to overcome elastic and resistive resistance increases, and the effort of the respiratory muscles necessary to create and ensure high velocities of gas flows in the respiratory tract increases many times over. Prolonged work of the respiratory muscles in such intense conditions can cause a decrease in its contractility and, ultimately, contribute to limiting the athlete’s maximum performance [4]. In this regard, conducting a comparative assessment of the functional reserves of the respiratory muscles of athletes of different specializations and different skill levels is very important to justify the introduction of additional targeted training of the respiratory muscles into the general training programs of athletes.

Objective of the study was to compare the maximal inspiratory strength and endurance of inspiratory muscles in athletes engaged in different types wrestling and skiing.

Methods and structure of the study. The experiment involved 20 young male athletes training strength (wrestlers of various types of martial arts) and endurance (skiers). All athletes had qualification categories from 1st sports category to master of sports. The con-

trol group included 10 physically active young men – university students who did not have special sports training. All participants were informed in detail about the methods used, the sequence of research and gave written consent to participate in them. The studies were conducted in accordance with the provisions of the Declaration of Helsinki on research involving human subjects and were approved by the local Ethics Committee. The athletes and student volunteers invited to participate in the study were of the same age category, had similar anthropometric data, did not have tobacco addiction, and did not take any pharmaceutical drugs at the time of the study. All participants in the experiment performed a load of increasing power on a bicycle ergometer "Schiller" (Switzerland). The work began with a load of 1 W/kg and every 2 minutes its value increased by 0.5 W/kg. The work continued until it was impossible to maintain the specified pedal speed (60-70 rpm) and the subject refused to continue. At rest, before the start of the bicycle ergometer test and immediately after its completion, the maximum strength of the inspiratory muscles was determined. The strength of contractions of the respiratory muscles was assessed by the amount of oral pressure created during maximum voluntary inspiratory (MIP) efforts with the airways blocked. The maneuver was performed based on the level of residual lung volume. MIP measurements were performed using a portable RPM device (FusionCare, UK) in accordance with the recommendations for respiratory muscle testing developed by the American Thoracic and European Respiratory Societies (ATS/ERS) in 2002 [1]. Soft latex mouthpieces connected to disposable antibacterial filters from the equipment manufacturer (FusionCare, UK) were used. Such mouthpieces fit tightly into the oral cavity and prevent even minimal air leakage when performing forced inspiratory maneuvers [10, 13]. Measurements were taken in a standing position at least 5 times with breaks of 1 minute; the maximum MIP value achieved was taken into account. Statistical data analysis was carried out using the Microsoft Excel statistical software package. Data are presented as mean ± error of mean (m ± SE). When comparing differences in indicators, Student's t-test and the non-parametric Wilcoxon test were used. Differences were considered statistically significant at $P<0.05$.

Results of the study and discussion. All study participants were of the same age category and had no significant differences in anthropometric parameters. The maximum strength of the inspiratory muscles was significantly higher than the control in all groups of athletes, and the highest MIP values were noted in the group of skiers and reached 155.4 cm of water column, which is 44.3% higher than the control (see table).

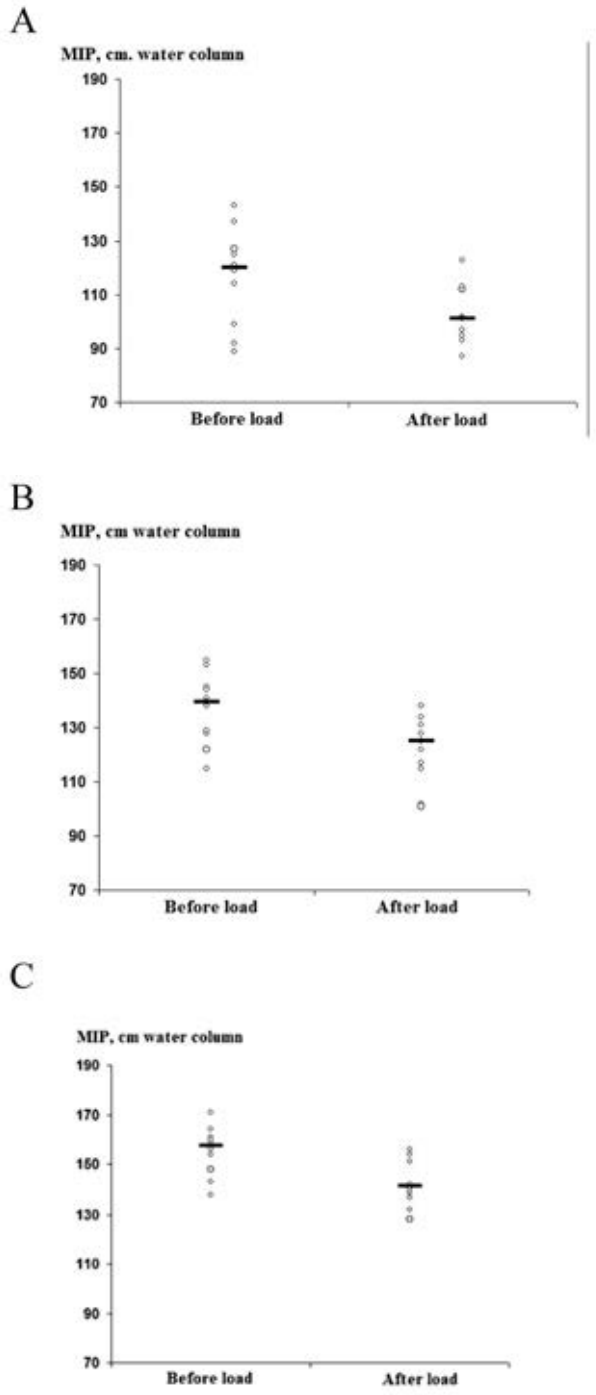
The results obtained showed that the maximum strength of the inspiratory muscles of endurance athletes is significantly higher than that of strength athletes and the general population of men of the corresponding age. These data are consistent with previously obtained information about higher values of maximum inspiratory pressure in highly qualified athletes: rowers [6] and swimmers [11]. The specific training of endurance athletes is aimed at developing the aerobic capabilities of the body, which are provided by the cardiorespiratory system. "Working hyperpnoea" is also the most important mechanism for training the respiratory muscles, which, in turn, promotes adaptive changes in the external respiration system, ensuring an improvement in the dynamic indicators of its function. At the same time, the results of our study showed that after performing a muscle load of increasing power, MIP values decreased both in the control group of volunteers (by 12%), and in the groups of martial artists (by 11%) and skiers (by 8%) (see drawing).

Similar data were obtained by other authors when studying changes in maximum inspiratory pressure in track and field athletes, runners and cyclists [7]. The authors found a decrease in MIP values after exer-

Functional characteristics of athletes and untrained volunteers before and after performing a load of increasing power "to failure"

Indicators	Control		Wrestlers		Skiers	
	Before load	After load	Before load	After load	Before load	After load
MIP, cm of water column	116,6±5,8	102,4±4,9*	137,0±4,1	121,6±4,03*	155,4±9,9	143,0±9,6*
$W_{max,}$ W		188,5±7,1		232±8,8#		255,8±9,1##
V_E, l	11,1±0,4	71,1±6,9	9,9±0,5	92,7±7,2#	11,6±0,3	122,9±8,2##

MIP, cm water column – maximum inspiratory pressure, Wmax, W – maximum power of the work performed; VE, l – minute ventilation value
** – p<0.05 relative to values within groups; # – p<0.05 ## – p<0.01 relative to control*



Maximum inspiratory pressure values and median values before and after bicycle ergometric load of increasing power in untrained volunteers (A), martial artists (B) and skiers (C) ($p<0.05$)

cise to failure by 13% and 17%, respectively, in athletes involved in athletics and cycling. A decrease in the strength of contractions of the inspiratory muscles after exercise is the main criterion for the development of their fatigue. Current evidence suggests that respiratory muscle fatigue triggers the activation of the "respiratory muscle metaboreflex," resulting in sympathetically mediated vasoconstriction of actively working locomotor muscles. This leads to a redistribution of blood flow towards the respiratory muscles, which require increased oxygen supply. This redistribution of blood flow and limitation of energy supply to intensely contracting locomotor muscles accelerates their fatigue, thereby contributing to refusal to continue working [8, 3]. At the same time, it should be noted that the total power of the work performed was maximum in the group of skiers (Table 1) compared to martial artists and the control group. At the same time, the degree of decrease in MIP values after stress testing in skiers was less than in wrestlers and untrained volunteers. These data allow us to conclude that the strength and endurance of the inspiratory muscles are highest in cross-country skiing athletes compared to wrestlers and the control group.

Conclusions. The most powerful functional reserves of inspiratory muscles have been identified in cross-country skiers, whose training is aimed at developing the aerobic capabilities of the body. At the same time, after performing a load of increasing power "to failure," the strength of the inspiratory muscles decreased both in the control group of subjects and in athletes training strength and endurance, which is likely due to the development of fatigue of the inspiratory muscles. Specific training of the respiratory muscles can be an effective method of increasing their strength and endurance in both martial arts athletes and skiers, as well as in healthy physically active people.

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Adaptation of voltage degree of regulatory systems to active physical activity in children with cerebral palsy

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Abstract

Objective of the study was to study the level of adaptive capabilities of the body of children with cerebral palsy based on the analysis of heart rate variability (HRV), determined before and after performing active physical exercises in a rehabilitation session.

Methods and structure of the study. The scientific work involved 303 children aged 5 to 14 years with a diagnosis of cerebral palsy and different levels of development of gross motor functions according to the international GMFCS scale. The frequency of occurrence (in %) of indicators of activity of regulatory systems (IARS) and indicators of functional resources in children before and after performing active physical activity was analyzed.

Results and conclusions. A low level of initial functional reserve and insufficient activity of the cardiovascular system were revealed, which should be taken into account when conducting classes. Adaptive reactions in children with varying degrees of disease severity are individual and are implemented in different ways. It was revealed that individually selected physical activity increases the activation of regulatory systems and functional resources in children with cerebral palsy, especially with severe motor impairments (level 4-5 of the GMFCS scale). To develop functional and physical abilities in children with cerebral palsy, continuous physical rehabilitation is necessary, as a result of which the body's capabilities gradually increase and long-term adaptation is formed, associated with the activation and mobilization of functional resources.

Keywords: *adaptation of the body of children with cerebral palsy, heart rate variability, active physical exercise.*

Introduction. Limited motor activity in children with cerebral palsy reduces their adaptive capabilities and leads to a decrease in the ability to adequately respond not only to active physical activity in classes, but also to everyday ones [2]. The ability to ensure adaptation to physical stress is determined not only by motor, but also by the functional capabilities of the body, which depend on the interaction of control regulatory systems (control, regulation and management) over the state of the whole organism [2, 5]. Assessment of the functional reserves of the mechanisms of autonomic regulation and various parts of the control system of physiological functions can serve as diagnostic and prognostic criteria in dynamic observations of the body's response to physical activity [1, 6, 7]. In children with cerebral palsy, the body's adaptation to physical activity occurs differently depending on the mental state, intensity and volume of the load, as well as the presence of functional reserves. If the physical activity used is inadequate, children with cerebral palsy may experience ambiguous reactions of the body from the cardiovascular system, which lead to failure of adaptation [4, 7]. Therefore, determining the level of adaptive capabilities of the body of children with cerebral palsy when performing physical activity is one of the most important tasks of physical rehabilitation.

Objective of the study was to assess the level of adaptive capabilities of the body of children with cerebral palsy based on HRV indicators obtained before and after performing active physical exercises in a rehabilitation session.

Methods and structure of the study. The work used the method of cardiointervalometry - HRV using the Varicard apparatus, which determines the degree of activity of regulatory systems according to the indicator of activity of regulatory systems with a differentiated assessment according to ranges and indicators of functional resources. The study involved 303 children diagnosed with cerebral palsy aged from 5 to 14 years and with different levels of development of gross motor functions according to the international GMFCS scale. Measurements of functional status were carried out before and after rehabilitation sessions with active physical exercises. The physical activity of children of all levels consisted of general developmental gymnastics, walking on a treadmill, working on a MOTOmed, a bicycle ergometer and other exercise equipment, and was selected individually taking into account the GMFCS levels and the functional state of their body. Children of levels III-IV GMFCS trained in the "Gross Trainer" to maintain a vertical position and provide a dosed load on the musculoskeletal system.

The research consisted of a comparative analysis of the frequency distribution (in %) of the degree of tension of regulatory systems and functional state according to IARS indicators in children with cerebral palsy before and after performing physical activity at each level of development of gross motor functions on the GMFCS scale.

A physiological assessment of the state of regulatory systems was expressed in points: 0 points - normal, +1 or -1 indicated a moderate deviation from the norm, with a score of +2 or -2 - a significant deviation from the norm. IARS values, consisting of five ranges, were assessed in points from 1 to 10, where: the physiological norm was from 1-2 points (the optimal level of tension of regulatory systems), moderate functional tension - 3-4 points, pronounced functional tension - from 5- 6 points, overexertion - 7-8 points, the assessment of failure of the body's adaptation was 9-10 points.

Results of the study and discussion. The degree of tension in regulatory systems in children with cerebral palsy is realized in different ways, changes and has a variable multidirectional functional organization with the inclusion of different levels of compensatory functions [2, 7]. The state of regulatory systems before physical activity in the majority of children (from 49 to 70%) of all five GMFCS levels was relatively balanced. Normal functioning of the cardiovascular system (CVS) was observed in 61% of children at GMFCS level I and 48% of children at level III. In 55% of children of levels IV-V, severe tachycardia was observed, which is characterized as an increased neuro-emotional state or lack of sufficient functional reserves. The majority (42-57%) of children experienced significant tension in autonomic homeostasis. A common characteristic of autonomic regulation of the initial state was increased tone of the sympathetic part of the autonomic nervous system in all groups. The activity of the sympathetic vascular center was normally observed in 50-70% of children of all levels, pronounced sympathetic activity was observed in 17-35% of children. The results of assessing the state of regulatory systems before and after physical activity are shown in the table.

After physical exercise, the state of the regulatory systems in all children, regardless of the level of GMFCS, was characterized by a decrease in the degree of central control and autonomic homeostasis due to increased autonomous regulation, that is, due to increased breathing and the removal of stress during physical exercise, which increases the activation of regulatory systems and balancing various body systems with each other. The greatest improvement in indicators was observed in children of levels IV-V of the GMFCS scale, i.e. with severe motor impairments. This confirms the fact of the positive effect of active physical exercise on the functional state of children with cerebral palsy.

According to the IARS indicators, it was revealed that the initial state of a large number of children was in the range of 4-6 points, which characterizes the state of functional reserve. 5% of children belonging to levels IV-V of the GMFCS scale were in the range with high tension of regulatory systems - 8-9 points, which was characterized by an increased risk of adaptation failure.

After the load, all children showed a transition of the body state into the normal range or close to normal; this was more evident in children of levels IV-V GMFCS.

Thus, indicators of heart rate variability are informative for assessing the adaptation of children's bod-

Frequency distribution (in %) of the degree of tension of regulatory systems (in %) in children with cerebral palsy before and after physical activity

Frequency of occurrence of the degree of tension of regulatory systems, % in children with cerebral palsy											
GMFCS	ASRS *	Functioning level		Stability of regulation		Vegetative homeostasis		Activity of the sympathetic vascular center		Degree centralization of management	
		before	after	before	after	before	after	before	after	before	after
Level 1	0	61	39	43	39	17	26	57	78	13	22
	1	22	39	0	0	9	0	17	17	0	0
	-1	0	17	17	39	4	9	13	4	17	30
	2	13	4	0	0	13	17	9	0	0	0
	-2	4	0	39	22	57	48	4	0	70	48
Level 2	0	33	31	24	31	16	18	62	58	18	22
	1	24	13	16	7	9	13	27	31	9	4
	-1	4	2	31	33	11	13	7	9	24	27
	2	38	53	2	4	22	22	4	2	0	7
	-2	0	0	27	24	42	33	0	0	49	40
Level 3	0	48	43	38	32	15	20	50	53	27	17
	1	22	17	3	3	15	13	35	30	3	5
	-1	3	10	22	33	15	12	8	8	23	33
	2	27	30	0	0	5	8	7	8	0	0
	-2	0	0	37	32	50	47	0	0	47	45
Level 4	0	24	27	21	27	12	16	70	66	15	24
	1	15	15	3	5	14	11	18	23	7	5
	-1	6	5	36	31	13	15	7	8	23	24
	2	55	53	0	1	16	17	5	3	2	2
	-2	1	0	40	35	45	41	1	0	53	45
Level 5	0	17	17	2	7	7	12	68	78	17	32
	1	29	27	0	7	10	7	20	20	2	12
	-1	0	5	34	24	10	7	10	2%	15%	10
	2	54	51	0	0	7	15	2	0%	2%	0
	-2	0	0	63	61	66	59	0	0%	63%	46

Note: ASRS – Assessment of the state of regulatory systems.*

ies to physical activity and can be used for dynamic observations. With the help of individually selected active physical exercises, real opportunities are opened for increasing the functional reserve of the body and physical abilities of children with cerebral palsy.

Conclusions. The initial functional state in children with cerebral palsy is characterized by a low level of functional reserve and insufficient activity of the cardiovascular system, which should be taken into account when developing programs using active physical exercises. For the development of functional and physical capabilities, children with cerebral palsy require continuous physical rehabilitation, as a result of which a gradual functional restructuring of the body occurs: physiological capabilities increase, long-term adaptation is formed, associated with the activation and mobilization of the body's functional resources. Indicators of activity of regulatory systems and the degree of tension of regulatory systems make it possible to assess the adaptive capabilities of the body of children with cerebral palsy when performing active physical exercises; they are informative indicators and can be used in dynamic observations.

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Physical culture and sports events as a form of social adaptation of students with health disabilities

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Abstract

Objective of the study was to identify students' attitudes towards physical education and mass events as a form of social adaptation of students with health limitations.

Methods and structure of the study. The scientific experiment was conducted at the Department of Physical Education of Altai State University in the 2022-2023 academic year as part of a physical education and sports event dedicated to the 50th anniversary of Altai State University "Adaptive Physical Culture Celebration", organized for students with health problems and disabilities. The program included a set of physical exercises that students of a special medical group with disabilities and/or health limitations could perform to the best of their abilities and who had necessarily undergone physical training for this event in the discipline "Physical Culture and Sports" (elective). At this event, students were asked to complete a survey.

Results and conclusions. Students assigned to a special medical group or health group 3 for health reasons feel the need to participate in various types of physical education and sports activities. This organization of involvement in physical activity makes it possible to increase student motivation, improve communication, and expand the range of knowledge in the field of physical education, sports and a healthy lifestyle.

Keywords: *special medical group, 3rd health group, disability, implementation.*

Introduction. The need for physical education and sports events is discussed at all levels of government and for all ages of the population of our country [1, 3, 4, 10]. A lot of work is devoted to organizing such events for students of higher educational institutions [2, 5, 6, 7]. At the same time, there is a category of students for whom physical education and sports activities are mostly unavailable; these are students classified for health reasons in a special medical group (SMG) or 3 health groups. To date, this issue has not been resolved, despite the fact that among athletes of various ages and sports qualifications, diseases of any of the organ systems are often diagnosed [9].

In the student environment, young people are very active, which includes physical education and sports activities, but students with health problems most often cannot do this, due to the lack of physical education and sports activities developed for such a contingent of students.

Objective of the study was to identify students' attitudes towards physical education and mass events as a form of social adaptation of students with health limitations.

Methods and structure of the study. The scientific research was carried out at the Department of Physical Education of Altai State University in the 2022-2023 academic year as part of a physical education and sports event dedicated to the 50th anniversary of Altai State University "Holiday of Adaptive Physical Culture."

The event was first organized for students with health problems and disabilities studying at Altai State University, Altai State Pedagogical University and Altai State Medical University. The program included a set

of physical exercises that students of a special medical group with disabilities and/or health limitations could perform to the best of their abilities and who had necessarily undergone physical training for this event in the discipline "Physical Culture and Sports" (elective).

At this event, students were asked to complete a survey (see table).

In the survey, we considered only the responses of SMG students - 102 students aged 17-22 years.

Results of the study and discussion. According to the survey results, it was revealed that 53.9% of students were involved in physical education during their school years, the rest were exempted for health reasons in various classes. In Fig. 1 presents the results of a survey of students about whether they were involved in sports or dance sections before entering the university. The results are presented in two groups of students who were exempt from physical education for health reasons and those who were not.

The figure shows that approximately the same number of students attended sports or dance sections before entering the university, regardless of whether they were exempt from physical education classes at school or not. These figures correspond to our previous study, which found that 43.8% of students with health problems engage in various sports and dance styles during their school years [8].

Distribution of answers to the question "Are students currently involved in physical education outside of university classes?" are presented in Fig. 2.

It can be stated that the number of students attending classes and engaging in physical activity outside the university has decreased compared to the period of study at school. To increase the interest and motivation of young people for regular physical education, various types of sporting events can be used.

The remaining questions of the survey were intended to study students' opinions about the event. The question of what motivated students to take part in the "Adaptive Physical Culture Festival" required a free-form answer. Among the reasons given were the following:

- desire to receive benefits (positive emotions, impressions, active recreation, etc.) – 26.2%;
- find out your abilities – 23.4%;
- convinced by the teacher – 18.9%;
- interest (in the event) – 17.1%;
- physical exercises (which were included in the event program) – 5.4%;
- communications (new acquaintances, communication with friends, team support) – 4.5%;
- victory (win or receive prizes) – 4.5%.

In preparation for the event, 89.2% of students did not experience any difficulties in preparing to participate in the "Adaptive Physical Culture Festival". 65.7% of students were not worried about their results at the event. Despite the fact that 34.3% of students noted that they were worried about their results at the event, 93.1% of respondents would like to take part in physical education and sports events in the future, such as the "Adaptive Physical Culture Festival".

Conclusions. Students assigned to a special medical group or health group 3 for health reasons feel the need to participate in various types of physical education and sports activities. This organization of involvement in physical activity makes it possible to increase student motivation, improve communication, and expand the range of knowledge in the field of physical education, sports and a healthy lifestyle.

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List of questions for students.

No.	Questions	Answer form
1	Were you exempt from physical education classes at school?	Yes /No
2	Before entering university, did you take part in sports or dance classes?	Yes / No, section
3	Are you currently involved in physical education outside of university classes?	Yes /No
4	What motivated you to participate in the "Celebration of Adaptive Physical Culture"?	Free answer
5	Have you experienced any difficulties in preparing to participate in the "Adaptive Physical Culture Festival"?	Free answer
6	Are you worried about your results at the Adaptive Physical Culture Festival?	Yes /No, free answer
7	Would you like to take part in physical education and sports events in the future (like the "Adaptive Physical Culture Festival")?	Yes /No

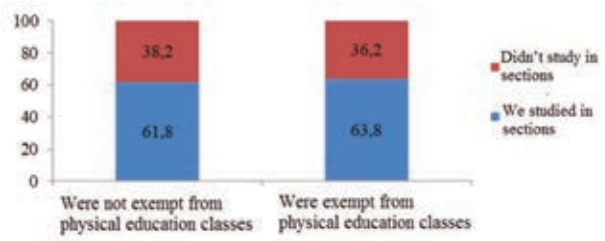

Figure 1. Distribution of students who were involved in sports or dance sections before entering the university (%)

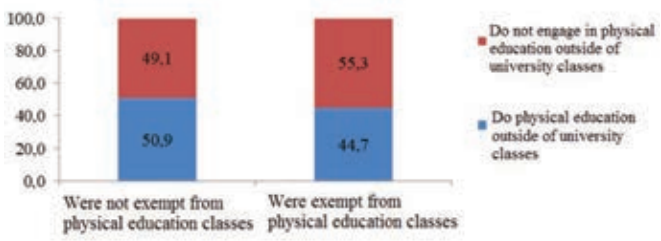

Figure 2. Distribution of students who engage in physical education outside of university classes (%)

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Development of motor activity of high school students by means of basketball

UDC 796

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Abstract

Objective of the study was to prove the influence of sports games on the development of motor activity of students aged 14–16 years.

Methods and structure of the study. The proposed program was as follows: participants in the experiment were offered a set of exercises from the lesson system, aimed at developing motor activity through special basketball exercises and playing basketball.

A series of notes on experimental lessons was developed and compiled taking into account the regulations governing the activities of secondary schools, in accordance with the main regulatory documents in the field of education of the Russian Federation, as well as on the basis of sample programs for children's and youth sports schools.

Results and conclusions. The use of our proposed methodology using the means of the sports game "basketball" turned out to be effective in the development of motor activity of schoolchildren.

It was revealed that with the help of the sports game "basketball" one can effectively develop motor activity, which underlies the physical development of students.

In the course of our work, we proved that using the developed methodology, the degree of development of motor activity in students increased. Consequently, this technique can be used when teaching students aged 14–16 years in the classroom, as well as when preparing young basketball players.

Keywords: *physical activity, students aged 14-16 years, physical education lesson, basketball, overall lesson density, motor density of the lesson.*

Introduction. The modern content of education in the field of physical culture aims not only at ensuring that a school graduate enters life with sufficient physical fitness, but also at ensuring that he is truly educated in physical culture, has the means and methods of strengthening and maintaining health, and increasing functional capabilities main systems of the body.

As practice shows, most modern children lack physical activity. As a result, the strength and performance of skeletal muscles decrease, which entails poor posture, curvature of the spine, and delayed age-related development [3].

Issues of increasing the physical activity of students in educational institutions have always been the focus of attention of specialists [1-4].

Objective of the study was to prove the influence of sports games on the development of motor activity of students aged 14-16 years.

Methods and structure of the study. To solve problems and achieve the set goal, the following methods were used in the work: theoretical analysis of scientific and methodological literature, testing, pedagogical experiment, methods of mathematical statistics.

The study was conducted in the Municipal State Educational Institution "Yastrebovskaya Secondary School" of the Achinsk District, Krasnoyarsk Territory. 9th grade students, 10 people, 5 boys and 5 girls, took part in the initial diagnostics. The conditions were created, the school gym, 10 basketballs, a whistle, and a

stopwatch were provided. Lessons were held 3 times a week, 40 minutes each.

The proposed program was as follows. The participants in the experiment were offered a set of exercises from the lesson system, aimed at developing motor activity through special basketball exercises and playing basketball.

The developed program is designed to help diversify the content of work in the classroom in a secondary school. One of the main incentives for students to engage in physical education is an interest in the game of basketball and its exercises.

The learning process is based on the requirements of the content of the educational process, which assumes a close relationship between theoretical, physical, technical, tactical, psychological and integral preparations carried out through physical exercises. Classes are held three times a week for one academic hour.

Theoretical classes are conducted in the form of 10-12-minute conversations during practical classes, as well as in the form of a separate lesson. Practical exercises are the implementation of exercises during the lesson.

The development of training sessions included a set of exercises for passing the ball, performing tactical actions, playing actions, throwing and dribbling the ball.

The training session was structured in compliance with the parts of the lesson and included the following exercises:

1. Warm-up (general developmental exercises in place, in motion, jumping, running exercises).

2. The main part (driving the ball, passing, tactical actions during the game of basketball, throwing).

3. Final part (recovery exercises: walking, attention games).

At the beginning of the experiment, when using a series of exercises new to the students, minor difficulties arose in the technique of performing individual exercises. Gradually, step by step, practicing these exercises, it was revealed that students had positive dynamics in the correctness and effectiveness of their implementation. During the experimental lessons in the preparatory part, they received a low-intensity load, which was confirmed by data from measuring the heart rate of 100-125 beats per minute. In the main part of the measurements, the heart rate was recorded at 150–180 beats per minute, which corresponds to a load of submaximal and maximum intensity. In the final part, the load corresponded to the average intensity - 130-140 beats per minute.

When conducting a physical education lesson, indicators of the general and motor density of the lesson are also important. If the total density is 42-45 minutes, then the motor density of the lesson should consist of 25-28 minutes and all this time the student must perform physical exercises that solve the main objectives of the lesson, alternating with active rest, only then will parts of the lesson be as mobile as possible, and when performing These conditions make it possible to achieve maximum motor activity.

Systematic classes using the developed methodology will allow students to cope with the difficulties that arise at the initial stage. As a result, students will increase their motor activity, endurance and physical development.

Before the experiment began, a motor activity test was conducted to determine the level of physical activity of students. The diagnostic results showed that the level of motor activity of 9th grade students was distributed as follows: high – 20% of students, average – 70%, low – 10%.

Table 1. Indicators of measurements of students before and after the experiment

No.	Student name	Motor density		Overall Density		Motor activity	
		D (1)	D (2)	D (1)	D (2)	D (1)	D (2)
1.	A-ko	30 %	40 %	30 %	30 %	60 %	70 %
2.	A-va	38 %	45 %	30 %	30 %	68 %	75 %
3.	V-овv	50 %	58 %	30 %	30 %	80 %	88 %
4.	E-chuk	50 %	55 %	30 %	30 %	63 %	85 %
5.	E-va	25 %	43 %	30 %	30 %	55 %	73 %
6.	Z-va	53 %	60%	30 %	30 %	83 %	90 %
7.	I-nov	43 %	48 %	30 %	30 %	73 %	78 %
8.	L- kaya	30 %	43 %	30 %	30 %	60 %	73 %
9.	M-va	33 %	45 %	30 %	30 %	63 %	75 %
10.	S-ev R.	45 %	53 %	30 %	30 %	75 %	83 %

Participants in the experiment during physical education lessons were engaged in a set of exercises from a system of lessons aimed at developing motor activity through special basketball exercises and playing basketball.

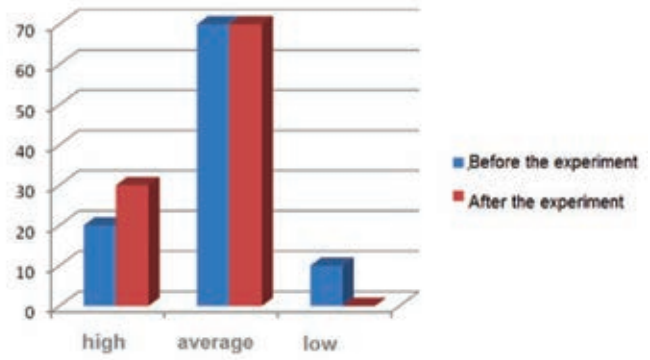
Results of the study and discussion. After the main experiment, 9th grade students were tested again to determine the degree of development of motor activity.

The measured indicators before and after the experiment are presented in Table 1.

According to the table, we can conclude that there were positive changes in motor density, total density and physical activity.

Analysis of the results indicates that the test scores before the experiment differ from the scores after the experiment. Consequently, positive changes have been achieved through the use of a series of notes used in lessons.

Based on the results of the experimental work, it was revealed that 9th grade students who were engaged in constant dynamics in physical education lessons became better. The high level increased by 10%, the average remained the same and it was possible to bring students from the low to the average level (see figure).



Comparative analysis of the level of motor activity

Conclusions. The use of the methodology we proposed using the means of the sports game "basketball" turned out to be effective in the development of motor activity in schoolchildren.

It was revealed that with the help of the sports game "basketball" one can effectively develop motor activity, which underlies the physical development of students. With the help of specially developed lesson plans for the development of motor activity, gradually and regularly increasing the volume, intensity and motor density of the lesson, we can improve the level of motor activity of students, which is very important for their development and motivation for a healthy lifestyle.

In the course of our work, we proved that using the developed methodology, the degree of development of motor activity in students increased. Consequently, this technique can be used when teaching students aged 14-16 years in the classroom, as well as when preparing young basketball players.

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Comparative analysis of coach motives in a commercial and non-profit sports organization

UDC 159.9

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Abstract

Objective of the study was to compare the degree of expression of motives for professional activity among coaches of a commercial and non-profit sports organization.

Methods and structure of the study. The technique “Possibility of realizing motives” (PRM) by V.I. Dominyaka, E.A. Rodionova. Team sports coaches from the city of St. Petersburg (n=40, men, age 24–28 years, professional experience from 3 to 5 years) took part in the study. "Footboland" is a children's football school (commercial organization) and a sports school in the Krasnoselsky district of St. Petersburg (non-profit organization).

Results and conclusions. Evidence was obtained that in a non-profit organization, the following motives are important for trainers: respect from other people, social prestige, career growth, the excitement of professional competition. Trainers of a non-profit organization believe that the organization does not provide them with the opportunity to fully realize these motives. In a commercial organization, the most important motives for trainers are: increasing their professional competence and satisfaction from the process of activity. A commercial organization helps trainers realize such motives for professional activity as satisfaction from the process of activity, a sense of freedom and independence in decision-making, and opportunities for self-realization in the profession.

It is advisable to use the obtained data in working with coaching staff, both at the time of accepting a specialist into an organization in order to clarify the organization’s real capabilities in satisfying the coach’s motivational orientations, and in the process of his professional implementation to prevent professional burnout.

Keywords: *coach, professional motivation, implementation of motives for professional activity, sports organization.*

Introduction. The main component for the successful implementation of any activity, including physical education and sports, is motivation [3, 5].

In coaching, there are a number of factors that motivate work. One of the most important factors is the result (success) of athletes, which is considered as an indicator of their own competence. In second place is the coach's salary. The third is love for the profession and working with people [4]. Of the listed factors, in commercial sports organizations, material incentives are a more flexible system, which includes basic wages, piecework, time-based, bonuses, bonuses, one-time payments (bonuses, annual, semi-annual, New Year's bonuses, for length of service, for merit), payment of transportation costs; covering the costs of retraining, advanced training, seminars, catering, etc. Material motivation is only one of several dozen of the most common motivating factors, and it is not the most effective. For example, managing motives such as career growth, status, fame, evaluation, and clarity of purpose can influence an employee’s enthusiasm no less than high salaries and bonuses [6].

Regardless of the organization, management is interested in having a motivated coach on staff. A motivated coach is an effective coach who brings success to his organization. Understanding what professional

motives a trainer implements in an organization and how much they are satisfied in the working conditions that the organization can provide, management can effectively manage their human (labor) resources [2].

Objective of the study was to compare the degree of expression of motives for professional activity among coaches of a commercial and non-profit sports organization.

Methods and structure of the study. The empirical study used the methodology "Possibility of realizing motives" by V.I. Dominyaka, E.A. Rodionova [1]. The study was conducted remotely, and coaches were sent a questionnaire with detailed instructions to fill out. The technique consists of two parts. In the first part, trainers were asked to evaluate how much the organization in which they work contributes to the implementation of each of the 16 motives of professional activity given below on a 10-point scale, where 10 is extremely significant, 1 is absolutely not significant. In the second part, coaches were asked to evaluate the significance of each of the 16 motives for professional activity. In this part, no more than three motives could receive the same rating at the same time.

Team sports coaches from St. Petersburg took part in the study. "Footboland" is a children's football school (commercial organization) and a sports school in the Krasnoselsky district of St. Petersburg (non-profit organization), (n=40, men, age 24–28 years, coaching experience 3-5 years). 20 trainers are a non-profit organization, 20 are a commercial one. To find differences in indicators in the two groups of trainers, the Mann–Whitney test was used (differences are discussed at the p≤0.01 level).

Results of the study and discussion. When studying the motives for a coach's professional activity, two indicators were assessed: how significant a specific motive for professional activity is for a coach and how much, in the coach's opinion, the organization in which he works contributes to the implementation of this motive (see figure).

Analyzing the data obtained, we can say that trainers working in a commercial organization have more

Average indicators of the expression of motives for the professional activities of trainers and their implementation in the organization where they work (0 – absolutely not significant/not implemented, 10 – extremely significant/implemented)

adequate expectations from the organization in realizing their professional motives. Significant differences in the motives of trainers and the possibility of providing conditions for their implementation were found in the motives: material wealth, a sense of stability, reliability and the opportunity to improve their own professional competence.

Trainers working in a non-profit organization had more significant motives for professional activity that the organization cannot fully satisfy compared to trainers in a commercial organization, and they differ. In their opinion, in a non-profit organization it is difficult to satisfy material needs, needs for career growth, receive satisfaction from the process of activity, feel freedom and independence in decision-making, feel success, realize the excitement of professional competition and there are few opportunities for full self-realization in the profession.

Assessing the motives, the satisfaction of which is facilitated by the organization in which they work, indicates that a non-profit organization helps to satisfy the motives of coaches in a sense of stability, reliability, it can provide great opportunities to satisfy the excitement of professional competition. A commercial organization provides great opportunities for communication with colleagues, satisfaction with the process, a sense of freedom and independence in decision-making, a sense of success, and the possibility of the most complete self-realization in professional activities.

Regardless of the organization, the trainers of both groups noted that organizations do not satisfy the motive of material wealth, which is of high importance to them.

Conclusions. In a non-profit organization, the most important motives for coaches are: respect from other people, social prestige, career growth, the excitement of professional competition. Trainers of a non-profit organization believe that the organization does not provide them with the opportunity to fully realize these motives. The non-profit organization helps coaches realize the motives of stability, reliability and the excitement of professional competition. In a commercial organization, the most important motives for trainers are: increasing their professional competence and satisfaction from the process of activity. A commercial organization helps trainers realize such motives for professional activity as satisfaction from the process of activity, a sense of freedom and independence in decision-making, and opportunities for self-realization in the profession. It is advisable to use the obtained data in working with coaching staff, both at the time of accepting a specialist into an organization in order to clarify the organization's real capabilities in satisfying the coach's motivational orientations, and in the process of his professional implementation to prevent professional burnout.

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Education of a team in fencing: the possibilities of an environmental approach and art pedagogy

UDC 37.01; 796.011.7; 796.86

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Abstract

Objective of the study was to reveal the features and possibilities of using a specialized environment for educating a sports team using art pedagogy methods.

Methods and structure of the study. The study was carried out using the example of teams whose core activity is fencing. The authors proceed from the idea that the aestheticization of the competitive process is not a sufficient basis for the effective education of a team in terms of the ideas of art pedagogy, as a result of which targeted managerial and organizational-pedagogical efforts are necessary to create an aesthetically valuable subject-spatial content of the training process.

Results and conclusions. An analysis of the practice of sports groups ("Victoria", "Musketeers of Setuni", "Florette", "Musketeer") made it possible to establish the educational feasibility of including students both in the existing specialized environment, aesthetically reflecting sports activity, and in the processes of creating such an environment, which as a result acquires unique proportionality to a specific team. Also, as a result of the study, it was revealed that the universalization of sports facilities reduces the effectiveness of using the environmental approach and methods of art pedagogy for educational work in sports teams.

Keywords: *history of sports pedagogy, sports team, education in a sports team, environmental approach in fencing, art pedagogy in sports.*

Introduction. The modern trend is the integration of sports and art and its broad consideration in the context of aestheticization [4, 6]. It gives rise to both new sports disciplines (for example, art fencing disciplines of the sport "fencing") and original forms of physical activity (parkour). However, the possibilities of an aesthetically valuable subject-spatial environment for educating groups through art pedagogy using the example of specific sports, including fencing, have not been sufficiently studied.

Objective of the study was to determine the possibilities of a specialized environment, studied in the aspect of the subject-spatial environment, for the education of a sports team using the example of fencing.

Methods and structure of the study. The research methodology is based on the study of scientific, theoretical and memoir literature, the use of modeling methods, comparative historical and pedagogical analysis, as well as content analysis. The study is based on the idea that the systematic decorative design of the venue for sports competitions, which meets the ideals of P. de Coubertin, brings together the spaces of life of sports and art: "spectacular performances are held in certain rooms … sports arenas, stadiums or courts are not much different from them" [4, p. 89]. We further assumed that the decoration of competitions, which, by the way, is also not always implemented (in the words of K.B. Rush, the lack of desire for sports among teenagers is due to the fact that their competitions are devoid of "festivity and play" [7, p. 87]) should be complemented by the creation of a specialized training environment where the trainer's

influence on the individual will be more effective. If we consider a fencing coach in the role of an actor, then the necessity of a decent stage for the success of his performances is obvious.

Considering that the assessment of sports by spectators and self-assessment of core activities is carried out by athletes, including from an aesthetic point of view, it is natural to assume the importance of aestheticism (a concept from the field of art) not only in competitive, but also in training activities [3]. Not only the coach, but also the athletes are more attentive to sports traditions, being in a room that has aesthetically valuable attributes: the "code of musketeer honor", portraits of outstanding coaches and athletes, a sports museum, etc. Observations show that in this case, fencers more often "turn on" protocols for following sports ethics and the principles of "fair play", however, the specific influence of environmental aesthetics on the education of the team requires clarification.

Results of the study and discussion. We will study the features of the environment as a subject-spatial environment, its perception and suitability for the application of educational methods of art pedagogy in sports groups using the example of a number of fencing clubs ("Victoria", Novosibirsk; "Musketeers of Setuni" and "Florette", Moscow; "Musketeer", Sverdlovsk) and the views of their leaders.

One of the founders of the Novosibirsk club "Victoria" K.B. Rush described the subject-spatial environment of the collective's life and the process of its creation: "... We built an estate for the children, a knight's estate. We were looking for... antique furniture. ... fanfare and satin, velvet and other "funded materials"" [7, p. 6]. As a result of the organization of the environment, "... a typical glass box began to resemble a magic lantern forgotten in the snow by a magician" [7, p. 8]; "a company of musketeers", which had "its own hall and house [hereinafter our italics – V.L., V.R.]" [8, p. 35]; "The fire shimmers and silvers the fanfares, plays on the silk of the guards' drums. The roots glitter with gold... behind the cut glass of a massive antique oak cabinet" [7, p. 48]. Among the team's "home" displays was, for example, a bronze plaque installed for motivational purposes "in honor of the only injection" inflicted by one of the athletes during an absolutely disastrous performance. The description is supplemented by coach P.V. Sleptsov: "... attention is immediately attracted by the massive wooden square of the shield with the Coat of Arms of the Siberian Land carved on it, surrounded by the inscription "Siberian Fencing Club "Victoria"." ... The entire length of the building is hung with the standards of club units ... many photographs memorable for the history of fencing" [8, p. 5].

The creation of a special environment is the result of K.B.'s conviction. Rush is that "the typical environment deprives [children] of creativity, imagination and internal growth" [7, p. 53]; No wonder they decided to build the children "a house in which even the walls are formed" [7, p. 55]. The idea of understanding the fencing club "Victoria" as an artistically decorated house can also be traced in the thoughts of P.V. Sleptsova [8, p. 38-39]. The expected result of staying in such a "house" was naturally a return to the original unity of the physical, moral and aesthetic principles [7, p. 57], that is, in the integration of sports and art.

The beauty of activity, apparently, was understood by K.B. Rush as a condition for patriotic education, as a result of which he especially vehemently opposed not only the lack of special skills of a fencing coach, but also his overly utilitarian orientation. The specialist saw in it a prerequisite for lack of spirituality, short-term interests and civic infantilism [7, p. 104]. Finally, the basis for the demand for methods and environmental approach of art pedagogy in fencing seems to be this thought of K.B. Russia: "a musketeer-fencer is also a true artist of his craft" [7, p. 106]. Victoria's internal competitions took place in a special indoor atmosphere, enhanced by artistic elements. As P.V. wrote Sleptsov, traditional club tournaments until the end of the 90s were costumed, included a special ceremony, and often staged battles before the start [8, p. 7], and in the club there was a place for a kind of stage fencing circle [8, p. 14]. Artistry was reinforced in parades with the participation of the "Victorians": "Four drummers will go ahead... in white satin cloaks with gold monograms of the club" [7, p. 26].

Head of the school "Musketeers of Setuni" L.G. Leitman believed that the main nuances influencing the formation of a person are "family, school and the environment in which the child grows up" [2, p. 9]. He described the joint training of the national teams of Hungary and the USSR as "a real fencing theater" [2, p. 51], where individual fighters fenced in a classical, and therefore "remarkably beautiful fighting stance" [2, p. 52]. With similar epithets L.G. Leitman also described the methodology of one of his fencing teachers: "The lesson of Vitaly Andreevich [Arkadyev] was like a mini-performance..." [2, p. 56]. At the same

time, "Arkadyev's theater (the expression was introduced into use by his student T. Lyubetskaya) was focused not on the self-presentation of the trainer-director, but on the development of the individuality of the "artist" - the athlete-fencer, that is, it was a purely pedagogical phenomenon. The same educational line was continued by L.G. Leitman: "I knew that first I needed to captivate children, open them to the beauty of sports. ... It is important that the section becomes their second home" [2, p. 115].

I agree with K.B. Rush and L.G. Leitman in his attention to the artistry of pedagogy and fencing, Moscow journalist and coach T.I. Kolchanova: "I went to see them [the children] as if I were going to a premiere, as if I were going to a benefit performance organized in my honor" [1, p. eleven]. The leitmotif of the perception of the Florette club at Housing Office No. 18 as a home is noticeable: "There was a house to which we came because we could not live without it" [1, p. 13]. It appeared, among other things, through the efforts of children who participated in clearing basements and looking for leather seats from old chairs that replaced wall targets [1, p. 29]. Without possessing the "old magic" similar to that organized in "Victoria", the atmosphere of the club no less fostered the spirit of the team. T.I. Kolchanova saw the value of art pedagogy and the environmental approach in the work of other trainers: "Half the institute gathered for [Timofey Ivanovich] Klimov's classes, as if for a performance!" [1, p. 85]; "Pasha [Kolobkov] says that this [commonwealth] comes from the coach [V.I. Nikolaychuk], who was able to create an atmosphere of home and family in the hall" [1, p. 122].

Honored Trainer of the RSFSR B.V. Mochalov described the training environment of the Musketeer sports school, organized in 1969 in Sverdlovsk: "... huge stained glass windows... [obliged fencers]... to do everything beautifully and correctly" [5, p. 61]. A specialized environment was created: "... a locker room was built on our own, and a target closet was made "out of nothing" by the parents. This truly unique structure... made the hall suitable specifically for fencing. ... On the shields ... they wrote the motto of the musketeers: "One for all - all for one" [5, p. 61].

Thus, a comparison of the historical aspects of the activities of the named schools and content analysis revealed the dominant significance of the epithets of beauty, home and theater in describing their environment. It is systematically confirmed in educational programs: "The joint work of children in the design of stands, festive decoration of the hall and training premises serves educational purposes. [This]... brings children closer... to the surrounding space in which they begin to feel comfortable... feeling like they are in their own home" [9, p. 53].

Conclusions. As a result of the study, it became possible to outline some features and possibilities of the environmental approach and art pedagogy for educating a sports team (using the example of fencing).

Firstly, it was discovered that fencing groups are able to attract and educate students both with an atmosphere of involvement in a noble activity and with the spirit of a unique club life. The named environmental options, which can be designated as "aristocratic" and "leisure," are promising for the use of educational methods of art pedagogy through the inclusion of athletes in the subject-spatial environment or in the processes of its creation. In both cases, it is important to create a feeling of the training environment as a common home for the coach and athletes, where it is natural to observe norms of behavior.

Secondly, the study of the history of the development of teams showed that the managerial task of rationalizing the use of premises often prevails over the organizational and pedagogical task of creating an aesthetically unique educational environment. The universalization of the environment leads to its insufficient specialization in relation to the type of sport and a specific team, which reduces the effectiveness of art pedagogy methods.

Thirdly, it is likely that the aesthetic deficiencies of the training process associated with conducting classes in multipurpose halls created the preconditions for the transformation of trainers' personal homes into "house museums", repeatedly mentioned in the literature. In this way, an additional environment is aestheticized and specialized, without its inclusion in the educational process, apparently, the profile activity of athletes will have less influence on their education.

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