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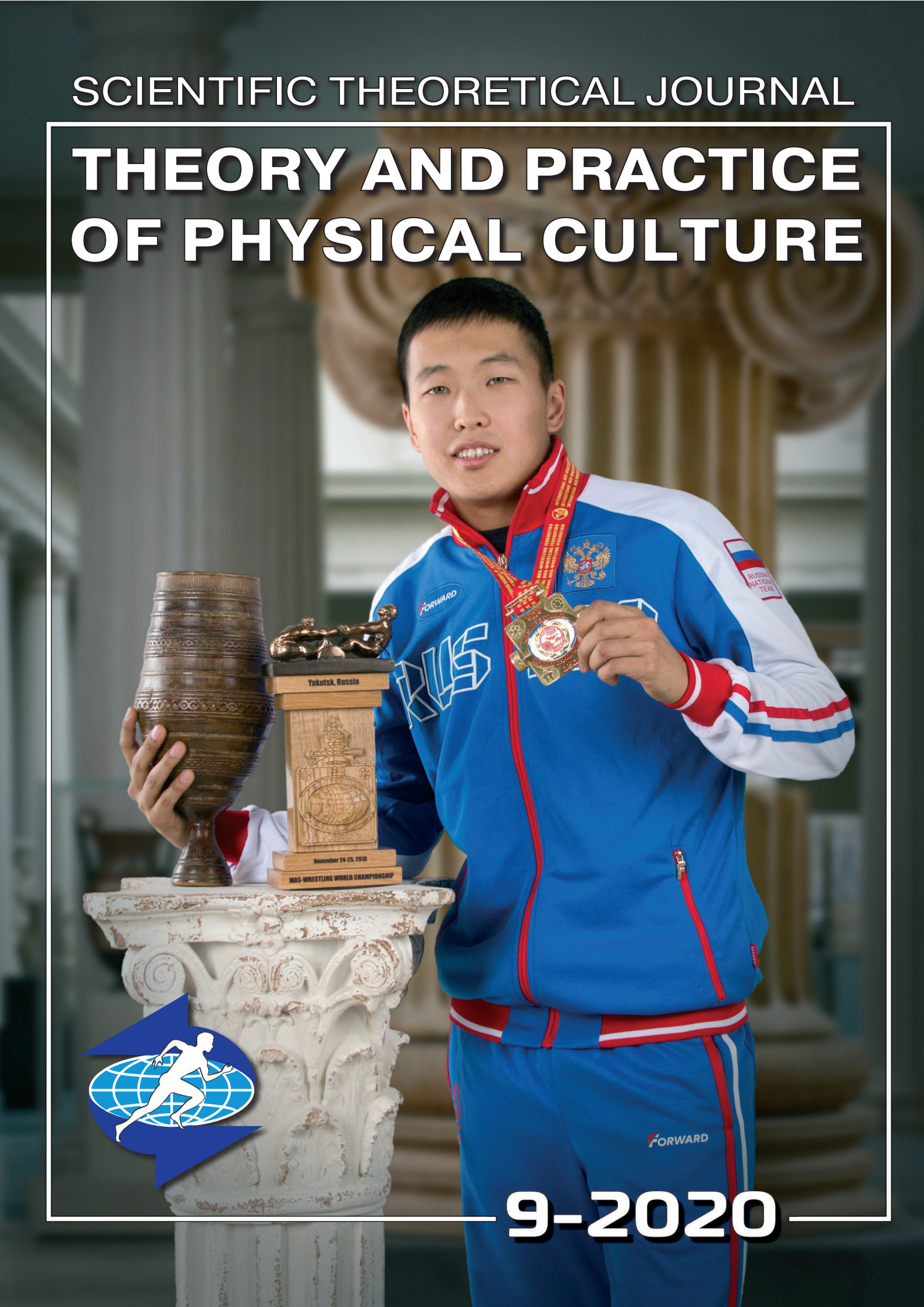

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Contents

NATIONAL WOMEN'S WRESTLING ELITE: COMPETITIVE PERFORMANCE RATING AND MONITORING SYSTEM IMPROVEMENT MODEL

UDC 796.015

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Abstract

Objective of the study was to explore the ways to improve the competitive performance indexing and monitoring **system applied in the elite women's wrestling sports.**

Methods and structure of the study. A database for the study was mined by analyses of the 2018 Russian Women's Freestyle Wrestling Championship's (RWFWC) video replays and competitive reports (referees' protocols) to rate performance of the strongest national female wrestlers (n=124) in 10 weight classes. We analyzed 146 bouts of the championship to obtain the following most informative competitive performance indices: total tactical/ technical actions; total score; specific/ total competitive success rates (by the weight classes); average tactical/ technical actions per bout and per minute; scoring attack interval; average bout time; tactical skill ratio; and technical mastery ratio.

Results and conclusions. Summarizing our findings on the ways to improve the competitive performance rating and monitoring system for the national women's wrestling elite, we have grounds to state that the proposed champion's competitive performance index rating and benchmarking method offers a sound reference base for comparative competitive performance analyses and rankings sensitive to the individual competitive performance indices and progress needs of every athlete. It should be also mentioned that the top competitive successes in this sport discipline will be secured not only by the sub-maximums on every specific competitive performance index scale but also the optimal individual competitive performance indices combinations for success in the national championships.

Keywords: *tactical/ technical actions, test rates, monitoring, women wrestler, competitive performance indices, analysis, championship, system, structure, standard, weight class, scoring attack interval, 2018 Russian Women's Freestyle Wrestling Championship's (RWFWC), tactical skill ratio; technical mastery ratio.*

Background. Competitive performance in modern wrestling is rated using combinations of competitive performance indices that include the competitive success rates (wins and standings) plus many other progress rating factors. Such performance test rates are indicative of the training system priorities, success of interventions to the training process and actual athletic progresses. The competitive performance indices may vary in a wide range depending on the wrestlers' specific and summarized competitive performance aspects, competitive situations and conditions and the actual competitive progress (Tarakanov B.I., 2000; Avdeev Y.V. et al., 2009; Goranov B. et al., 2011; Nerobeev N.Y., 2014; Apoiko R.N., 2016; Karelin A.A., Tajmazov A.B. et al., 2016).

Objective of the study was to explore the ways to improve the competitive performance indexing and monitoring system applied in the elite women's wrestling sports.

Methods and structure of the study. A database for the study was mined by analyses of the 2018 Russian Women's Freestyle Wrestling Championship's (RWFWC) video replays and competitive reports (referees' protocols) to rate performance of the strongest national female wrestlers (n=124) in 10 weight classes. We analyzed 146 bouts of the championship

Table 1. *Competitive performance indices of the 2018 RWFWC champions*

Weight class, kg	Wins	Score	Total tactical/ technical actions		Points		Scoring attack interval, s	Tactical skill ratio, points	Technical mastery ratio, points
			per bout	per min	per bout	per min			
50	4	2,13	3,75	0,93	8,00	1,99	64,3	0,68	0,74
53	4	1,88	4,00	0,96	7,50	1,81	62,2	0,80	0,79
55	4	1,58	4,00	0,67	6,33	1,06	90,0	0,80	0,76
57	4	1,88	4,25	0,88	8,00	1,66	67,9	0,85	0,89
59	4	1,94	4,25	1,00	8,25	1,94	60,0	0,81	0,80
62	3	2,18	3,66	1,63	8,00	3,56	36,8	1,00	1,00
65	3	2,00	3,67	0,63	7,33	1,26	95,5	0,73	0,73
68	3	1,60	3,33	0,56	5,33	0,89	108,0	0,91	0,89
72	5	2,38	2,60	0,73	6,20	1,75	83,1	0,72	0,79
76	3	2,17	4,00	0,86	8,67	1,86	70,0	0,86	0,93
M		1,97	3,75	0,89	7,36	1,78	73,8	0,82	0,83
m		0,26	0,54	0,35	1,08	0,87	23,1	0,10	0,08
σ		0,08	0,17	0,11	0,34	0,27	7,3	0,03	0,03

to obtain the following most informative competitive performance indices: total tactical/ technical actions; total score; specific/ total competitive success rates (by the weight classes); average tactical/ technical actions per bout and per minute; scoring attack interval; average bout time; tactical skill ratio; and technical mastery ratio. These competitive performance indices were calculated as recommended by the relevant methods by Apoyko R.N., Tarakanov B.I., 2015; Vorobyeva N.V., Karelin A.A., Tarakanov B.I., 2018. A special priority in the analyses was given to 37 bouts of the RWFWC champions in every weight class.

Results and discussion. Having analyzed the RWFWC data, we found the following average competitive performance indices: competitive success rate: 2.00±0.03 points; average tactical/ technical actions per bout: 2.30±0.20; average score per bout: 4.60±0.31; average tactical/ technical actions per minute: 0.58±0.08; average score per minute: 1.15±0.17; scoring attack interval: 108.2±3.9s; average bout time: 4 min 06±11s. It should be noted that the success rates and average bout times were found fairly equal for the sample, whilst the competitive performance indices were better for the winners. This finding urged us to further analyze the database with a special emphasis on the national champions' competitive performance indices applicable as the benchmarks/ reference values. Given in Table 1 are the individual averaged competitive performance indices of the RWFWC champions in every weight class.

As demonstrated by Table 1, the RWFWC champions scored high on every competitive performance index scale, although the individual data variations were quite wide. Thus the competitive success rates made up 1.60 to 2.38 points (1.97± 0.08 points on average); total tactical/ technical actions per bout was estimated at 2.60 to 4.25 (3.75±0.17 on average); tactical/ technical actions per minute: 0.56 to 1.63 (0.89±0.11 on average); score per bout: 5.33 to 8.67 (7.36±0.34 on average); score per minute: 0.89 to 3.56 (1.78±0.27 on average); scoring attack interval: 36.8s to 108.0s (73.8s on average); tactical skill ratio: 0.68 to 1.00 (0.82 points on average); and technical mastery ratio: 0.73 to 1.00 (0.83 points on average). The data variations were found indicative of the individual differences in the competitive performance of elite wrestlers even in case of equal competitive success rates.

Table 2. *Competitive performance index benchmarks for the national women's wrestling elite*

Competitive performance indices	Benchmarks				
	Excellent	Good	Medium	Low	Poor
Competitive success, score	2.3 plus	2,1-2,2	1,9-2,0	1,7-1,8	1,6 minus
Tactical/ technical actions per bout	4,3 plus	4,0-4,2	3,6-3,9	3,2-3,5	3,1 minus
Tactical/ technical actions per minute	1,3 plus	1,1-1,2	0,8-1,0	0,6-0,7	0,5 minus
Score per bout	8,6 plus	7,8-8,5	7,0-7,7	6,2-6,9	6,1 minus
Score per min	2,6 plus	2,1-2,5	1,5-2,0	1,0-1,4	0,9 minus
Scoring attack interval, s	69 plus	61-70	71-80	81-90	91 minus
Tactical skill ratio, points	0,90 plus	0,85-0,89	0,80-0,84	0,75-0,79	0,74 minus
Technical mastery ratio, points	0,91 plus	0,86-0,90	0,81-0,85	0,76-0,80	0,73 minus

Table 3. *National women's wrestling elite ranked by the competitive performance indices*

Weight class, kg	Scores								Total score	Rank
	Success rate	Total tactical/ technical actions		Points		Scoring attack interval, s	Tactical skill ratio	Technical mastery ratio		
		per bout	per min	per bout	per min					
50	3	3	4	3	4	5	1	1	24	6
53	4	3	3	3	4	5	3	2	27	5
55	4	2	1	2	1	1	3	2	16	7-10
57	5	3	4	3	3	5	4	4	31	2-3
59	5	3	5	3	3	5	3	2	29	4
62	3	5	4	5	5	5	5	5	37	1
65	3	2	3	2	3	1	1	1	16	7-10
68	2	1	1	1	1	1	5	4	16	7-10
72	1	2	1	3	5	1	1	2	16	7-10
76	4	3	5	3	5	2	4	5	31	2-3

The above data and analyses were used to put together a set competitive performance index benchmarks on a five-point scale with an analysis of the mean values and standard deviations: see Table 2.

As demonstrated by Table 2, the set of comparative competitive performance index benchmarks for the women's wrestling elite make it possible to profile the individual competitive performance and objectively compare and rank all the national leaders to find the key competitive performance indices critical for success. Given in Table 3 is the national women's wrestling elite ranking by these competitive performance indices.

Having analyzed the data given in Table 3, we see that the specific and total competitive performance indices may differ even when the competitive success rates are virtually the same. Of special interest are the rating points of the 62kg weight class winner who demonstrated maximums on every competitive performance index scale with the 37 points scored in total that is the group highest level. She is followed by the 57kg and 76kg weight class winners, both with 31 points. Ranked moderate are the total scores of the 59kg, 53kg and 50kg weight class winners with their 29, 27 and 24 points, respectively. The lowest specific and total scores of 16 points were made by the 55kg, 65kg, 68kg and 72kg weight class winners. These data show that the elite women wrestlers may be highly successful even with the relatively moderate competitive performance indices.

Conclusion. Summarizing our findings on the ways to improve the competitive performance rating and monitoring system for the national women's wrestling elite, we have grounds to state that the proposed champion's competitive performance index rating and benchmarking method offers a sound reference base for comparative competitive performance analyses and rankings sensitive to the individual competitive performance indices and progress needs of every athlete. It should be also mentioned that the top competitive successes in this sport discipline will be secured not only by the sub-maximums on every specific competitive performance index scale but also the optimal individual competitive performance indices combinations for success in the national championships.

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ROLE OF PSYCHOPHYSIOLOGICAL STATE IN COMPETITIVE ACTIVITY OF TEAM ATHLETES

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Abstract

Objective of the study was to determine a differentiated impact of psychophysiological parameters of team athletes on their competitive activity as well as determine the possible combination of these parameters that would ensure stable competitive results.

Methods and structure of the study. The vibration imaging technology with the use of VibraMed10 software was applied as the main research method. Sampled for the study were 16 skilled rugby players. At the first stage, we assessed the subjects' psychophysiological state at rest. At the second stage, the efficiency of performance of tactical-technical actions of the rugby players was recorded during the game. The efficiency of their technical-tactical actions was evaluated by the positive and negative actions: successful scrums, lineouts, rucks, mauls, territories won. This was followed by a comparative analysis of the game performance and individual parameters of the players' psychophysiological state.

Results and conclusions. According to the results of registration of the subjects' technical-tactical actions, all rugby players were divided into 4 groups: those with the high level of game performance - from 60 to 80%, with the average level - from 40 to 60%, with the low level - from 20 to 40%, and with the unsteady level. The rugby players with 20-40% efficiency of technical-tactical actions were charismatic and were characterized by high self-regulation, with a marked lack of aggressiveness and energy level in particular. The athletes with 40-60% efficiency of game performance demonstrated a higher level of aggressiveness and energy level against the background of stable rates of charisma and self-regulation. The subjects with 60-80% efficiency of technical-tactical actions were characterized by a unidirectional movement towards an increase in aggressiveness, self-regulation, and energy level.

It was found that each individual psychophysiological indicator in team athletes does not guarantee the successful technical-tactical performance. It is only owing to the balance and interdependence of several incentives (in this case, aggressiveness, energy level, self-regulation) that steady competitive results can be ensured.

Keywords: *psychophysiological state, vibration imaging technology, competitive performance, skilled athletes from team sports.*

Background. Immediate diagnostics of athletes' psychophysiological state on 10 indicators using a vibration imaging technology makes it possible to study the impact of individual parameters of their psychophysiological state on their technical and tactical progress. Monitoring of the psychophysiological state of rugby players during top-ranking competitions is key to pursuing a planned goal. However, to determine athletes' fitness for important matches we need to identify and study the impact of individual parameters of their psychophysiological state on the efficiency of their technical and tactical actions. The earlier studies helped identify 10 major psychophysiological parameters: stress, anxiety, danger, tranquility, energy level, self-regulation, inhibition, aggressiveness, neuroticism, charismatics [2, 3]. This choice is due to

the fact that each of the identified parameters reflects both the psychological characteristics of athletes and their physiological and behavioral characteristics.

Objective of the study was to determine a differentiated impact of psychophysiological parameters of athletes from team sports on their competitive activity as well as determine the possible combination of these parameters that would ensure stable competitive results.

Methods and structure of the study. The vibration imaging technology with the use of VibraMed10 software was applied as the main research method [4]. The efficiency of their technical-tactical actions was evaluated by the positive and negative actions: successful scrums, lineouts, rucks, mauls, territories won. This approach is based on the principle of ball possession and its use by the attacking team, where the technical and tactical actions are conditionally divided into 4 groups: Group 1 - standard positions: place-kick, 22-meter drop-out, set scrum, lineout; Group 2 – semistandard provisions: ruck, maul; Group 3 – handling the ball: attacks by the defenders, attacks by the attacking players, attacks by the defenders with the involvement of the attacking players, backline game (analysis of all attacks based on the concept of the channel system in the game organization); Group 4 - kicking: tactical strikes, attacking strikes; short and high kick, shots on goal, drop goals and backline kicking [1].

This was followed by a comparative analysis of the game performance and individual parameters of the rugby players' psychophysiological state.

Results and discussion. To solve the first stage problem, the current psychophysiological state of the rugby players was tested; the test results are presented in Table. 1.

The baseline data obtained indicated no statistically significant deviations in the resting rates of the subjects. Almost all of them were within the normal distribution range. At the second stage, the psychophysiological state of the rugby players was tested before the competitions, during which we rated their technical and tactical skills and determined the percentage of successfully performed technical elements. The results of the identified ratios are presented in Table 2.

On the one hand, the key to achieving the set goal is to change the athletes' psychophysiological characteristics affected by the high psycho-emotional tension caused by intense competitive stresses, and on the other hand, how and how much they affect the efficiency of their technical-tactical actions. The technical and tactical performance rates will make it possible to determine more precisely the importance of each individual psychophysiological parameter in the overall sports result.

The data obtained showed statistically significant differences in the athletes' ability to successfully perform the technical-tactical actions depending on their overall psychophysiological state, which, due to the fierce confrontation with the opponent, can also be changed rapidly, and that is what happens on the playing field.

Therefore, a rapid change in the overall psychophysiological state of the rugby players is seen as a short-term bodily response to the rapidly changing game situations. Under such fast-changing conditions, even skilled athletes act in different ways. For example, out of 16 participants of the study, only 5 subjects demonstrated a 60-80% technical and tactical progress, which was considered a high level of sports mastery. The technical-tactical skills in the other 4 rugby players ranged between 40-60%, which could easily be attributed to the average level. The technical and tactical performance of another 4 rugby players was estimated at 20-40%, which could not be considered satisfactory. We also identified another category of athletes, whose technical and tactical

Table 1. *Psychophysiological test results of skilled athletes from team sports at rest (n=16)*

Parameters	M±S	Vi (S/M)	bMin	bMax
Aggressiveness	43.70±6.96	15.98	20.00	50.00
Stress	27.50±3.21	11.90	20.00	40.00
Anxiety	28.92±8.95	33.67	15.00	40.00
Danger	33.36±4.03	12.26	20.00	50.00
Tranquility	63.59±6.95	11.60	50.00	100.00
Charisma	76.41±4.12	5.50	40.00	100.00
Energy level	24.03±3.89	16.54	10.00	50.00
Self-regulation	69.75±4.57	6.65	50.00	100.00
Inhibition	17.96±3.42	18.62	10.00	25.00
Neuroticism	34.16±12.23	35.98	10.00	50.00

Legend: M – mean value of the parameter within a given period of time; S – standard deviation; Vi –variability of the parameter changes; bMin and bMax – minimum and maximum value of the parameter.

Table 2. *Competitive performance of team athletes depending on their psychophysiological state, %*

Parameters	20-40% (n=4)	40-60% (n=4)	60-80% (n=5)	Unstable efficiency (n=3)
	M±S	M±S	M±S	M±S
Aggressiveness	35.55±6.24	41.63±6.46	46.24±7.05	53.09±8.45
Stress	30.87±3.14	28.13±3.44	24.91±3.43	26.47±2.60
Anxiety	35.75±7.01	25.20±10.85	29.54±8.75	23.77±9.36
Danger	33.87±3.88	31.80±4.32	33.33±3.96	34.81±3.94
Tranquility	68.47±6.08	66.48±6.57	64.51±6.84	51.68±8.79
Charisma	71.28±5.26	76.65±5.95	81.21±2.88	74.93±2.20
Energy level	19.33±2.57	21.61±3.36	28.86±4.71	25.50±5.00
Self-regulation	69.96±4.28	71.01±5.24	72.58±4.30	63.09±4.51
Inhibition	15.54±2.47	18.87±4.17	17.87±3.36	20.14±3.78
Neuroticism	24.68±7.87	41.67±15.56	33.56±12.07	37.79±13.86

progress was unpredictable. There were 3 people in this category classified as a group of rugby players with unstable performance rates.

Due to the differentiation of the rugby players by the efficiency of their play activities, it became possible to conduct a comparative analysis of individual psychophysiological parameters of the athletes, which largely ensured their technical and tactical progress. As seen in Table 2, there was a clear trend of domination of some "special" parameters that significantly affect the outcome of the technical-tactical actions. These included aggressiveness, charismatics, energy level, and self-regulation. The overall picture of the apparent differences can be seen in the figure that shows the dynamics of these parameters in relation to the rugby players' performance. The figure illustrates that the range of the registered minimum and maximum technical and tactical performance rates ranges from 20 to 80%. In general, the dynamics depicted in the figure do not provide a complete picture of the impact of each of these parameters on the performance results. This is primarily due to the fact that the statistical averages for the whole sample cannot be informative and reliable in relation to a particular athlete. Therefore, it is necessary to study the dynamics of the psychophysiological parameters in the rugby players groups with similar technical and tactical progress rates.

The rugby players with 20 to 40% efficiency of the technical-tactical actions were characterized by charisma and self-regulation skills, with a marked lack of aggressive and particularly energetic behavior. The athletes with 40-60% efficiency demonstrated a higher level of aggressiveness and energy level with the stable values of charisma and self-regulation. When executing the technical-tactical actions during the competitions, the rugby players with 60-80% efficiency were found to have a unidirectional movement

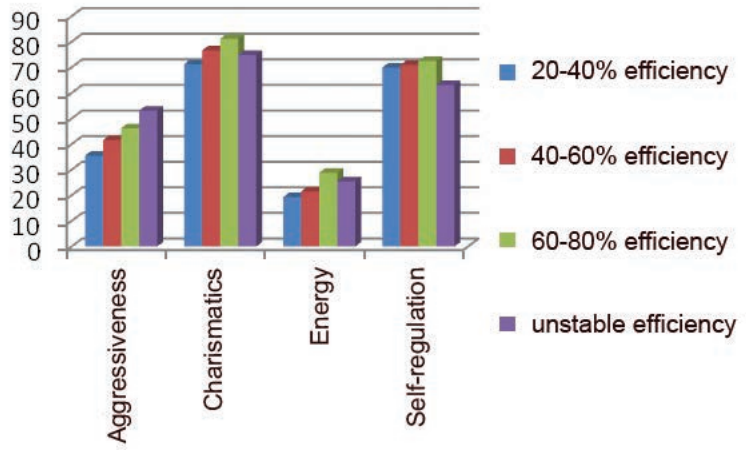

Diagram of psychophysiological parameters of rugby players depending on their competitive performance, %

towards an increase in the levels of aggressiveness, self-regulation, and energy level. This was a balanced movement. In the group of rugby players with unstable efficiency, the uneven results were on the plane of the undeveloped mechanism of regulation of own psychophysiological state and as a result - the lack of reliability in the execution of the technical-tactical actions. The athletes of this category can execute the game techniques against the background of increased aggressiveness, with the lack of energy resources to demonstrate success, or aggressiveness and energy level may be limited in size though not controlled by the inability to regulate their own state.

Based on the identified dynamics in the psychophysiological characteristics of the rugby players, we were able to single out the most significant ones. Thus, the balance and mutual conditionality of aggressiveness, self-regulation, and energy level make it possible to estimate the stability of the athletes' overall psychophysiological state in a competitive environment. In addition, the psychophysiological stability of the acquired state ensures the stable technical and tactical skills in a constantly changing environment.

The analysis results indicated that it is incorrect to claim that a particular psychophysiological parameter has an exclusive impact on the technical-tactical performance of rugby players. As shown in the study, the diagnostics of the current state of athletes must be approached from the point of view of a comprehensive assessment, in particular taking into account at least 3 essential parameters: aggressiveness, energy level, and self-regulation.

Conclusion. It was found that each individual psychophysiological indicator in athletes from team sports does not guarantee the successful performance of technical-tactical actions. It is only owing to the balance and interdependence of several incentives (in this case, aggressiveness, energy level, self-regulation) that steady competitive results can be ensured.

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'FITLIGHT' TRAINING SYSTEM BENEFITS FOR NEUROMUSCULAR CONTROL TRAINING IN BASKETBALL

UDC 796.323.2

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Abstract

Objective of the study was to test the fitlight simulation method to improve neuromuscular interconnections in basketball players.

Methods and structure of the study. The educational experiment was carried out from September 2019 to November 2019. Sampled for the study were 30 basketball players from Saint Petersburg Academy of the Investigative Committee and Saint-Petersburg State University of Architecture and Civil Engineering.

The Experimental Group subjects were to perform dribbling exercises on the fitlight simulator, which consisted of the wireless LED disks controlled by a tablet controller.

Results and conclusions. The Fitlight Training System for the neuromuscular control training in academic basketball was tested beneficial as verified by the EG progress of 36.2% (65.7s versus 41.9s in the pre- versus post-experimental NC tests) as a result of the special priority to the on-spot and on-the-move dribbling/ ball control trainings with the attention fixed on the color-triggered skills. The difficulty-stepping game situation modeling trainings resulted in the ball control errors being reduced by 43.6%, and ball losses almost halved down. The EG progress may be attributed to the Fitlight Training System assisted trainings that helped excel both the NC and tactile sensations in the group. The tested benefits of the Fitlight Training System assisted training model give us good reasons to expect it being highly efficient for the coordination skills training purposes in the academic basketball training systems.

Keywords: *basketball, movement coordination qualities, response rate, neuromuscular control, Fitlight Training System.*

Background. Modern basketball offers the following game positions for the players: point guard, shooting guard, center, small forward and power forward. Center (number 5) is normally the tallest and heaviest player who must fight for rebounds on the basket. Power forward's (number 4) main role is to intercept ball in defense and attack and back up the attack by a second scoring attempt; and the small forward's (number 3) major role is basically to score. Unlike the others, the forwards are dominantly very tall to fight for rebounds on the basket and need to have high mid- and long-distance scoring power. Shooting guard (number 2) has a few game goals, with a special priority to defense and attack support/ completion actions – that means that he must be perfect in passing, mid- and long-distance shooting and dribbling. And a point guard (number 1) is the key player that shall perfectly feel and control the situation and the teammates' positions and actions on the court. Point guard is the key attack design player who sets the stage for and manages the teamwork in attack and defense and, hence, shall immediately respond to every strong or weak action in the opponent team game by spearheading the counteractions. This player must be top skilled in high-speed dribbling and ball control.

As found by analyses of the 2018-19 Saint Petersburg University Competitions replays and formal statistics, the loser teams made 19.9±1.4 ball losses per game including 13.8±0.7 losses due to blunders in the ball control and dribbling. Every dribbling/ ball control error opens up a window of opportunity for the opponent for an immediate runway, with 93% easy scoring probability. A survey of the professional basketball coaches showed that most of them give a special priority to the high-speed game with multiple perfect passes and accurate shooting. This priority may be the reason for the ball control and dribbling skills being relatively neglected in trainings [3].

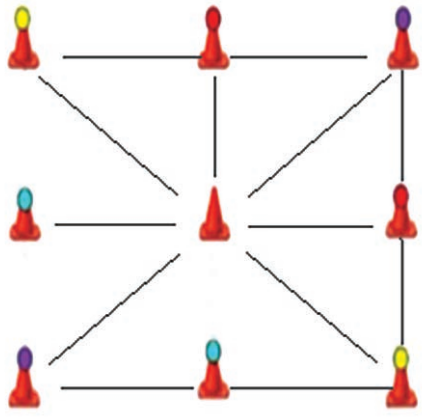
Objective of the study was to test benefits of a Fitlight Training System for the neuromuscular control training in academic basketball.

Methods and structure of the study. The educational experiment was carried out from September 2019 to November 2019. Sampled for the study were 30 basketball players from Saint Petersburg Academy of the Investigative Committee and Saint-Petersburg State University of Architecture and Civil Engineering. We sampled for the study academic basketball players from the Academy of the Investigative Committee (n=15) and Military Academy of Communications (n=15) including Candidate Masters of Sport (n=16), Class I players (n=13) and formally unqualified players (n=11). The sample was split up into Experimental Group (EG, n=15 from Academy of the Investigative Committee), and Reference Group (n=15 from the Saint-Petersburg State University of Architecture and Civil Engineering), with the group neuromuscular control skills tested by the pre-experimental tests as described hereunder.

The Fitlight Training System used for the EG trainings includes wireless LED disks controlled by a tablet and used as targets the athlete are required to touch or shade. It should be mentioned that the Fitlight Training System may be adapted for any sport discipline for the response speed, dexterity and coordination training purposes [4, 5], with the test data immediately processed on a real time basis to maintain due feedback with the trainee; with the individual performance data saved for further analyses [1, 2].

The Fitlight Training System test is designed as follows. The athlete will start with the ball from the central cone, with 8 other cones placed around 8m afar. In 5s since the start, LED on one of the cones will light up yellow, red, purple or turquoise two times at most per color. The athlete will rush to the lit cone, do what the color requires, touch the disc and come back to the center. In 3 seconds the next LED will light up, and so the test goes on until all 8 tasks are fulfilled: see Figure. The colors may mean the following: red requires the athlete making a front dribbling sequence; yellow means the athlete should make a front under-left-leg dribbling sequence; turquoise means the same for the right leg; and purple requires the behind-the-back dribbling sequence. The ball control skills will be rated by the total successful test time. In case of an error, the athlete will be penalized by an extra color.

The EG trainings were designed as follows. Till the mid-September, the EG run the Fitlight Training System assisted on-spot ball control trainings. The color-specific tasks were the following: high/ low one-hand dribbling with the disc touched by the free hand; front one-hand dribbling with the disc touched by the other hand; under-the-leg ball dribbling with the disc touched by the free hand; and behind-the-back dribbling with the disc touched by the other hand. Since the mid-September (next two weeks), the Fitlight Training System assisted trainings were color-programmed by the coach using 2-4 colors only: see Figure 1. In October, the EG was trained to control ball on the right-left moves in a 5m range on a single-color signal plus run 4-8 color tests on the coach-programmed Fitlight



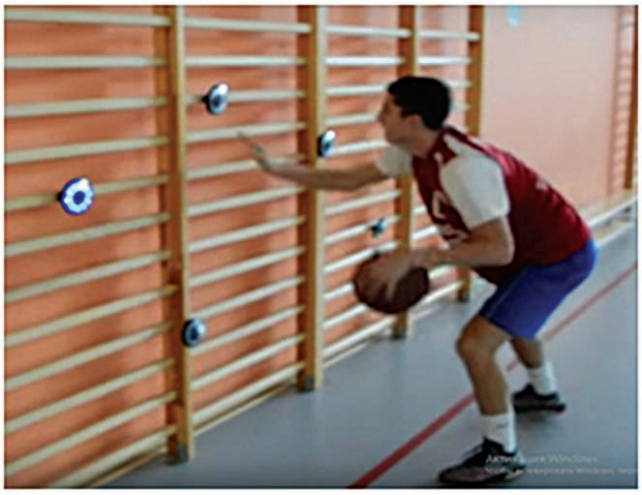


Figure 1. *Fitlight Training System: training pattern*

Table 1. *Pre- versus post-experimental neuromuscular control test data of the EG and RG*

Test	RG, n=15	EG, n=15
Ball control time test, s	Pre 64,9±3,5 Post 57,7±1,9	Pre 65,7±3,9 Post 41,9±1,5(*)
Ball control errors, count	Pre 3,8±0,3 Post 3,1±0,3	Pre 3,9±0,3 Post 2,2±0,4(*)

Note: (*) $p<0.05$ for the pre- versus post-experimental EG vs. RG test data

Training System. Then, till mid-November, the EG run the coach-programmed Fitlight Training System (4-8 color) trainings, with every color requiring two-three actions (e.g. front, under-the-leg and behind-the-back dribbling actions); and since mid-November, in the other two weeks, the difficulty was stepped by 3-4m on every disc, with the 8-12 colors per training cycle.

The RG was trained for these three months as required by the standard academic basketball training curriculum.

Results and discussion. The Fitlight Training System assisted trainings were found beneficial for the neuromuscular control as verified by the significant progress EG versus RG demonstrated by the pre- versus post-experimental tests: see Table 1 hereunder.

Conclusion. The Fitlight Training System for the neuromuscular control training in academic basketball was tested beneficial as verified by the EG progress of 36.2% (65.7s versus 41.9s in the pre- versus post-experimental neuromuscular control tests) as a result of the special priority to the on-spot and on-the-move dribbling/ ball control trainings with the attention fixed on the color-triggered skills. The difficulty-stepping game situation modeling trainings resulted in the ball control errors being reduced by 43.6%, and ball losses almost halved down. The EG progress may be attributed to the Fitlight Training System assisted trainings that helped excel both the neuromuscular control and tactile sensations in the group. The tested benefits of the Fitlight Training System assisted training model give us good reasons to expect it being highly efficient for the coordination skills training purposes in the academic basketball training systems.

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SIMULATION OF WEIGHTLIFTING TRAINING PROCESS

UDC 796.015

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Abstract

Objective of the study was to theoretically substantiate and analyze practical benefits of a new training model for the weightlifting elite.

Methods and structure of the study. We analyzed for the purposes of the study the relevant study reports on the modern training technologies and human body adaptability issues in extreme weightlifting training cycles. We gave a special priority to the specific cellular-level adaptation mechanisms in our study. The study included findings of a long-term new training model testing experiment. The model was designed with account the theoretical and practical research findings analyzed herein.

Results and conclusions. In the experimental training model design, the most important task was to ensure selective hypertrophy of the fast muscle fibers in those muscle groups that determine the working effect of the competitive exercises. We also considered the mechanisms of reaction of the endocrine system to stress loads and the targeted assimilation of hormones into the "target cells" - in this case, into the fast muscle fibers.

The study made it possible to systematize the factors that promote the synthesis of nucleic acids and proteins in the muscle fibers, on which the intensity of myofibril mass accumulation depends, and which, in turn, affects the strength of muscle contraction. We also studied the factors that suppress the effects of intracellular synthesis of structural proteins and reduce the intensity of accumulation of myofibril mass.

The new weightlifting training model piloting experiment showed the model being beneficial as verified by the competitive progress of the Kazakhstan Republican weightlifting elite that won since then quite a few medals at the Asian Weightlifting Championships, Asian Games, World Championships and Olympic Games.

Keywords: *sports training theory, training system priorities, training system efficiency, weightlifting elite, muscle group, muscle fibers.*

Background. In view of the growing competitiveness of the modern sports, the research communities take efforts to advance the theoretical, methodological and practical methods to improve the efficiency of the training systems. The national weightlifting team gives a high priority to the new training tools development and practical application initiatives. These developments are designed to capitalize on the best modern sports training technologies and practical experiences of the leading weightlifting experts and sport elite [6].

Objective of the study was to theoretically substantiate and analyze practical benefits of a new training model for the weightlifting elite.

Methods and structure of the study. We analyzed for the purposes of the study the relevant study reports on the modern training technologies and human body adaptability issues in extreme weightlifting training cycles. We gave a special priority to the specific cellular-level adaptation mechanisms in our study. The study included findings of a long-term new training model testing experiment. The model was de-

signed with account the theoretical and practical research findings analyzed herein.

Results and discussion. Individual progress in the elite weightlifting sport is known to depend on the competitive skills and special physical qualities. As found by many studies, it is the maximal and explosive strength rates that determine the competitive performance dynamics closely correlated with the weightlifting competitive success rates [9]. Therefore, it is commonly understood that the competitive progresses are largely determined by the maximal and explosive strength training elements focused on the relevant key muscle groups. A special priority will also be given to the specific speed-strength qualities mobilized in the competitive weightlifting events [4].

As found by the relevant studies, maximal strength building results in hypertrophy of the fast and slow muscle fibers, whilst explosive strength grows with selective hypertrophy of the fast muscle fibers [13]. No wonder that the modern weightlifting training systems give a special attention to the fast muscle fibers hypertrophy encouraging practices focused on the key muscle groups. Theoretical analyses have found that a competitive progress in the weightlifting sport will be secured, among other things, by the efforts to accumulate the myofibrils mass on the whole and the fast muscle fibers mass in particular. This goal is ranked high among the priorities of the long-term adaptability building efforts with application of specific loads [5] to attain the competitive progress objectives of the training system [14].

High-intensity power trainings are known to generate and fast accumulate free creatine, lactate, hydrogen ions and ADP in muscle cells and reduce the pH [8]. This process triggers labilization of the MC membranes, cell nucleus and lysosomes to increase the membrane permeability for hormones, enzymes and nutrients (amino acids, lipoproteins and glycogen). A few cellular-level process studies have shown that the adaptive hormones (adrenaline and hydrocortisone) and high density lipoproteins penetrating into the sarcoplasm activate the lysosome infiltration to the cell nucleus [7]. The more the lysosome and cell nucleus membranes are labilized, the more lysosomal enzymes (proteinase, acid phosphatase, etc.) penetrate into the nucleus. When the lysosomal enzymes enter the nucleus, the DNA molecule will split and mRNA will be synthesized in a wide range of proteins. Having entered into the sarcoplasm, mRNA binds to ribosomes to form polysomes facilitating synthesis of protein molecules. The protein synthesis and new organelles (including myofibrils) formation rate depends on the number of newly formed polysomes and intensity of the amino acids penetration into the cell – which in its turn depends on how labilized the membrane is and how high the blood amino acids are. It is also important that the rate of amino acids penetration through the membrane largely depends on anabolic hormones [3]; plus the protein synthesis intensity depends on the immune cells found in the sarcoplasm [7].

It should be also emphasized that prolonged high-intensity practices may extensively damage the muscle cells and suppress synthesis of nucleic acids and proteins – thereby undermining the training process efficiency [8]. As found by some studies, a relatively long action of highly-concentrated lactic acid may result in destruction of different protein structures and even some points in the cell membrane; with such destructions activating specific organelles dominated by lysosomes. This process releases specific enzymes to fragment the messenger RNAs in the cell sarcoplasm and form active ribosomes and polysomes. With reduction of active polysomes, synthesis of protein is inevitably suppressed and the myofibrils mass accumulation process is slowed down with the relevant regresses in the strength training process.

Based on the above theoretical analysis, we designed a new weightlifting theoretical and practical training model including a base micro-cycle sub-model [11]. A key practical priority of the new model is that a weekly training is planned on Friday to mimic as close as possible the actual competitions, with the classical weightlifting practices run with extreme weights regardless of the micro-cycle type. Practical tests and weightlifting results in such trainings are used as the progress benchmarks to track the adaptation process and make prudent training system management decisions. Scientific data show that such training are highly effective for fast motor units activation associated with a high stress on the central nervous system and a resultant activation of the endocrine system that increases blood hormones for up to three days [2]. A few researchers report that the key hormone activity form is the kinetic (triggering) action that mobilizes the relevant target organs – mostly by their structure and functions being influenced via the genetic apparatus of cells [3].

Therefore, we arrived to the idea that the target cells need to be activated to capture hormones within the above time. In case of weightlifting, it is the fast muscle fibers that shall be targeted. The fast muscle fibers may be activated by a short-term high-intensity sport-specific training workloads, with the physiological stress increasing the muscle cell membrane permeability for hormones and nutrients [7, 8]. The latter will activate the muscle fibers genetic apparatus on a selective basis and increase the intensity of the nucleic acids and proteins synthesizing process. With this purpose, the Saturday microcycle model (after the stress training) offered a high-intensity (80-85% sub-maximal) fast muscle fibers activation training tools rather than a traditional rehabilitation day. This new model was tested in the national team training systems, although it still needs a sound experimental

basis to verify the expected benefits dominated by the individual competitive success rates.

One more important point that shall be considered by the weightlifting training system design theory and practice is the virtually linear correlation between the contractile protein (actin in the thin fibers) in myofibrils and the total creatine in the muscle cells [1]. There are good reasons to believe that when the physical training is dominated by the alactate energy supply mechanism, the total creatine will grow with the actin synthesis and myofibrils mass accumulation processes being intensified. When these processes are combined with the ATP re-synthesis intensification, the contractile capacity of the muscle fibers will grow as well [1].

The experimental weightlifting training model and relevant practical tools prioritize the alactate energy supply mechanism and exclude every training element that may add to the lactic acid accumulation process. As found by some study reports, the anaerobic-glycolytic energy supply mechanism activation always results in suppression of the alactate energy supply mechanism [10, 12] to effectively undermine the speed-strength training process efficiency.

Conclusion. The new weightlifting training model piloting experiment showed the model being beneficial as verified by the competitive progress of the Kazakhstan Republican weightlifting elite that won since then quite a few medals at the Asian Weightlifting Championships, Asian Games, World Championships and Olympic Games.

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TEAM SPORTS AND ACTIVE GAMES TO IMPROVE SPEED-STRENGTH TRAINING OF YOUNG VOLLEYBALL PLAYERS

UDC 796.325

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Abstract

Objective of the study was to test benefits of an active games prioritizing speed-strength training model for the 10-12 year old volleyball players.

Methods and structure of the study. We tested, for the purposes of the study, physical fitness with the speed-strength rating standing long jump and Abalakov standing high jump tests; strength rating push-up tests and the speed rating 30m sprint tests [1]. Sampled for the tests (run at "Taktika" Volleyball Center in 01.09.2017 to 31.05.2018) were the 10-12 year-old volleyball players (n=16) split up into Experimental and Reference Groups (EG, RG). The experimental training model was designed to emphasize the speed-strength trainings in the physical fitness progress domain. Based on the pre-experimental physical fitness and speed-strength test data, we developed a customizable active games prioritizing speed-strength training model for the EG.

Results and conclusions. The use of active games to develop the young volleyball players' speed-strength qualities yielded significant results. The findings made it possible to substantiate the pedagogical conditions that are necessary for the effective management of the process of speed-strength training of junior volleyball players. The most preferable parameter for standardizing the speed-strength loads in volleyball is the time of heart rate recovery to 120-130 bpm.

The new active games prioritizing speed-strength training model for the 10-12 year old volleyball players was tested beneficial as its facilitates the long-term age-specific adaptation to the training workloads with good progress in the physical fitness, technical skills and speed-strength domains.

Keywords: *speed-strength training, physical fitness, active games, volleyball groups, competitive performance, 10-12 year old athletes.*

Background. Physical activity is known to improve functionality of every bodily system and facilitate harmonious physical progress and natural intensive maturation with improvements in every psycho-physiological function and individual physical resource accumulation process. A special role in this process is played by critical periods most favorable for functional progress [2]. Regular trainings are known to help improve motor response speeds among other qualities, with the 9-12 year period known to be the most sensitive for such trainings when the response speed grows particularly fast. When the response speed trainings are neglected or ineffective in this period, the accumulated backlog may be hardly liquidated later on.

Athletic physical qualities on the whole and the response speed in particular are critical for progress in the sport-specific motor skills and their time-efficiency [5]. Thus the modern volleyball techniques give a special priority to every game technique and tactical action being fast enough for success. High-speed actions in volleyball may be classified into the active field control footwork; quick and unexpected ball control actions; and teamwork actions including efficient tactics i.e.

Table 1. *Pre- versus post-experimental physical fitness test data of the sample*

Tests	Pre-experimental					Post-experimental					
	Group	X	δ	M	V	Group	X	Δ	m	V	t
30m sprint, s	EG	6,86	0,38	0,076	5,5%	EG	5,56	0,38	0,08	6,8%	13,2
	RG	7,0	0,95	0,19	13,5%	CG	6,11	0,46	011	7,5%	4,04
2x15m shuttle sprint, s	EG	10,8	0,43	0,086	3,9%	EG	8,27	0,48	0,1	7,4%	19,4
	RG	10,7	0,68	0,14	6,3%	CG	8,53	0,51	0,1	6%	12,6
Standing long jump, cm	EG	107,8	9,38	1,87	8,7	EG	160	9,5	2,02	5,9%	18,9
	RG	102,8	11,8	2,35	11,4%	CG	143	11,7	2,84	8,2%	11,8
Quintuple long jump, cm	EG	6,00,2	43,5	8/69	7,2%	EG	801	31,4	6,7	3,9%	18,9
	RG	602,7	44,7	8,94	7,4%	CG	698	54,3	13,1	7,8%	6,03

timely responses to every game situation [4]. A special attention in this context is given to the modern sport research projects geared to improve speed-strength trainings in the junior volleyball sport. The projects will find new education and training models, methods and tools for volleyball beginners to facilitate fast technical and tactical progress, and one of the tools they apply is the modern active games of special appeal and benefits for children and adolescents due to their natural proneness to challenging physical exercises and physical activity geared to cope with obstacles and attain specific self-assertion competitive goals.

The common physical progress securing volleyball training systems in application to adolescent players make a special emphasis on speed, agility and speed-strength endurance elements in the active game formats. Since the modern active games toolkits are rather versatile, they may bring multisided physical and personality developmental benefits for the age-specific physical education systems [3, 5].

Objective of the study was to test benefits of an active games prioritizing speed-strength training model for the 10-12 year old volleyball players.

Methods and structure of the study. We tested, for the purposes of the study, physical fitness with the speed-strength rating standing long jump and Abalakov standing high jump tests; strength rating push-up tests and the speed rating 30m sprint tests [1]. Sampled for the tests (run at "Taktika" Volleyball Center in 01.09.2017 to 31.05.2018) were the 10-12 year-old volleyball players (n=16) split up into Experimental and Reference Groups (EG, RG). The experimental training model was designed to emphasize the speed-strength trainings in the physical fitness progress domain. Based on the pre-experimental physical fitness and speed-strength test data, we developed a customizable active games prioritizing speed-strength training model for the EG.

Special attention in the model design was given to the age- and gender-specific physical fitness and speed-strength training tools including competitive relay races, active games, active team exercises

Table 2. *EG and RG progress tests rates for the study period*

Tests	EG		RG	
	Total growth	Growth rate, %	Total growth	Growth rate, %
30m sprint, s	1,3	18,9	0,89	12,7
2x15m shuttle sprint, s	2,53	27,3	2,17	20,2
Standing long jump, cm	52,2	48,4	36,2	35,2
Quintuple long jump, cm	198,8	30,0	95,3	15,8
Harvard step test, points	10	16,8	6,9	11,6

Table 3. *Age-specific proportions of the speed-strength training tools in the new model, %*

Speed-strength training tools	Age groups, years		
	10	11	12
Top-speed sprints	40	35	30
Jumps and versatile jumping practices	25	20	15
Sprints, ball handling runs, ball juggling on the move	15	20	25
Response training ball exercises on the move	15	15	20
Training machines assisted and dumbbell practices	5	10	10

with special multi-/off-/up-jumping, throwing and weightlifting practices including push-ups, pull-ups, fitball juggling and other exercises, plus the muscle-group-focused exercises to train abs, thighs and dorsal muscles. Speed qualities were trained by multiple maximal/ sub-maximal intensity repetitions of speed exercises with a special focus on fast responses, plus difficulty-stepping (accelerated ascends, upstairs running etc.), top-pace limbs workouts, skipping rope exercises, relay races etc. Every practice included active game elements to secure harmonized progress in the speed, strength and speed-strength qualities [6]. We run special training sessions focused on these qualities once a week; whilst on the whole the trainings took 2 academic hours 3 times a week. The sample progress was tested by the pre- versus post-experimental physical fitness and speed-strength tests.

Results and discussion. Benefits of the active games prioritizing speed-strength training model for the 10-12 year old volleyball players are demonstrated in Tables 1 and 2. Given in Table 3 are the age-specific proportions of the speed-strength training tools in the new model.

Prior to the model design, we ran a questionnaire survey to rank the priority age-group-specific speed-strength training tools to obtain the following ranking (in a descending order by importance): (1) Careful selection and prudent management of the training process for the whole training period; (2) High-quality material/ technical provisions for the trainings; (3) Prudently customized/ individualized speed-strength training tools; (4) Special knowledge and skills advancement courses for the volleyball coaches, with an emphasis on the age-specific speed-strength training tools; (5) Prudent time-efficient management of the speed-strength trainings; (6) Efficient age-specific proportions of the speed-strength training tools; (7) Selecting the most effective speed-strength training tools; (8) Progress facilitating moral and psychological climate in the volleyball team; (9) Methodologically grounded design of the speed-strength training process; and (10) Ample supply of training machines, weights, dumbbells, barbells and other equipment for the speed-strength trainings.

The physical fitness and speed-strength trainings of the 10-12 year old volleyball players shall be sensitive to their individual responses to the speed-strength workloads, with a special priority to the rehabilitation-control heart rate tests. We recommend the speed-strength training workloads for the age group being controlled by the heart rate rehabilitation time needed to achieve the 120-130 beats/ min threshold as follows:

- The controlled-intensity-and-pace speed-strength practices are recommended to be limited by 10-15s and repeated 5-8 times; and jumping practices limited by 12-16s and repeated 7-9 times;
- Throwing practices shall be limited by 20-35s and repeated 14-20 times in every round;
- Rest breaks in between the speed-strength practices shall be 50-60s long.

We found the throwing active games prioritizing speed-strength trainings being most beneficial and safest when they are run 2 times a week, with three serial repetitions; whilst the jumping active games may be run 3 times a week with six serial repetitions. It should be emphasized that the training tools need to be prudently customized and individualized otherwise their benefits may widely differ.

Conclusion. The new active games prioritizing speed-strength training model for the 10-12 year old volleyball players was tested beneficial as its facilitates the long-term age-specific adaptation to the training workloads with good progress in the physical fitness, technical skills and speed-strength domains.

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SKILL-LEVEL-SPECIFIC PHYSICAL FITNESS MODEL FOR WINTER POLYATHLON

UDC 796.015.682

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Abstract

Objective of the study was to analyze benefits of a skill-level-specific special strength and speed-strength training model for elite polyathlon.

Methods and structure of the study. The experiment was carried out at the Department of Physical Education of Kazan State Power Engineering University. The subjects were tested during the competitions, when their physical and physiological possibilities were maximized. Sampled for the study were 20 qualified athletes (males): Class I - 11 subjects; Candidate Masters of Sport and Masters of Sport - 9 subjects, who were divided into 2 subgroups according to their qualifications.) The model testing experiment was timed to a competitive cycle when the sampled athletes were subject to a few strength and speed-strength tests. The strength tests included the carpal dynamometry tests and suspension and pull-ups tests on a horizontal bar. And the speed-strength qualities were tested by the traditional standing long jump and 1min jumping rope test.

Results and conclusions. In the course of muscle training, the strength fitness rates in Candidate Masters of Sport and Masters of Sport were considerably higher than in Class I athletes. The speed-strength indicators in Candidate Masters of Sport and Masters of Sport did not differ significantly in comparison with those Class I athletes. Based on the findings, it can be concluded that in the planning of training loads in the annual training cycle, it is important to maintain the achieved level of performance of motor actions and on this basis develop the speed-strength qualities, thus increasing their effectiveness, which will further on lead to the achievement of high sports results and more stable competitive performance.

Keywords: *polyathlon, strength, speed, speed-strength, skill level, special strength training tools, physical fitness, Candidate Master of Sport, Master of Sport.*

Background. Modern winter polyathlon includes shooting, pull-ups (men), prone push-ups (women), and cross-country ski race. It is rather traditional for the modern polyathlon training systems to give special attention to the special strength training tools geared to (1) secure the best individual physical fitness control scenarios as dictated by the seasonal events; and (2) secure progress in the specific event/ skill set [5]. These requirements have largely changed the training traditions, particularly in the elite sport division. And it is only natural that the advanced training systems require sets of special strength and speed-strength progress tests to control the individual progresses by the test exercises [1-4, 6-8].

Objective of the study was to analyze benefits of a skill-level-specific special strength and speed-strength training model for elite polyathlon.

Methods and structure of the study. The experiment was carried out at the Department of Physical Education of Kazan State Power Engineering University. The subjects were tested during the competitions, when their physical and physiological possibilities were maximized. Sampled for the study were 20 qualified athletes (males): Class I - 11 subjects; Candidate

Masters of Sport and Masters of Sport - 9 subjects, who were divided into 2 subgroups according to their qualifications.)

The model testing experiment was timed to a competitive cycle when the sampled athletes were subject to a few strength and speed-strength tests. The strength tests included the carpal dynamometry tests and suspension and pull-ups tests on a horizontal bar. And the speed-strength qualities were tested by the traditional standing long jump and 1min jumping rope test.

Results and discussion. The strength progress tests found growth in the winter polyathlon sample, with the carpal strength tested to significantly ($p \leq 0.05$) grow from 53.36kg in Class I group to 61.22kg in the CMS/ MS group – that means 14.83% progress. The pull-ups test found growth from 36.36 times in Class I group to 43.22 times in the CMS/ MS group ($p \leq 0.05$), i.e. the 18.89% progress. And the straight arms suspension test showed growth from 182.36s in the Class I group to 211.67s in the CMS/ MS group ($p \leq 0.05$), i.e. the 16.1% progress.

The speed-strength test data and analyses showed significant progress in every of the three tests with the skills growth from Class I to CMS/ MS ($p \leq 0.05$). Thus in the standing long jump tests, the sample made progress from 243.2cm in the Class I group to 247.56cm in the CMS/ MS group ($p > 0.05$), i.e. 1.87%. About the same progress of 1.26% was found in the 1min jumping rope test: from 175.45 times to 177.67 times ($p > 0.05$), respectively. Having analyzed the speed-strength progress data, we should note that the progress was mostly skills-unspecific ($p \geq 0.05$), albeit the highly-skilled athletes still showed notably more consistent speed-strength progress on the whole.

Having analyzed the pre- versus post-experimental tests in the skill-level-specific special strength and speed-strength training model for elite polyathlon groups testing experiment, we found the model beneficial. The model and test data may be recommended for application in the annual training cycle planning [5, 7-9].

Conclusion. In the course of muscle training, the strength fitness rates in Candidate Masters of Sport and Masters of Sport were considerably higher than in Class I athletes. The speed-strength indicators in Candidate Masters of Sport and Masters of Sport did not differ significantly in comparison with those Class I athletes. Based on the findings, it can be concluded that in the planning of training loads in the annual training cycle, it is important to maintain the achieved level of performance of motor actions and on this basis develop the speed-strength qualities, thus increasing their effectiveness, which will further on lead to the achievement of high sports results and more stable competitive performance.

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BENEFITS OF INDIVIDUAL SPECIAL STRENGTH TRAINING MODEL FOR TOUCH PASS EXCELLENCE IN ELITE FOOTBALL

UDC 796/799

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Abstract

Objective of the study was to develop and test benefits of a special strength training model for touch pass excellence in elite football with the relevant field zone control trainings using special strength training machines.

Methods and structure of the study. The educational experiment was carried out at the premises of Lesgaft National State University of Physical Education, Sport and Health with the support from Specialized Children and Youth Sports School of Olympic Reserve No. 1 of the Admiralteysky District of St. Petersburg.

The field zone control elements in the training model were mastered using a special training ground ('stand') that includes a standard futsal goal divided into 9 identical squares plus three 2x2m field zones around the ground center 5m afar from the goal. The touch pass trainings were run at low and high speeds with the touch passes varied by the zones and levels.

Results and conclusions. The research results indicated a direct correlation between the quantitative, parametric, assessment of the level of development of special strength fitness of the leading muscle groups of the lower limbs and the technical fitness improvement strategy chosen by a qualified football player.

A correlation analysis under the study found the strongest correlation between the abductor muscle groups' maximal strength test rates and successful top-level touch passes; plus a high correlation between the standing long jump test rates and the abductor muscle groups' maximal strength test rates. We also found a strong correlation between the adductor muscle groups' strength and successful touch passes – that was interpreted as indicative of the new training model being beneficial. Generally, success of any sport training model may be rated by the percentages of successful technical-tactical actions in a practical game. In this particular study, we had to model the target technical-tactical actions for the purposes of fair comparative analysis on the special training ground to offer the same number of test attempts to every player in the model testing experiment.

Keywords: *touch pass, special strength training, field zone, technical training, special training machines, motor skills.*

Background. Presently one may find a wide range of the theoretical and practical football study reports [2, 5] with concern to the football-specific motor skills and the relevant versatile skill-specific training models. Analyses of the key football techniques have been largely advanced by the modern research technologies highly sensitive to every movement control and execution element in every motor skill [1, 3]. It is the growing technical fitness levels of the football elite that provide a sound basis for the increasingly versatile game tactics and efficient game design and management models. Individual technical progress of every player may be classified into the technical and functional resource building components, with the individual situation-specific technical toolkits determined by the actual individual physical qualities and fitness [4]. This is the reason why the precompetitive technical and tactical fitness

Table 1. *Field zone control training ground with touch pass excellence zones and levels*

Field zone control training ground	Vertical touch pass levels	Horizontal touch pass levels
		

tests of the football teams give so high priority to the special strength versus technical fitness tests.

Objective of the study was to develop and test benefits of a special strength training model for touch pass excellence in elite football with the relevant field zone control trainings using special strength training machines.

Methods and structure of the study. The educational experiment was carried out at the premises of Lesgaft National State University of Physical Education, Sport and Health with the support from Specialized Children and Youth Sports School of Olympic Reserve No. 1 of the Admiralteysky District of St. Petersburg.

The field zone control elements in the training model were mastered using a special training ground ('stand') that includes a standard futsal goal divided into 9 identical squares plus three 2x2m field zones around the ground center 5m afar from the goal. The touch pass trainings were run at low and high speeds with the touch passes varied by the zones and levels – as given in Table 1 hereunder.

The core goal of the new training model was to offer the field zone control and touch pass excellence model for a frontal movement of a player. Basically the model was designed to train the core low-limb muscle groups responsible for the touch pass on the frontal movement using special training machines [4].

Results and discussion. The research results indicated a direct correlation between the quantitative, parametric, assessment of the level of development of special strength fitness of the leading muscle groups of the lower limbs and the technical fitness improvement strategy chosen by a qualified football player.

A correlation analysis under the study found the strongest correlation between the abductor muscle groups' maximal strength test rates and successful top-level touch passes; plus a high correlation between the standing long jump test rates and the abductor muscle groups' maximal strength test rates. We also found a strong correlation between the adductor muscle groups' strength and successful touch passes – that was interpreted as indicative of the new training model being beneficial. Generally, success of any sport training model may be rated by the percentages of successful technical-tactical actions in a practical game. In this particular study, we had to model the target technical-tactical actions for the purposes of fair comparative analysis on the special training ground to offer the same number of test attempts to every player in the model testing experiment.

Conclusion. One of the key components of an individual technical fitness in elite football is the special strength tests of the key muscle groups responsible for the field zone control and touch pass execution. The individual progress in the touch pass skills was found facilitated by the special low-limb strength touch pass in the regular technical fitness process. The individual progress in the technical fitness including the touch pass skills was secured under the study by a new special training ground with goal zones and field zones to facilitate the varied-speed and varied-level touch pass excellence trainings on a focused, customizable and individualized basis.

The effectiveness and quality of performance of the specified motor action by the qualified football players were improved by correlating their special strength fitness rates, obtained during the execution of local physical exercises on weight machines with threshold loads, with the maximal strength rate, maximal strength reach time, and technical fitness level [4].)

Progress in the touch pass excellence training at the second horizontal level of the special training ground was secured by special strength building exercises on the strength training machines with maximal movement amplitudes. The technical resource of the players was effectively mobilized by a special focus on the abductor and adductor muscle groups claimed by the touch pass specific motor skills, and on the force peaking time.

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SPECIFICS OF TRIATHLON TRAINING

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Abstract

Objective of the study was to identify the peculiarities of modern triathlon training process design.

Methods and structure of the study. We analyzed the primary and secondary sources, studies by the Serbian and foreign researchers on the Internet and in electronic journals, as well as personal experience of the authors.

Results of the study and conclusions. The training process design is based on a competitive year (it should not be equated to a calendar year) and a competitive period. The competitive year (macrocycle) is divided into fewer cycles: mesocycles, microcycles, one training day, and one training session. Particular attention should be given to work with young triathletes, as the period of ontogenesis is critical to the achievement of high sports results and development of certain anthropological potential.

Each training session should be clearly structured and characterized by its purpose, load intensity, choice of the training tools and methods, rest breaks. The goal of each training session must be a part or sub-goal of the cycle to which it belongs.

The triathlon training process should be designed with the participation of a sport physician who regularly monitors the athletes' cardiovascular and respiratory system functioning, blood parameters, etc.

Keywords: *triathlon, training process design, sensory period, anthropological potential.*

Background. Triathlon as a new sport is very interesting from the perspective of the training process design. It refers to cyclic and endurance sports. In triathlon, we are simultaneously looking for answers to the following questions: how and how much to train, how to coordinate trainings in three different sports (swimming, cycling, running) into a functional whole, how to distribute loads in a given period, what training tools and methods to use.

Objective of the study was to identify the peculiarities of modern triathlon training process design.

Methods and structure of the study. We analyzed the primary and secondary sources, studies by the Serbian and foreign researchers on the Internet and in electronic journals, as well as personal experience of the authors.

Results and discussion. ***Physiological model in triathlon.*** Triathlon is structured as endurance sports. The maximum oxygen consumption for upper triathletes ranges between 5.5 and 6.5 l/min.

The Olympic triathlon race lasts 2 to 3 hours depending on the athlete's sex and part. If the training is adjacent, triathletes must survive the entire race with the high oxygen consumption rates, which is 75-85% of VO_2 max. During this time, the energy required for work is mainly produced by the aerobic sources (95%) and the remaining energy (5%) is produced by the anaerobic sources (the energy profile is highly depen-

dent on the configuration of the area in which the race is run).

The swimming lap, transition, and finishing start due to the functioning of the anaerobic energy-saving mechanisms.

The pulse rates are close to the anaerobic threshold throughout the entire race or get somewhat higher. The average heart rate is 150-170 bpm, so the blood lactate concentration varies within the reduced metabolic acidosis (3-7 mmol/l). The energy consumption during the race is extremely high and amounts to 20 kcal/min, or 2400-3600 kcal for the entire race. That is why the right diet, through glycogen supercompensation, is required a few days before the race to provide triathletes with a sufficient amount of energy substrate that dominates in the race [2].

Table 1. *Physiological structure of Olympic triathlon [5]*

Systems	Unit	Olympic triathlon
Heart and circulation	Beats / min	150 – 170
O_2 absorption	VO_2 max	75 – 85
Energy production	Aerobic/ anaerobic 95/5 %	95 / 5
Energy consumption	kcal/min, total	20 / 2400 – 3600
Glycolisis	Lactate (mmol/l)	3 – 7

Specifics of triathlon training. Triathlon includes three disciplines, so training loads are distributed in four rotating microcycles.

Table 2. *Rotation of training loads in triathlon disciplines [5]*

Microcycles	Swimming	Cycling	Running
1	heavy	moderate	easy
2	easy	heavy	moderate
3	moderate	easy	heavy
4	easy	easy	easy
5	Rotation as in the first week (+ 5-10% workload)		

Table 2 shows that triathlon trainings are not identical by the week. Each “strong” microcycle is followed by rehabilitation so that the body could regenerate. In the fourth microcycle, low-intensity exercises are used in all three disciplines. In the fifth cycle, the training schedule in the disciplines is the same as in the first one. However, after active recovery, the body is able to train with a higher volume or 5-10% intensity. Therefore, training loads are gradually increasing in all three disciplines without fear of overtraining [1, 3, 6].

Cyclization in triathlon. A competitive year (should not be equal to a calendar year) and a competitive period lie at the core of the training process. The competitive year (macrocycle) is divided into fewer cycles: mesocycles, microcycles, training days, and one training session [7].

***One training session and training day.** Triathlon training as a basic training unit consists of two main phases:

– **effort phase,** which is also known as a catabolic phase. It consists of:

* *introducing part* - implies “warming up” of the body and takes about 40 minutes. This phase has a common and specific part that should be harmonized.

* *main part* - represents the direction of training towards the set goal. The direction may be as follows: method, coordination, flexibility, speed, endurance, and a combination of the above qualities (first, working on coordination and speed, and then on endurance).

– **rest phase**, which is also known as an anabolic phase, and serves to cool the body by gradually decreasing the load intensity. These can include mild exercises for relaxation, massages, etc. At the end of the first stage of recovery, there begins the second phase of rest, where correct nutrition is of particular importance.

***Microcycle.** This is a one-week cycle (though may be shorter or longer) consisting of the training days and individual trainings to achieve the common goals of the microcycle, which depends on the microcycle goal and type.

Increment of training loads is the most complex and most important process within the microcycle structure. The 3:2 system consists of three training sessions with a sharp increase in workload followed by two light workouts. The 2:1:1:1:1 system consists of two training sessions with heavy workloads followed by one light workout succeeded by another high-intensity training session and ending with a low-intensity workout. One of the best systems is the 5:2 system (a gradual increase in workload from the first to the fifth day and then two relaxing days).

***Mesocycle.** This period consists of 3-6 microcycles. A mesocycle is considered to be the basic training cycle. This period is characterized by clear and measurable cumulative effects of adaptation to the training incentives applied, sufficient time to make the transition from a lower to a higher training level. A mesocycle may be focused on the development of speed, strength, endurance... This direction determines the type of a mesocycle.

The simulating mesocycle consists of the following microcycles:

1. Main. 2. Simulating. 3. Simulating. 4. Relaxing.

In the preparatory period:

1. Preparatory. 2. Preparatory. 3. Main 4. Relaxing.

In the precompetitive period:

1. Preparatory. 2. Main. 3. Simulating. 4. Relaxing.

The **competitive mesocycle** was designed as a 1:3 system (one high-load training microcycle with gradual reduction of the workload during the subsequent three microcycles). These four microcycles are followed by competitions.

*** Period** consists of several mesocycles. Depending on the competition schedule, one period may consist of 2-6 mesocycles. Periods:

– The **preparatory period** consists of:

***The first part**, which includes the basic mesocycles, where the load volume (basic skills) is gradually increased.

***The second part** of the preparatory period is focused on the enhancement of specific capabilities and is therefore referred to as a special preparatory stage.

– **Pre-competitive** - during this period, athletes should reach a high physical fitness level. Among the optimal structural designs of the precompetitive period is the training-control mesocycle that includes the following microcycles:

1. *Preparatory*. 2. *Main*. 3. *Simulating*.
4. *Simulating*.
1. *Preparatory*. 2. *Preparatory*. 3. *Main*.
4. *Simulating*.

– **The structure of the competitive period** depends on the competition schedule. A good physical shape is the key focus of the simulating mesocycle.

– **Interim or rehabilitation period** is the period when conditions should be created so that novice and motivated athletes started the next preparatory period while gradually increasing the low-intensity workload [5].

***Macrocycle.** The macrocycle was designed to achieve the planned sports result [7].

Conclusion. Particular attention should be given to work with junior triathletes, as the period of ontogenesis is critical to the achievement of high sports results and development of certain anthropological potential.

Each training session should be clearly structured and characterized by its purpose, load intensity, choice of the teaching tools and methods, rest breaks. The goal of each training session must be a part or sub-goal of the cycle to which it belongs.

The triathlon training process should be designed with the participation of a sport physician who regularly monitors the athletes' cardiovascular and respiratory system functioning, blood parameters, etc.

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PERSONAL FEATURES OF TEAM SPORTS REPRESENTATIVES

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Abstract

Objective of the study was to survey, analyze and find correlations in the personality traits of athletes in team and individual sports, with basketball players and boxers sampled for the study.

Methods and structure of the study. The Surgut State University's Psychology Department has run for the last few years the athletes' personality tests and surveys in Surgut in the Khanty-Mansi Autonomous Okrug (KMAO) and some other regions [2, 3]. We sampled for this study the 24-36 years old qualified and having the 3+ years long sport records Samara Basketball Club players for an Experimental Group (EG, n=10) and athletes of the Boxing Federation of Surgut (KMAO) for a Reference Group (RG, n=30). The sample was tested by the Cattell16 Personality Factor Questionnaire to rate the relatively independent personality factors classified into 4 groups: communicative, intellectual, emotional and control ones.

Research results and conclusions. The results of the analysis indicate the existence of a relationship between the parameters of volitional and behavioral self-regulation of athletes and their individual psychological characteristics, however, the nature of this dependence varies between representatives of team and individual sports. The study demonstrated the need for efficient and professional psychological support in sports, since the competitive progress in modern sports requires the individual physical and mental resource being mobilized in full, formatted and developed for the sport-specific goals. The study data gives grounds to believe that the sports psychology in its evolution with give a growing priority to the more comprehensive personality studies and detailed differentiations in the personality inventories on a sport-specific basis.

Keywords: *sports activity, personality traits, volitional control, behavioral control, Cattell16 Personality Factor Questionnaire, basketball, boxing.*

Background. Personality qualities tests and analyses are given a special priority by the modern sports psychology. The role of sports in this context may be viewed as multidimensional. On the one hand, they are dominant in the athlete's life being a driving force for personality progress. As provided by A.N. Leontyev, "multiple individual activity vectors intersect and are knotted by the relevant necessary social relationship. These knots and their hierarchy may be interpreted as the "mysterious personality core" commonly referred to as "I"; in other words, this personality core is formed in the individual living environment rather than inside the person, under his/her skin" [7, p. 17]. And on the other hand, sports facilitate progress of certain mental qualities like any other specific activity that may be profiled by personality research tools "as provided by the specific scientific mental phenomena research methods in context of the systemic fundamentals of the personality socializing, culturing and self-development agenda", as stated by A.G. Asmolov [1, p. 30].

Sports activity is of special interest in the above context. In some aspects it is much the same as any other activity, whilst in other aspects it is rather spe-

cific. It may be primarily due to the fact that a sports activity is geared to transform the athlete's personality in the physical and mental domains rather than in the objective environment – i.e. the sporting subject is at the same time a sports activity object, with the individual competitive progress being indicative of the personality sport-specific transformations and achievements; and this is the reason why "competitions are deemed obligatory as an extreme test ground for the physical, technical and, the last but not least, mental qualities" [6].

Lately the sport research communities have given a growing priority to the mental qualities and their contributions to the competitive progresses, and many researchers have tried to identify the common and specific athletic personality traits in the sport contexts. Thus, an American sports psychology research team found the athletes "commonly tested with high aggression, high success motivations, extraversion, high willpower, authoritarianism, and excellent emotional balancing and self-control qualities" [8, p. 45].

V.P. Koryagina, having studied a large sample of elite athletes [5], found the following most typical personality traits: high emotional balance, confidence, independence, self-reliance, risk tolerance, high self-control, sociability etc. Of special interest for researchers and supporters is the question whether or not the personality traits contribute to the competitive successes, particularly in the modern team sports in view of their special entertainment aspects.

Objective of the study was to survey, analyze and find correlations in the personality traits of athletes in team and individual sports, with basketball players and boxers sampled for the study.

Methods and structure of the study. The Surgut State University's Psychology Department has run for the last few years the athletes' personality tests and surveys in Surgut in the Khanty-Mansi Autonomous Okrug (KMAO) and some other regions [2, 3]. We sampled for this study the 24-36 years old qualified and having the 3+ years long sport records Samara Basketball Club players for an Experimental Group (EG, n=10) and athletes of the Boxing Federation of Surgut (KMAO) for a Reference Group (RG, n=30). The sample was tested by the Cattell16 Personality Factor Questionnaire [4] to rate the relatively independent personality factors classified into 4 groups: communicative, intellectual, emotional and control ones. The EG and RG test data arrays were matched using the Mann-Whitney U-test.

Results and discussion. The survey failed to find any significant intergroup differences in the following groups of factors: communicative traits (Uemp. = 10.5), intellectual traits (Uemp. = 3) and emotional traits (Uemp. = 7.5), that means that both of the groups are sociable, open to cooperation, receptive to new things, innovative; demonstrate analytical thinking, good working capacity, realistic attitudes and social contacts, prepared for leadership, enthusiastic in teamwork, believe in luck; demonstrate high learning abilities and willingness to experiment.

The above test data give reasons to believe that both groups, regardless of the individual or team sports activity, have similar basic personality traits that may be developed as required by a specific sport discipline. At the same time, we found both the individual and team sport groups having certain distinctive personality traits that have been, as we believe, largely formed by their sports. Falling within the statistically significant zone are the intergroup differences on the following scales: Practicality/ Imagination development" (Uemp. = 14.5); "Rigidity/ Sensitivity" (Uemp. = 25), "Low/ high self-control" (Uemp. = 29.5), and "Impulsivity/ Standard behavioral control" (Uemp. = 13.5).

The survey found the following personality traits dominating in the EG: well developed imagination; creative resource; some rigidity in relationships; impulsivity; flexible attitudes to social norms; whilst the boxing RG was tested more practical; overly attentive to minor things; striving for patronage in communication; with strong self-controls; determination in the progress agenda; businesslike attitudes; and conscious observance of behavioral norms and rules. This gives us the reasons to believe that the individual personality traits are somewhat determined by the specific sporting activity.

The survey data and analysis showed that the team sporting EG is more introverted, somewhat callous towards the others; impulsive; focused on benefits in every situation; and at the same time more irresponsive. The individually sporting RG was tested more extraverted (focused on external reality); more responsible in adherence to accepted behavioral norms; higher on the emotional and behavioral control scales; and more empathic.

The correlation analysis of the survey data designed to find, above all, the volitional and behavioral self-control correlations in context of the individual psychological traits, was run using the Pearson criterion, with self-control [2, 3], volitional control [2, 3] and personality factors rated on every scale. The EG survey data were found correlated in the following pairs: volitional control with the suspicion (rxy = 0.894); volitional control with dominance (rxy = 0.532); volitional control with intelligence (rxy = 0.846); and self-control with the emotional tension (rxy = 0.735).

The RG survey data were found correlated in the following pairs: volitional control with the emotional

tension (rxy = 0.590); and self-control with the emotional tension (rxy = 0.535). The correlation analysis showed the behavioral self-control and individual psychological factors being similar in both groups, with the behavioral control largely determined by the emotional tension degree. The team and individual sports groups were also tested different in the following aspects: the basketball players' volitional control was found correlated with intelligence, suspicion and proneness to leadership; whilst the boxers' volitional control was found correlated with the emotional tension and behavioral control at the same time.

The survey data and analysis on the whole showed that the subjective and objective mental status and personality traits are rather diverse and formatted by both the individual psychological traits and sporting activity.

Conclusion. The study once again demonstrated the need for efficient and professional psychological support in sports, since the competitive progress in modern sports requires the individual physical and mental resource being mobilized in full, formatted and developed for the sport-specific goals. The study data gives grounds to believe that the sports psychology in its evolution with give a growing priority to the more comprehensive personality studies and detailed differentiations in the personality inventories on a sport-specific basis.

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ACADEMIC SPORTS ELITE AND AMATEUR SPORTS COMMUNITIES: ETHNIC SPORTS AWARENESS SURVEY

UDC 796.01:316

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Abstract

Objective of the study was to find and analyze attitudes to the Hapsagay wrestling and mas-wrestling in the academic elite sport and mass amateur sport communities.

Methods and structure of the study. We sampled for a questionnaire survey the North-Eastern Federal University students (n=200) engaged in the academic elite sport and mass amateur sports.

Results and conclusions. The comparative analysis revealed that most respondents were interested in hapsagay and mas-wrestling and agreed that hapsagay was a popular sport among the Yakut young population.

Those engaged in elite sports believed that hapsagay and mas-wrestling primarily contribute to the development of speed-strength, strength, and speed abilities, agility, and endurance. Those engaged in mass sports gave priority to speed, agility, and strength.

The questionnaire survey data analysis showed the efforts of the Yakut sport community and trainers being successful in popularizing the Hapsagay wrestling and mas-wrestling in the schoolchildren and youth cultures.

Based on the questionnaire survey data and analysis, we have every reason to state that the ethnic Hapsagay wrestling and mas-wrestling sports are increasingly popular in the North-Eastern Federal University student community. Being so popular and accessible for the mass physical education and sports service, the ethnic sports heavily contribute to the progress of mass sports movements in the Republic.

Keywords: *physical education and sports, ethnic sports, Hapsagay wrestling, mas-wrestling, athlete, elite sports, mass amateur sports, freestyle wrestling.*

Background. Ethnic Hapsagay wrestling has been traditional for ages and still remains very popular in the Republic of Sakha. Its name means the 'agility contest' in the Yakut language [6] and implies, in its modern version, a technical skill toolkit geared to throw or otherwise force the opponent touch the ground by whatever body part save for the feet for competitive success. The HP techniques are free of painful holds and long power submissions on the ground unlike the other martial arts [1]. Since 1932, the Yakut ethnic Hapsagay wrestling has been listed in the USSR and then Russian sports classifiers.

'Mas tardyhyy' is a Yakut equivalent for the 'stick tug' or mas-wrestling as it is known in the global sports. "Mas" means a wooden stick in Yakut and wrestling is the commonly understandable English meaning for multiple professional combat sports including Greco-Roman, freestyle wrestling and judo sports [4]. It was in 2003 that mas-wrestling was formally listed with the Russian Sports Register. Since the both ethnic sports are increasingly popular the world over, we feel it could be beneficial to probe attitudes to and awareness of the Hapsagay wrestling and mas-wrestling in the academic elite sport and mass amateur sport communities.

Objective of the study was to find and analyze attitudes to the Hapsagay wrestling and mas-wrestling in the academic elite sport and mass amateur sport communities.

Methods and structure of the study. We sampled for a questionnaire survey the North-Eastern Federal University students (n=200) engaged in the academic elite sport and mass amateur sports.

Results and discussion. The question "Do you think Hapsagay wrestling and mas-wrestling are the same sport?" was responded in a somewhat controversial manner. Thus the elite sport group was found perfectly aware of both of the sports. As for the amateur sports group, 46% differ Hapsagay wrestling from freestyle wrestling saying that hapsagai as a single-touch bout, whilst the freestyle wrestling goal is to press the opponent's shoulder blades to the carpet; 21% of amateur sports believe that Hapsagay wrestling is a freestyle wrestling version with the only difference that Hapsagay wrestling is a single-touch outdoor martial art in traditional outfits (shorts); 19% feel the difference albeit fail to describe it exactly; 5% believe that Hapsagay wrestling is the Yakut equivalent for freestyle wrestling; and 9% were uncertain on the point. The survey data analysis has found the majority of the sample interested in both ethnic sports and acknowledging the Hapsagay wrestling being highly popular in the Yakut youth communities.

It should be mentioned that the question "Whether or not the Yakut *mas tardyhy* tradition is fully respected by the modern mas-wrestling?" has been disputed in the Republic since 2015. Thus 38% of the athletes competing in mas-wrestling and ethnic *mas tardyyy* reported feeling the difference and appreciating at the same time that the modified version of the traditional *mas-tardyhyy* was listed in the RF Sports Register. We should note that 62% of the sample believes that the authentic name and traditional rules of the Sakha people's sport should have been better preserved by the formal mas-wrestling. It should be also noted that the mas-wrestling trainees point to the difference in the stick grips – as it should always be parallel in the traditional *mas-tardyhyy.*

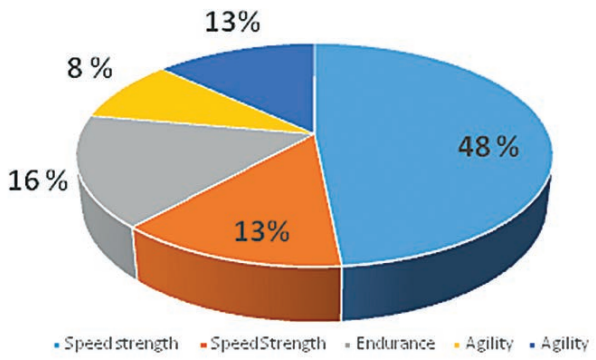

Figure 1. *Responses to the question 'What physical qualities and skills are developed by Hapsagay wrestling and mas-wrestling sports?'*

The above Figure visualizes the responses to the question *'What physical qualities and skills are developed by Hapsagay wrestling and mas-wrestling sports?'* The elite sport group ranked the qualities as follows: speed-strength 48%, strength 16%, agility 14%, speed 13%, and endurance 9%. And the amateur sports group ranked them as follows: speed 46%, agility 33%, and strength 21%. It should be noted that the amateur sports group was found close to the elite sport group in its awareness of the both sports.

The questionnaire survey data analysis showed the efforts of the Yakut sport community and trainers being successful in popularizing the Hapsagay wrestling and mas-wrestling in the schoolchildren and youth cultures. Thus the survey found 54% of the sample having a school Hapsagay wrestling experiences (n=15, including 6 qualified athletes) and mas-wrestling experiences (n=55 including 20 qualified athletes). A republican (Ulus- and cities-specific) Hapsagay wrestling progress analysis showed that for the last 7 years (since 2011) the national junior and adult Hapsagay wrestling population has been fast growing. The Hapsagay wrestling progress in every Ulus (county) and city may be due to the enthusiastic efforts of the local Ulus Hapsagay wrestling federations [3]. A special contribution to the Hapsagay wrestling sport progress in the Republic has been made by the sports coverage by the Republican mass media service, mass sports "Games of Dygyna", "Urk Walan", "Obugeler onnyuular" tournaments and the national Ysyakh Sports Festival with participation of the local sport celebrities, plus the growing international Hapsagay wrestling and mas-wrestling competitions.

Conclusion. Based on the questionnaire survey data and analysis, we have every reason to state that the ethnic Hapsagay wrestling and mas-wrestling sports are increasingly popular in the North-Eastern Federal University student community. Being so popular and accessible for the mass physical education and sports service, the ethnic sports heavily contribute to the progress of mass sports movements in the Republic.

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PHYSICAL EDUCATION IN MODERN POPULAR LIFESTYLES AND PRIORITIES: SURVEY IN VOLGOGRAD REGION

UDC 796.01:316

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Abstract

Objective of the study was to rate and analyze the popular physical education / physical activity agenda in Volgograd and Volzhski (Volgograd Oblast) by a questionnaire survey.

Methods and structure of the study. The study involved the residents of Volgograd (n=400) and Volzhsky (n=200). The sample was stratified by the city districts. The sample size for each stratum was determined in proportion to its size within the general population. Then, within each district, we randomly identified the household, in which we selected the respondents according to the quota. The major method of data collection was a formal questionnaire survey. The respondents' physical fitness level was determined based on the physical activity indicators that determine the potentials for personal development inherent in their way of living and consciousness.

Results and conclusions. The findings indicated a low physical fitness level of the residents of the region, which negatively affects their health, on the one hand, and on the other - a positive trend in the use of such physical activities as walking and setting-up exercises. Most residents are aware of their health issues and having motivations for physical activity, although still taking no decisive physical activation solutions due to the poor physical education / sporting agendas and shortage of social support, time and/or finance for the physical education / sporting initiatives.

Keywords: *physical education, healthy lifestyle, consciousness, health, physical activity, physical activity motivations.*

Background. The ongoing social and economic reforms in modern Russia have given a new impetus to the traditional lifestyles and increased the role of money in popular values and priorities, with the growing emphasis rather on the economic well-being – often at sacrifice of mental and physical health. At the same time, the socio-economic and personality progress agendas cannot be successful enough without a reasonable progress in the physical education and health domain. Correlation between individual health and physical activity is commonly acknowledged, with the individual health agendas often manifested in the actual physical culture, activity and body shape/ harmony [1]; whilst an individual physical activity generally depends on the physical and mental health and the social environment on the whole [4].

There are a few approaches to the interpretation of culture on the whole and physical culture in particular. Let us analyze the two key ones for a theoretical and empirical interpretation of the study subject. First, culture is viewed as a specific national/ group/ popular lifestyle element in a specific historical period [5]. As far as physical culture is concerned, it is important to analyze the modern Russians' physical activity first of all. Second, physical culture may be analyzed as a part of individual consciousness with the relevant mental constructs. Culture from this viewpoint may be interpreted as a system of thinking patterns, sentiments and activity motivations formed in the individual life cycle [7, p. 5, 6]. This physical education study domain makes it possible to rate

the individual values and motivations for specific health-prioritizing physical activity forms and physical trainings [2, p. 11].

Despite the abundant supply of the physical education / health and physical activity/ inactivity studies, the effects of specific physical education aspects (mental, social, procedural) on the popular physical activity and physical progress agendas and lifestyles of the modern Russian population are still underexplored.

Objective of the study was to rate and analyze the popular physical education / physical activity agenda in Volgograd and Volzhski (Volgograd Oblast) by a questionnaire survey.

Methods and structure of the study. The popular physical education agenda was rated by a set of physical activity test rates indicative of the individual personality physical progress values, lifestyles and agendas. We run a questionnaire survey to rate the popular physical education versus its theoretical and empirical interpretation: see Table 1.

Table 1. *Physical education meaning: theoretical and empirical interpretation*

Theoretical interpretation	Operational concepts
Personality physical progress	Adequacy of the reported physical activity time
	Sporting activity
Physical education agenda in the lifestyle	Physical education popularity
	Physical education regularity
Physical education in mental constructs	Physical education motivations
	Individual/ group physical education preferences

The questionnaire survey designed with a special priority to a formal interview method was run in July 2018 to obtain quantitative data for the physical education rating purposes as provided by study [6, p. 17]. We sampled for the survey 600 residents (47% male and 57% female sample) of Volgograd (n=400) and Volzhsky (n=200) cities, with the sampling error estimated at ± 4.5%. The sample was stratified by the city districts, with every district group sampled proportionate to its size in the total population. Respondent households were then randomly sampled in every district within the relevant quotas.

Results and discussion. The survey found one of five respondents in need of physical education progress and acknowledging the need to find more time for physical activity; while the rest reported having enough time for physical activity albeit actually the time was found short: see Table 2.

Table 2. *Responses to the question "Do you assign enough time for physical activity"?*

Response options	n	%
Certainly so	24	4
Rather so than not	108	18
Rather not	384	64
Certainly not	84	14
Total	600	100

Physical progress is undoubtedly facilitated by a sporting activity, although only one fifth of the respondents reported going in for some sports including outdoor walking and fitness trainings in clubs and sports centers, with about one third of the [sporting] sample going in for the latter see Table 3.

Table 3. *Physical activity/ inactivity reported by the sample*

Response options	n	%
Home sitter: TV, reading, house chores	228	38
Outdoor walking	108	18
Sports	96	16
Trainings in sport gyms, fitness centers	96	16
Mass cultural events	24	4
I have no spare time for physical activity	48	8
Total	600	100

50% of the sample reported different physical education practices in their lifestyles. We rated the physical education regularity to find more than a half of the sample reportedly engaged in regular physical education: see Table 4.

Table 4. *Physical education regularity survey*

Response options	n	%
Daily physical education	228	38,0
Few times a week	156	26,0
Once a week	0	0
Few times per month	168	28,0
Once a month	48	8,0
Total	600	100,0

Outdoor walking was reported as the most popular form of physical activity – probably due to the Volgograd and Volzhsky residents preferring the most accessible and affordable physical activity that requires no special clothing, accessories or equipment and claiming not too much time. The reported physical activity forms, however, provide no insight into the actual physical education motivations, values and priorities, and they were subject to a special analysis later on. Some analysts rank the physical education motivations as follows: natural need for physical activity; health agenda; physical progress needs; need for communication, etc. [3, p. 98, 99].

Our survey found the local physical activity motivations being specific in some aspects. For example, we found the local residents prone to collective rather than individual physical education – with more than 40% of the sample reporting prepared for a collective physical activity with acquaintance(s). This finding underlines the role of social environment for the physical education / sporting agendas. More than a quarter of the sample reported health physical activity driven by the immunity improvement goals. Ranked third among the physical education motivations was the body shaping agenda reported by one sixth of the sample. 11.0% of the sample reported the physical education driven by the health needs/ conditions – that means that health conditions are not dominant among the physical education motivations – notwithstanding the fact that 35.2% of the sample reported being chronically ill including 29.3% reporting congenital diseases and 70.7% acquired diseases. It should be mentioned that only 21% of the sick subsample mentioned physical inactivity among the reasons for their health conditions.

Based on the questionnaire survey data and analyses, we found most of the sample aware of their health issues and having motivations for physical activity, although still taking no decisive physical activation solutions due to the poor physical education / sporting agendas and shortage of social support, time and/or finance for the physical education / sporting initiatives.

Conclusion. The questionnaire survey data and analyses showed the lifestyles and mental constructs of some regional Russian population groups prioritizing physical activity, although the actual physical activity was reported inadequate and limited mostly by the outdoor walking and occasional physical education practices in sport gyms, and largely motivated by the local social environments.

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STUDENTS' INTEREST IN VARIOUS FORMS OF PHYSICAL EDUCATION AND SPORTS ACTIVITIES

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Abstract

Objective of the study was to find and analyze attitudes of the academic youth to the academic physical education and sports service.

Methods and structure of the study. The Chechen State Pedagogical University's Physical Education Department faculty run two questionnaire surveys of the 1-3rd year full-time students (n=277 and n=1903) of different university departments to profile their attitudes to the academic physical education and sports service on a sport-specific basis.

Results and conclusions. The survey found the regional academic youth giving the highest preferences to fitness, volleyball, judo, chess, football, freestyle wrestling and table tennis services in the academic physical education and sports curriculum. At the same time, we found the sample being still unaware of the great benefits of academic sports for the physical, morphological and functional progress. We recommend promoting the academic sport club activities to cultivate the physical education / health/ sporting lifestyles in the academic communities.

Keywords: *questionnaire survey, sports, university students, physical education and sports, efficiency, physical fitness, physical activity.*

Background. Academic physical education and sports service geared to secure optimal physical fitness and progress in motor skills and physical qualities has long been in high priority for the national physical education and sports expert community. It is paramount in this context to find ways to effectively customize the physical education and sports service to the actual progress needs and interests of the academic communities. We believe that the academic physical education and sports-specific customization initiatives shall be designed to secure necessary physical activity for the student groups – based on the methodological and institutional foundation for the sports-prioritizing youth physical education and sports service laid by V.K. Bal'sevich and L.I. Lubysheva [1, 2].

Objective of the study was to find and analyze attitudes of the academic youth to the academic physical education and sports service.

Methods and structure of the study. The Chechen State Pedagogical University's Physical Education Department faculty run two questionnaire surveys of the 1-3rd year full-time students (n=277 and n=1903) of different university departments to profile their attitudes to the academic physical education and sports service on a sport-specific basis.

Results and discussion. The survey found 277 students preferring sport group practices as demonstrated by the responses to the question "What sports practicing sites do you prefer?", with most preferring communal sports at places of residence to the university group sports. We should note that 74% of the

Table 1. *1-3 year students': sport preferences survey data*

Sports	Physical education and sports department	Department of technology and economics	Natural science department	Arts department	Physics and mathematics department	Philology and law department	Pedagogy, psychology and defectology institute	Total	%
Body building	0	-	-	-	17	1	6	24	1,26
Basketball	5	2	-	2	12	2	5	28	1,47
Boxing	4	6	-	1	2	11	7	31	1,62
Freestyle wrestling	21	5	-	-	18	4	-	48	2,52
Judo	6	3	-	3	5	76	2	95	4,99
Volleyball	12	15	-	3	67	67	24	188	9,87
Kettlebell sport	0	-	-	--	2	-	-	2	0,01
Athletics	1	5	-	-	2	13	-	21	1,10
Futsal	1	-	-	-	6	3	-	10	0,52
Table tennis	0	6	2	-	4	10	13	35	1,83
Powerlifting	1	-	-	-	-	-	-	1	0,05
Sambo	1	2	-	-	-	-	-	3	0,15
Weightlifting	1	1	-	-	2	2	-	6	0,31
Football	20	8	-	-	26	5	2	61	3,20
Fitness	1	35	5	28	65	178	20	332	17,44
Chess, checkers	0	9	-	11	15	34	9	78	4,09
Taekwondo			-	16	-	-	-	16	0,84
Swimming			-	-	-	-	3	3	0,15
Badminton	4		-	-	-	-	15	19	0,99
Physical Education	74	99	94	22	167	173	273	902	47,39
Total	152	196	101	86	410	579	379	1903	

sample opted for university group sport services. To have more detailed survey data, we run a second survey (n=1903) of the 1-3rd year students: see Table 1 hereunder.

Students were offered to highlight their preferences in 19 sports. The survey found 52% of the sample preferring team sports; of which 9.87% prefer volleyball and 32% other team sports. The rest of the sample mostly preferred martial arts (22%); and the smallest preference was found for powerlifting and kettlebell sports (0.05% and 0.01%, respectively). The students were found driven in their preferences by the available material and technical base, coaching service quality and regional progresses of the sport disciplines. The high proportion of those opting for martial arts may be explained by the traditional priority to these sports in the region. We also found modern fitness service being highly popular (33%) – apparently due to the pedagogical university student community being dominated by women, plus the fact that the fitness groups enjoy three training gyms well served by experienced instructors. We also found 7.8% of the sample opting for chess and checkers. We were concerned to find as many as 47.4% of the sample opting for the standard physical training curriculum in the academic physical education and sports service – that means that they appear to underestimate the health and physical progress benefits of the modern academic sports that facilitate morphological and functional progress and provide great mass sporting, competitive and physical education / health experiences.

Conclusion. The survey found the regional academic youth giving the highest preferences to fitness, volleyball, judo, chess, football, freestyle wrestling and table tennis services in the academic physical education and sports curriculum. At the same time, we found the sample being still unaware of the great benefits of academic sports for the physical, morphological and functional progress. We recommend promoting the academic sport club activities to cultivate the physical education / health/ sporting lifestyles in the academic communities.

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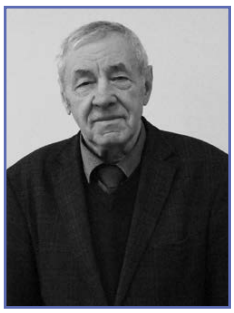
HOMOTOXICOLOGY TO PREVENT OVERSTRAIN OF ATHLETES' MUSCULOSKELETAL SYSTEM

UDC 614.8; 796.071.424.2



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Abstract

Objective of the study was to substantiate the use of the antihomotoxic medication "Traumeel S" to prevent local blood circulation disorders in tennis players during trainings aimed to improve their special working capacity.

Methods and structure of the study. Sampled for the study were 12 tennis players qualified from Class I to Masters of Sport. At the first stage of the study, we assessed micro-circulation in various parts of the upper limbs. The temperature was measured using an infrared thermometer (model DT-635) with a measurement accuracy of ±0.1°C. The temperature dynamics was determined before and after the training loads corresponding to the rate of 20 bpm. Further, we analyzed the detected temperature reactions in individual parts of the upper limbs of each athlete during the 1st minute of recovery. At the second stage, a complex antihomotoxic medication "Traumeel S" was used to prevent microcirculation disorders under the training loads. Then we analyzed the detected temperature reactions in each athlete during the 1st minute of recovery with the use of "Traumeel S" ointment.

Results of the study and conclusions. The findings showed that the use of the modern antihomotoxic medication "Traumeel S" under the training loads contributes to the prevention of local blood circulation disorders in the upper limbs of athletes. It is reasonable to use this antihomotoxic medication during trainings aimed to improve special working capacity to prevent overexertion of the upper limbs of tennis players at an early stage. Local blood circulation disorders can be detected during the preliminary diagnosis of overstrain of the musculoskeletal system using an infrared thermometer.

Keywords: *disadaptation, sanogenesis, chronic overstrain, risk factors, homotoxicology, prevention, integrative medicine.*

Background. The modern athletic training system is characterized by high amounts and intensity of training and competitive loads (risk factors), which may lead to overstrain of the adaptation mechanisms and thus to different diseases of the bodily systems and organs. In most cases, athletes suffer from overstrain of the musculoskeletal system, which is diagnosed as a microtraumatic disease. One of the pressing problems in modern sports is the prevention and rehabilitation of athletes diagnosed with overstrain of various parts of the musculoskeletal system [6]. Biological medicine has developed integrated means to prevent the humoral, reversible stage of overstrain of the musculoskeletal system. However, the application methodology of these means in different sports has been developed insufficiently [3]. Rehabilitation and health restoration necessitate the intensification of non-specific sanogenetic mechanisms: overall resistance, immunity, adaptation, regeneration, blood and lymph microcirculation, detoxification. The biological medicine means and methods are aimed to "support" sanogenesis [7]. Among the methods of biological medicine is homotoxicology - a holistic direction of the synthesis of allopathy and homeopathy developed by the German physician and scientist G.G. Rekkeveg [4]. According to his theory, the

balance in the human body may be disturbed by the buildup of toxins, which if excessively accumulated in the body tissues cause diseases. The staged nature of clinical manifestations of the body's counteraction to homotoxins and compensation can be expressed in 6 phases. In the humoral phases, toxins can be removed by the body itself through various drainage systems and detoxification. The onset of the musculoskeletal system disorders in athletes corresponds to the humoral, reversible phases of homotoxicosis. The therapeutic treatment is meant to minimize painful manifestations and accelerate the process of detoxification of damaged tissues. In allopathic medicine, nonsteroidal anti-inflammatory drugs are used for this purpose; their prolonged administration is accompanied by adverse side effects in the form of systemic allergic reactions (bronchospasm, hives, edema). In biological medicine, antihomotoxic complex preparations have a mild stimulating effect directed at the physiological activation of the body's protective systems. The preparations were developed taking into account the phases of homotoxicosis, which can make the treatment more effective. In terms of its formula, the antihomotoxic medication **"Traumeel S"** is characterized by complex pharmacological effects on the connective tissue: anti-inflammatory, antiexudative, immunostimulative, regenerative, analgetic, antihemorrhagic, venotonic [5]. "Traumeel S" is on the list of drugs allowed by the WADA's Athlete Committee. According to 226 Russian sports doctors, "Traumeel S" is an effective and safe preparation and an alternative to nonsteroidal anti-inflammatory drugs in the treatment of musculoskeletal diseases [2].

Upon the recommendations of N.V. Kornilov et al. [1], the sub-clinical early stage of overstrain of the musculoskeletal system should be diagnosed by the functional tests using thermal imaging, angiography, and EMG, treatment method - laser therapy; the clinical stage of chronic overstrain - electromyography, osteometry, treatment methods - electromagnetic therapy. Thus, for the early functional stage of the musculoskeletal system overstrain, thermometry is to be used to identify the "cold" zones within the overstrain region due to the microcirculation disturbance.

Objective of the study was to substantiate the use of the antihomotoxic medication Traumeel S to prevent local blood circulation disorders in tennis players during trainings aimed to improve their special working capacity.

Methods and structure of the study. Sampled for the study were 12 tennis players qualified from Class I to Masters of Sport. Microcirculation was assessed in various parts of the upper limbs using an infrared thermometer (model DT-635). A complex antihomotoxic medication "Traumeel S" by Heel was used to prevent microcirculation disorders under the training loads.

Results and discussion. At the first stage of the study, we assessed micro-circulation in various parts of the upper limbs. The temperature was measured using an infrared thermometer (model DT-635) with a measurement accuracy of ±0.1°C. The temperature dynamics was determined before and after the train-

Table 1. *Temperature distribution across upper limbs of tennis players before and after exercise prior to experiment (°C)*

Temperature measuring point location	Quiescent state	1st min of recovery	Significance of differences, p
Wrist flexor	34.43±2.03	33.82±1.93	>0.05
Wrist extensor	34.35±1.53	32.89±2.4	>0.05
Medial epicondyle fractures of the elbow	33.29±0.92	32.68±1.2	>0.05
Lateral epicondyle fractures of the elbow	34.03±1.01	34.09±2	>0.05
Deltoid muscle (medialis)	33.83±1.07	33.46±0.76	>0.05

Table 2. *Number of tennis players with different temperature reactions in the musculoskeletal system after exercise prior to experiment*

Temperature measuring point location	Number of people		
	No changes in temperature°C	Temperature decrease °C	Temperature increase °C
Wrist flexor	2	9	1
Wrist extensor	8	3	1
Medial epicondyle fractures of the elbow	3	9	-
Lateral epicondyle fractures of the elbow	2	10	-
Deltoid muscle (medialis)	1	11	-

Table 3. *Temperature distribution across the upper limbs of tennis players before and after exercise with the use of "Traumeel S" ointment (°C)*

Temperature measuring point location	Quiescent state	1st min of recovery	Significance of differences, p
Wrist flexor	33.9±1.63	33.61±1.69	>0.05
Wrist extensor	33.98±1.66	33.67±2	>0.05
Medial epicondyle fractures of the elbow	32.18±1.16	31.78±1.26	>0.05
Lateral epicondyle fractures of the elbow	33.87±0.89	33.55±0.92	>0.05
Deltoid muscle (medialis)	33.73±0.98	33.36±0.92	>0.05

ing loads corresponding to the rate of 20 bpm, which is consistent with the current model of working capacity of tennis players.

The results of measurements obtained in the group of athletes before and after the training session with a specified load intensity are presented in Table 1. The data obtained showed that the temperature decreased by more than 0.4°C at three out of five measuring points after exercise. The values did not differ statistically significantly but indicated an unsatisfactory response of the musculoskeletal system to physical loads.

Further, we analyzed the detected temperature reactions in individual parts of the upper limbs of each athlete during the 1st minute of recovery. Table 2 presents the number of tennis players who demonstrated different temperature reactions in individual parts of the upper limbs after the training loads. The data obtained showed that the majority of tennis players had a decreased temperature reaction at four measuring points out of 5. These temperature reactions testified to the disturbance of the local blood circulation, thus indicating the overstrain of the musculoskeletal system of the tennis players.

The identified temperature reactions in the individual parts of the upper limbs is an indication of the nonconformity of the external training load to the functional state of the "working" upper limbs. This is a sign of a training violation, a violation of the physical load individualization principle, and incomplete recovery of the musculoskeletal system after exercise.

At the second stage, an antihomotoxic medication "Traumeel S" was used to prevent the microcirculation disturbance under training loads.

The results of the measurements of the temperature reactions in individual parts of the upper limbs of the athletes before and after the training session with a specified load intensity using "Traumeel S" ointment are presented in Table 3. The data obtained indicated a temperature decrease by less than 0.3 °C at each of the 5 measuring points after loading. The figures did not show any statistically significant differences but testified to a satisfactory response of the musculoskeletal system to physical loads, which exceeded the detected responses of the musculoskeletal system of the tennis players prior to the experiment.

Then we analyzed the detected temperature reactions in the upper limbs of each athlete in the 1st min of recovery with the use of "Traumeel S". Table 4 presents the number of tennis players with different temperature reactions of the musculoskeletal system after training loads. The results indicated that the temperature reactions in the individual parts of the upper limbs did not change in the majority of tennis players, while 8 tennis players were found to have an increase in the temperature in their wrist extensors. These temperature reactions characterized high load tolerance that prevented the overstrain of the musculoskeletal system.

The comparative analysis of the pre- and post-experiment indicators showed that the exercise perfor-

Table 4. *Number of tennis players with different temperature reactions of musculoskeletal system after exercise with the use of "Traumeel S" ointment*

Temperature measuring point location	Number of people		
	No changes in temperature °C	Temperature decrease °C	Temperature increase °C
Wrist flexor	9	2	1
Wrist extensor	2	2	8
Medial epicondyle fractures of the elbow	11	1	-
Lateral epicondyle fractures of the elbow	11	1	-
Deltoid muscle (medialis)	9	3	-

mance with the use of “Traumeel S” ointment causes positive reactions of the tennis players’ musculoskeletal system to physical loads. The stability or increase in the temperatures at the measuring points while using the ointment showed that the early stage of the overstrain of the athletes’ musculoskeletal system did not develop. The observed dynamics proved that “Traumeel S” may prevent circulatory disturbance in tennis players during trainings aimed to develop their special working capacity.

Conclusions. The findings showed that the use of the modern antihomotoxic medication “Traumeel S” under the training loads contributes to the prevention of local blood circulation disorders in the upper limbs of athletes. It is reasonable to use this antihomotoxic medication during trainings to improve special working capacity to prevent overexertion of the upper limbs of tennis players at an early stage. Local blood circulation disorders can be detected during the preliminary diagnostics of overstrain of the musculoskeletal system using an infrared thermometer.

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EFFECTS OF SPORTS ACTIVITIES ON MORPHOFUNCTIONAL INDICATORS IN YOUNG MALE STUDENTS

UDC 796.01:612

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Abstract

Objective of the study was to identify the effects of regular sports activities on the morphofunctional development of young male students.

Methods and structure of the study. The study involved the 16-19 year-old indigenous males (n=760), including 322 (42.37%) sporting males - Group 1 and 438 (57.63%) non-sporting males - Group 2. The study was carried out in Yakutsk under the program of unified technology to determine the level of physical development. Besides, it includes identification of the anthropometric, functional, somatotypological, and constitutional features.

Results and conclusions. The analysis of the main morphofunctional indicators of the indigenous males with different levels of motor activity revealed statistically significant differences in most of them. Sports activities affect such parameters as chest circumference, vital capacity, birth-death ratio, muscle strength, and body component composition (absolute and relative fat and muscle body mass).

The analysis of the morphofunctional indicators in the representatives of various constitutional types, depending on their sports activities, indicated the role of the genetic and phenotypic markers in the formation of the body. Significant differences were detected in the muscle and fat components indicating the effects of regular sports activities and a more harmonious physical development of athletes. In the representatives of the brachymorphic somatotype, the morphofunctional indicators did not differ significantly depending on sports activities.

Keywords: *physical development of young males, morphofunctional status, constitutional characteristics, somatotypological characteristics.*

Background. The existing unstable economic, ethnic and cultural situation, as well as the significant changes in demographic indicators, necessitate the development of biomedical programs aimed to maintain and improve public health and impact forecast in the morphophysiological adaptation of the human body to environmental conditions [1-3].

The genotypic (ethnic, constitutional) and phenotypic (climatogeographic) factors influence biological and demographic processes, which in turn are reflected as features of physical development and other health indicators of the modern generation, and the changing age structure of the population [4-6].

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Results and discussion. The main morphofunctional indicators of the groups are presented in the table.

The table shows no statistically significant differences in the body length rates of the Groups 1 and 2 males ($p>0.05$). With a tendency towards a larger body mass in the group of athletes, the differences were also insignificant. The statistically significant differences ($p<0.001$) were obtained when measuring the chest circumference, which was 87.72±10.63 cm for the athletes, ranging from 73.30 cm to 118.00 cm; for Group 2 84.3010.53 cm (72.00-111.50 cm).

Regular exercises are known to increase the vital capacity rates significantly. The vital capacity rates were equal in Group 1 - 3734.32±162.49 ml, in Group 2 - 3454.93±157.82 ml ($p<0.01$). Accordingly, this rate per kilogram of body mass was 62.13 ml/kg and 58.79+1.08 ml/kg. The increase in the birth-death ratio was accompanied by the higher values of chest excursion - by 1.64 cm ($p<0.05$). The higher rates of vital capacity, chest excursion, and birth-death ratio in the athletes indicated sufficiently high functional reserve capacities, which is an important mechanism of adaptation to physical loads and other environmental factors.

The highest wrist dynamometry rates were also found in the young males involved in sports. The right and left hand dynamometry rates in this group equaled 39.88±0.81 kg and 37.55±0.84 kg in absolute value and 65.69% and 61.85% in relative value. In Group 2, the absolute values were 37.78±0.75 kg and 34.70±0.71 kg, the relative ones - 63.96% and 58.78% ($p<0.01$).

The analysis of the hemodynamic indices in Group 1 revealed a downward trend in HR. Thus, while in the athletes, HR equaled 72.33±0.90 bpm, in Group 2 subjects it was 73.82±0.70 bpm. There was also a slight decrease in the blood pressure rates in the males involved in sports.

The analysis of the distribution of constitutional types among the young males revealed the diversity of somatotypes. According to the Rees-Eysenck index, 42.24% of males involved in sports belonged to the dolichomorphic somatotype, 51.86% - to the mesomorphic body type, and 5.9% - to the brachymorphic one. Among the non-sporting males, the figures were as follows: 57.99%, 38.13%, and 3.88%, respectively.

The Rees-Eysenck index in the sporting young males of all somatotypes indicated the predominance of mesomorphic body type. The somatotype diagnostics of the young males not involved in sports revealed that it was the dolichomorphic body type that prevailed.

The analysis of the morphofunctional indicators in the representatives of various constitutional types depending on their physical activity level helped identify the role of the genetic and phenotypic factors in the formation of the human body. We detected significant differences in the fat and muscle body mass components, which testifies to the more harmonious physical development of athletes. Among the representatives of the brachymorphic somatotype, the morphofunctional indicators did not differ statistically significantly in dependence to sports activities.

The analysis of the main morphofunctional indicators of the indigenous males with different levels of

Table 1. *Main morphofunctional indicators in indigenous male group according to motor mode (M±T)*

Indicators	Subjects		p<
	Sports (n=322)	Physical training (n=438)	
Body length, cm	169.40±10.74	170.53±0.53	-
Body mass, kg	60.71±0.89	59.16±0.71	-
Chest circumference, cm	87.72±0.63	84.30±0.53	0.001
Chest excursion, cm	8.38±0.23	6.73±0.17	0.001
Vital capacity, ml	3734.32±162.49	3454.93±157.82	0.01
Birth-death ratio	62.12±1.13	58.79±11.08	0.05
Right wrist dynamometry, kg	39.88±0.81	37.78±10.75	0.01
Right wrist strength index, %	65.69	63.96	-
Left wrist dynamometry, kg	37.55±0.84	34.70±0.74	0.05
Left wrist strength index, %	61.85	58.74	-
Deadlift dynamometry, kg	121.78±2.46	121.27±13.08	-
Deadlift strength index, %	200.6	205.3	-
HR, bpm	72.33±0.90	73.82±10.70	-
SBP, mmHg	111.77±1.13	114.38±11.43	-
DBP, mmHg	71.27±0.83	72.20±10.98	-
Body mass index	21.1310.24	20.28±10.22	0.01
Ponderal index	1.25±0.02	1.19±10.01	0.01

motor activity revealed statistically significant differences in most of them. Sports activities affect such parameters as chest circumference, vital capacity, birth-death ratio, muscle strength, and body component composition (absolute and relative fat and muscle body mass).

Conclusions. The body of athletes has higher functional characteristics, which in turn can contribute not only to the improvement of sports results but also to better tolerance to unfavorable climatic conditions of Yakutia. Sports activities of the residents of Yakutia promote the development of their functional reserves and improves the adaptation mechanisms, which undoubtedly has a positive effect on the viability of the organism.

Therefore, the somatotype diagnostics results provided an objective picture of the morphofunctional characteristics of young male athletes. It can be assumed that regular sports activities stimulate the development of the body properties, which contribute to the creation of a stable population in the modern North without disrupting the overall structure of the northern ecotype.

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SPORTS ACTIVITIES TO CREATE INCLUSIVE ENVIRONMENT FOR CHILDREN WITH DISABILITIES AND HEALTH LIMITATIONS

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Abstract

Objective of the study was to analyze the most promising elements in an adaptive sport school service in the context of inclusive education service for children with disabilities and health limitations.

Methods and structure of the study. We analyzed, for the purposes of the study, the relevant study reports, formal statistical reports of the Kabardino-Balkarian Republic government agencies, plus used the relevant inclusive education service modeling tools.

Results and discussion. The analysis of the current inclusive education model made it possible to take into account the determinants that affect the effectiveness of its implementation in the Kabardino-Balkarian Republic: the possibility to group healthy and disabled children into one sporting group is hindered by different approaches to and time spent on training. However, according to the coaches, this form of adaptive physical education has significant advantages over the traditional one for both healthy and disabled children, who feel more comfortable, become more open and trusting to the people around them and to the coaching staff; there is still a need to involve in these activities sponsors and experts - coaches, psychologists, doctors.

The authors conclude that the inclusive education service progress in the Kabardino-Balkarian Republic needs to be based on certain revisions of the fundamental values and ideas about the service at every level of the traditional education system, with a special priority given to promotion of adaptive physical education and sports and expansion of inclusive education environments for progress of children with disabilities and health limitations in the Republic; in order to effectively reap benefits of cooperative multi-professional social grouping and progress facilitating initiatives built up on high trust, respectful recognition of everyone and solidarity, for success in the inclusive culture building process.

Keywords: *inclusion, adaptive sport school, adaptive physical education and sports, disabilities and health limitations, inclusive education service.*

Background. The Russian educational system gives a high priority to inclusivity assurance initiatives among its key policy goals. Experts urge the policy-makers to respect the special cultural needs of the children with disabilities and health limitations as most of them are tested with poor cognitive activity, immature educational motivations, low working capacity, poor communication, inadequate emotionality, responsibility, dependability and independence (Narzulaev, 2010). As required by the valid provisions for the education service accessibility for people with disabilities and health limitations, an inclusive school education project shall be duly budgeted to take every effort to secure an accessible education service and barriers-free educational environment for successful socialization and progress of students with disabilities and health limitations. At this juncture, however, the national inclusive education system is still in progress and we can still see a gap between the growing social demand for the inclusive service, on the one hand, and the still insufficient service system that fails in some aspects to meet the demands from the inclusive education process subjects, on the other hand.

Objective of the study was to analyze the most promising elements in an adaptive sport school service in the context of inclusive education service for children with disabilities and health limitations.

Methods and structure of the study. We analyzed, for the purposes of the study, the relevant study reports, formal statistical reports of the Kabardino-Balkarian Republic government agencies, plus used the relevant inclusive education service modeling tools.

Results and discussion. Our prior study reports analyzed only the issues of children with disabilities and health limitations training in the general education school system. It should be noted, however, that the problems highlighted in these studies are no less relevant for the republican Adaptive Sport School, the only state government institution in the Kabardino-Balkarian Republic which mission is to secure multi-sided physical rehabilitation and socialization of children with disabilities and health limitations and serve as a progress driver for the adaptive physical education and sports in the Republic. The adaptive sport school trains children with different health issues who demonstrate great competitive accomplishments including medals won in the municipal, regional, federal and international competitions for children with disabilities, qualifications for the Russian national deaf taekwondo team, republican (KBR) team of archers with musculoskeletal disorders, etc.

Thus, Tatiana Zhilova, adaptive sport school student, was ranked fourth at the 2017 (XXIII) Summer Deaflympics in Turkey (Samsun). Madina Satushieva and Tatyana Zhilova won gold medals in the 49-kg and 67+kg weight classes in 2019 Russian Taekwondo Championship in Krasnoyarsk for hearing impaired athletes – with a great support from their families and healthy peers. Our practical experience shows that families need to be supported no less than their unhealthy children, since a parental hostility or reluctance to the special health needs and developmental issues of their children and little if any emotional support may give rise to disharmonies in the children's socializing process up to maladaptive personality traits including anxiety, aggression, marginalization etc. [2, p. 8].

The adaptive sport school trainers and teachers, in their efforts to improve the family climate for the children with special health needs, meet and communicate with the families to explain what the parents could do to facilitate the child's progress at every stage of the training process; analyze the current needs of the families (whether or not they need support to transport the child to adaptive sport school; what is their income level, if there are some other children to take care of, etc.); organize mass cultural, entertainment and team sport/ game events; and offer practical support and help, including via all kinds of sponsorships. The Elbrus municipal district authorities, for instance, offer summer training camps at the Sokol Health Rehabilitation Center for the athletes with disabilities and health limitations with special health/ rehabilitation/ progress facilitating and motivational provisions.

The inclusive education service system shall give a special priority to the IPES motivations of children with disabilities and health limitations with a special priority to the key elementary motivations like: improve the physical fitness; improve the movement control skills and movement freedom on the whole; overcome shyness in the peer social contacts/ communication and, when possible, establish closer friendly relations with them in special progress facilitating environments; develop immunity to potential negative attitudes from peers and adults; demonstrate progress in coping with the health conditions by due mental and physical efforts, despite "every new skill seeming more difficult"; develop sensitivity to own health conditions and trainers' recommendations even if they run counter to own desires; work hard for physical progress and success in the disabled sports; and build up the knowledgebase formed at general education school despite whatever pessimistic forecasts. We have seen many times progresses in the family attitudes when the children show improvements in the physical, moral and mental conditions including progresses upon long-term treatment and rehabilitation courses in other medical institutions. The family expectations are demonstrated by the school achievements and growing demand for the adaptive sport school service enjoyed at present by more than 120 children from many Republican cities.

It should be mentioned that success of the innovation education policy with its "sustainable innovative culture" cannot but depends on the dynamic and harmonized historical and cultural progress of the region, with the inclusive education models designed to factor in the local/ national cultural specifics of the region [3, 4]. Thus the Kabardino-Balkarian Republic government decided to hand over part of the sports equipment and accessories procured under the state program "Accessible Environment in the Kabardino-Balkarian Republic" to the municipal districts and counties to facilitate progress of the republican adaptive physical education and sports system.

The Sports and Tourism Committee of the Kabardino-Balkarian Republic Parliament on its visiting meeting (December 2019), analyzed the situation with the adaptive physical education and sports progress in the Republic and activities of the Adaptive Physical Education and Sports Center, and found the following: growing demand for the adaptive physical education and sports network and rehabilitation facilities to lure the children with disabilities and health limitations in adaptive sports, since only 30% of them

enjoy services of the Adaptive Physical Education and Sports Center; insufficient funding of the adaptive physical education and sports system that may hamper its progress for the period up to 2024; shortages of special equipment and accessories, adaptive physical education and sports facilities and large-space venues at the adaptive sport school – that limits the group (diagnose-specific) adaptive physical education services; shortage of professional human resource for the republican adaptive physical education and sports system and, as a result, low quality of the adaptive physical education and sports / health services to the people with disabilities and health limitations in the communities; need for better public awareness/ communication services from the relevant local government agencies, special health institutions, clubs and groups sensitive to the adaptive physical education and sports / health needs of the people with disabilities and health limitations.

Research works under the "Regional innovative inclusive education cluster of Kabardino-Balkarian State University as a network community" Project made it possible to tackle the above problems and contribute to the public awareness of the adaptive physical education and sports issues in the Republic. Analysis of the existing inclusive education service model design [4] made it possible to rate its benefits and drawbacks in the Kabardino-Balkarian Republic: it was found, among other things, that the inclusive education service is still limited by the differences in the education service models for healthy children and those with disabilities and health limitations with the relevant education service schedules.

The adaptive sport school trainers tend to believe, however, that the adaptive physical education and sports model has proved its benefits as compared to the traditional education system for healthy children – as the inclusive education makes the healthy children tolerant to the health issues in the groups, help develop high empathy, well communicate with children with disabilities and health limitations and help them in their educational and training needs; whilst the children with disabilities and health limitations develop fair confidence, better socialize, become more open in contacts and trustful in relations with the surrounding people and training personnel. However, there is still a need for sponsorship and specialist service (trainers, psychologists, doctors etc.) for progress; with a special need for a special hotel for children with disabilities and health limitations to stay in the rehabilitation/ precompetitive periods. The hotel could help avoid interruptions in the inclusive education service process and solve multiple everyday transportation problems faced by the children with disabilities and health limitations i.e. improve the accessibility of the adaptive sport school classes and competitions for them.

Conclusion. The inclusive education service progress in the Kabardino-Balkarian Republic needs to be based on certain revisions of the fundamental values and ideas about the service at every level of the traditional education system, with a special priority given to promotion of adaptive physical education and sports and expansion of inclusive education environments for progress of children with disabilities and health limitations in the Republic; in order to effectively reap benefits of cooperative multi-professional social grouping and progress facilitating initiatives built up on high trust, respectful recognition of everyone and solidarity, for success in the inclusive culture building process.

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RELATIONSHIP OF LABORATORY AND FIELD TEST INDICES IN ADAPTIVE SWIMMING

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Abstract

Objective of the study was to identify the relationship between laboratory test results and swimming test rates in people with disabilities.

Methods and structure of research. Subject to the study were swimmers with hearing impairment and musculoskeletal disorders at the age of 15-19 years engaged in adaptive sports.

Research results and conclusions. The highest correlations with the results in the "16x50 m" test were shown in such parameters of efficiency of the unit of the musculoskeletal girth of the lower and upper extremities in the test "to muscular failure" as the load phase increase angle in the arm exercise ($r=0.929$, $p<0.01$), the load phase increase angle related to the power of failure in the arm exercise ($r=0.988$, $p<0.01$), the power of failure with respect to the musculoskeletal girth of the shoulder and arms as a whole ($r=-0.930$, $p<0.01$), the pulse cost in relation to the musculoskeletal girth of the legs and arms related to the power of failure ($r=0.893$, $p<0.01$). Among respiratory and metabolic indices, the swimming results to the greatest extent correlate with the oxygen consumption at maximal load ($r=-0.796$, $p<0.01$), carbon dioxide emission at the time of muscular failure ($r=-0.708$, $p<0.01$), oxygen pulse at maximal load ($r=-0.794$, $p<0.01$) and on the 2nd minute of recovery ($r=-0.823$, $p<0.01$). What calls attention to itself is that there is quite a high correlation between the resting heart rate ($r=0.793$, $p<0.01$), especially in the orthostatic test ($r=0.823$, $p<0.01$), and the swimming time.

Thus, some promising parameters of integrated control have been identified to make the adaptive swimming training process more effective.

Keywords: *adaptive swimming; integrated control, relationship of laboratory and field tests.*

Background. The problems of integrated control as an important aspect of sports training management have been covered in the fundamental works of V.N. Platonov devoted to the training of domestic swimmers [2], as well as in the works of C.J. Gore devoted to the training of Australian swimmers [5]. However, in recent years, new ideas have emerged about the key factors of physical training of swimmers at different stages of sports selection [3, 4]. The equation of average swimming speed [1] was composed. However, the inclusion of these components in the integrated assessment of swimmers' training poses serious organizational and methodological difficulties and becomes possible only at the level of the Russian team, including an interdisciplinary research team, and under specific conditions (hydrodynamic channel, equipment to conduct tests directly on water). Thus, the search for new informative methods to control the level of training in adaptive swimming, combining tests both in laboratory and pool conditions, which is the subject of this study, remains a topical issue.

Objective of the study was to identify the relationship between laboratory test indicators and swimming results in people with disabilities.

Methods and structure of research. Subject to the study were swimmers with hearing impairment and musculoskeletal disorders at the age of 15-19 years engaged in adaptive sports. The adaptive reactions at the vegetative level were assessed at rest and in the orthostatic test based on the heart rate variability rates using the "ORTOExpert" diagnostic system and "Science" software application. The COSMEDK5 portable device was used to measure the respiratory and metabolic rates during load testing. The athletes were subject to a step load test "to failure" at the load power of 15 W performed with both the upper and lower limbs, each step taking 1 minute. Electrocardiogram and heart rate were recorded after each load step with the help of the GuarkT12x hardware-software complex and Polar cardio tester. Based on the circumferences and skin-fat folds of the thigh, shin, forearm, and shoulder, the skin-muscle girth of the corresponding segments was determined. The effectiveness and efficiency of swimming were evaluated in the "16x50 m" test (1st-4th segments - easy, 5th-8th - faster, 9th-12th - fast, 13th-16th - maximum). We measured the swimming time and speed, the length and speed of the swimming stroke, the swimmers' heart rate at each segment. Based on the results of measurements, two graphs and trend lines were constructed: the ratio of the stroke speed to the swimming speed as a coefficient of effectiveness; the ratio of the heart rate to the swimming speed as a coefficient of efficiency.

Results and discussion. The heart rate variability analysis revealed that only 11.1% of swimmers had a satisfactory level of adaptation, 55.6% –

Table 1. *Relationship between cardiac rhythmogram data and swimming time in "16x50 m" test*

Cardiac rhythmogram data (n=18)	Average time at the segments	Average time at the 13th-16th segments (maximum)	Best time
Resting heart rate, bpm	r = 0,793, p< 0,01	r = 0,800, p< 0,01	r = 0,811, p< 0,01
HR in the orthostatic test, bpm	r = 0,823, p< 0,01	r = 0,818, p< 0,01	r = 0,837, p< 0,01
Mr, sec	r = -0,736, p< 0,01	r = -0,715, p< 0,01	r = -0,775, p< 0,01
MOr, sec	r = -0,641, p< 0,01	r = -0,651, p< 0,01	r = -0,679, p< 0,01
Mt, sec	r = -0,764, p< 0,01	r = -0,756, p< 0,01	r = -0,774, p< 0,01
Functional state, c.u.	r = -0,614, p< 0,01	r = -0,609, p< 0,01	r = -0,626, p< 0,01
Adaptation, c.u.	r = -0,665, p< 0,01	r = -0,661, p< 0,01	r = -0,675, p< 0,01

Table 2. *Relationship between effectiveness and efficiency of per unit of musculoskeletal girth of lower and upper limbs in step load test "to failure" and swimming time in "16x50 m" test*

Parameters of work «to failure» (n = 18)	Average time at the segments	Average time at the 13th-16th segments (maximum)	Best time
Failure rate (legs/arms), W	r = -0,783, p< 0,01 r = -0,839, p < 0,01	r = -0,783, p< 0,01 r = -0,822, p < 0,01	r = -0,764, p< 0,01 r = -0,808, p < 0,01
Pulse cost of work at the time of failure (legs/arms, HR) bpm/W)	r = 0,833, p< 0,01 r = 0,867, p < 0,01	r = 0,829, p< 0,01 r = 0,844, p < 0,01	r = 0,840, p< 0,01 r = 0,867, p < 0,01
HR during the leg work, bpm/W/kg	r = 0,816, p< 0,01	r = 0,801, p< 0,01	r = 0,834, p< 0,01
Pitch angle in the loading phase during the arm work, rad	r = 0,927, p < 0,01	r = 0,929, p < 0,01	r = 0,903, p < 0,01
Pitch angle in the loading phase / arm work power, rad/W	r = 0,988, p < 0,01	r = 0,982, p < 0,01	r = 0,985, p < 0,01
Musculoskeletal girth of the thigh, см^2	r = -0,814, p< 0,01	r = -0,808, p< 0,01	r = -0,838, p< 0,01
Musculoskeletal girth of the shin, см^2	r = -0,899, p< 0,01	r = -0,894, p< 0,01	r = -0,950, p< 0,01
Skin-fat fold of the shoulder, mm	r = 0,678, p < 0,01	r = 0,689, p < 0,01	r = 0,655, p < 0,01
Failure rate / musculoskeletal girth of the shoulder, W/cm^2	r = -0,928, p < 0,01	r = -0,930, p < 0,01	r = -0,910, p < 0,01
Failure rate / musculoskeletal girth of the arms, W/cm^2	r = -0,803, p < 0,01	r = -0,803, p < 0,01	r = -0,781, p < 0,01
PC / musculoskeletal girth of the legs (HR), bpm/cm^2	r = 0,729, p< 0,01	r = 0,711, p< 0,01	r = 0,772, p< 0,01
HR / musculoskeletal girth of the legs and arms/ failure rate (HR), bpm/cm^2/W	r = 0,893, p< 0,01 r = 0,864, p < 0,01	r = 0,884, p< 0,01 r = 0,874, p < 0,01	r = 0,918, p< 0,01 r = 0,857, p < 0,01

Table 3. *Relationship between respiratory and metabolic rates when working "to failure" and swimming time in "16x50 m" test*

Parameters of work «to failure» (n = 18)	Average time at the segments	Average time at the 13th-16th segments (maximum)	Best time
VT at the peak of loading, legs/arms, l/min	r = -0,655, p< 0,01 r = -0,682, p< 0,01	r = -0,656, p< 0,01 r = -0,678, p< 0,01	r = -0,653, p< 0,01 r = -0,678, p< 0,01
VO_2 at the peak of loading, legs/arms, ml/min	r = -0,796, p< 0,01 r = -0,650, p< 0,01	r = -0,796, p< 0,01 r = -0,639, p< 0,01	r = -0,758, p< 0,01 r = -0,611, p< 0,01
VO_2 throughout the arm work, ml/min	r = -0,762, p< 0,01	r = -0,742, p< 0,01	r = -0,720, p< 0,01
VCO_2 at the peak of loading, legs/arms, ml/min	r = -0,708, p< 0,01 r = -0,629, p< 0,01	r = -0,715, p< 0,01 r = -0,618, p< 0,01	r = -0,667, p< 0,01 r = -0,600, p< 0,01
VO_2/HR at the peak of loading. legs/arms, ml/beat	r = -0,794, p< 0,01 r = -0,703, p< 0,01	r = -0,783, p< 0,01 r = -0,692, p< 0,01	r = -0,764, p< 0,01 r = -0,667, p< 0,01
VT at the 2nd min of recovery after the leg work, l/min	r = -0,641, p< 0,01	r = -0,645, p< 0,01	r = -0,617, p< 0,01
VO_2 at the 2nd min of recovery after the arm work, ml/min	r = -0,714, p< 0,01	r = -0,710, p< 0,01	r = -0,657, p< 0,01
VO_2/HR at the 2nd min of recovery, legs/arms, ml/beat	r = -0,750, p< 0,01 r = -0,823, p< 0,01	r = -0,741, p< 0,01 r = -0,811, p< 0,01	r = -0,659, p< 0,01 r = -0,782, p< 0,01
VO_2 at the 5th min of recovery after the leg work, ml/min	r = -0,746, p< 0,01	r = -0,748, p< 0,01	r = -0,732, p< 0,01
HR at the 5th min of recovery after the arm work, bpm	r = 0,645, p< 0,01	r = 0,632, p< 0,01	r = 0,637, p< 0,01
VO_2/HR at the 5th min of recovery, legs/arms, ml/beat	r = -0,802, p< 0,01 r = -0,612, p< 0,01	r = -0,804, p< 0,01 r = -0,600, p< 0,01	r = -0,778, p< 0,01

tension of the adaptation mechanisms, and 33.3% – poor adaptation. The cardiac rhythmogram data showed significant correlations with the swimming results, from which statistical indicators were allocated (Table 1). What calls attention to itself is that there is quite a high correlation between the resting heart rate, especially in the orthostatic test, and the swimming time.

In the step load test "to failure", the power per unit of the musculoskeletal girth was higher for the upper limbs; the pulse cost was also higher for the upper limbs. When analyzing the relationship between the step load test rates and the swimming time in the "16x50 m" test, the most informative parameters turned out to be: the pitch angle in the loading phase when working with the upper limbs, the pitch angle in the loading phase relative to the failure rate when working with the upper limbs, failure rate relative to musculoskeletal girth of the shoulder and arms in general, the pulse rate relative to musculoskeletal girth of the upper and lower limbs, taking into account failure rate, pulse rate when working "to failure" with the lower and upper limbs. At the same time, the most significant correlations with the swimming test rates were noted in the laboratory test "to failure" performed with the upper limbs (Table 2).

At the peak of loading, with the same respiratory rate, increased lung ventilation during the leg work was due to the increase (3.1 times as much) in the respiration depth, as opposed to the arm work (twice as much). The oxygen pulse reached its maximum at the point of failure, and it was higher during the leg work. With regard to the respiratory coefficient, the maximum was reached not at the peak of loading but at the 2nd minute of recovery. Accordingly, up to the 2nd min of recovery, increased lung ventilation was also maintained. In addition, at the 5th min of recovery after the leg work, HR and oxygen pulse equaled 114.5% and 113.6%, respectively, and after the leg work - 107.2% and 99.2%, respectively. Among the respiratory and metabolic indicators, it was oxygen consumption and carbon dioxide emissions, oxygen pulse, and ventilation rates that correlated most with the swimming results (Table 3). At the same time, the cardiorespiratory rates were in a higher correlation during the leg work. We assume that this was due to the insufficient level of special strength training of athletes, which prevented them from fully realizing their cardiorespiratory working capacity.

The best swimming time at a particular distance segment correlates with:

– the average length of the swimming stroke (r=-0.834, p<0.01), on the 13th-16th-m segments (r=-0.813, p<0.01), on the fastest segment (r=-0.739, p<0.01);

– the average coefficient of effectiveness (r=0.895, p<0.01), on 13th-16th-m segments (r=0.891, p<0.01), on the fastest segment (r=0.819, p<0.01);

– the average coefficient of efficiency (r=0.965, p<0.01), on 13th-16th-m segments (r=0.968, p<0.01), on the fastest segment (r=0.693, p<0.01);

Conclusion. The study data helped identify a set of informative laboratory test rates that correlate well with the swimming test rates, which enables to use them to enhance the quality of the educational and training process management in adaptive swimming.

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ACADEMIC MASS WRESTLERS AND UNSPORTING STUDENTS: GRIP STRENGTH VERSUS ARM MUSCLES ENDURANCE CORRELATION ANALYSES

UDC 796.89.034.2(571.56)

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Abstract

Objective of the study was to analyze the grip strength correlation with muscular endurance in men's mass wrestlers versus their unsporting peers, plus arm muscle fatigue and recovery rates in the sport-specific maximal tension and workout till muscular failure tests.

Methods and structure of the study. We sampled for the study North-Eastern Federal University (NEFU) students (n=54, males only) on their informed consent. Carpal strength and fatigue were tested by an electronic carpal dynamometer "DMER-120" (made in Russia) as follows: the subject standing with the dynamometer in the straight dominant (writing) arm was given 12 attempts of a 3-second maximal strength test with 5-second rest breaks. The muscular endurance and recovery rates were obtained by a Rotating Bar Hang test.

Results and conclusions. Local fatigue of the arm muscles in the maximal-strength trainings with repetitions was found independent of the actual strength and sporting experiences. There are also good reasons to assume that the local arm fatigue rates in sub-maximal-strength trainings largely depend on the arm muscle fitness rates. Correlation analysis found no significant correlations between the arm strength rates (CD tests) and muscular endurance (rotating bar hang tests). This means that high arm strength may not necessarily be associated with high arm muscular endurance in the sport-specific grip tests.

We found a moderate negative correlation between the arm fatigue rates and arm muscle recovery rates in the sporting group and an insignificant correlation of both in the unsporting group – that may be indicative of the mas-wrestling sport facilitating growth of this correlation. This finding may be explained by the sports on the whole and mas-wrestling developing the arm muscle recovery ability after high-intensity workouts till refusal. We would, therefore, recommend further studies to clarify the arm muscles recovery mechanism performance versus the training workloads and the trainees' physical fitness rates.

Keywords: *mas-wrestling, carpal strength, muscular endurance, muscle group, carpal dynamometry, fatigue, recovery.*

Background. Modern mas-wrestling sport implies varied-intensity competitive stresses with every key muscle group mobilized for success [1, 6] in a traditional stick tagging bout of two athletes ('magyns'). It is a common knowledge that a competitive success in mas-wrestling largely depends on the individual carpal strength and muscular endurance among other sport-specific physical fitness qualities [2, 3, 7]. Some of the modern physical progress theoreticians believe that strength and endurance are generally antagonistic qualities – that means that progress in one of them may trigger a regress in the other. Researchers often mention in this context that training systems shall be prudently designed with account of the practical contradiction/ incompatibility of the strength and endurance building elements [8-10]. We tend to believe, however, that the actual level of antagonism of both qualities training methods may widely vary depending on the muscles mobilization rates – e.g. in the global versus local muscle group workouts.

As emphasized by V.M. Zatsiorskiy when considering the correlation between the local muscle group strength versus endurance, 'actual muscular endurance largely depends on the muscle strength – e.g. the stronger people generally attain higher repetitions in strength tests – albeit mostly when the load is high enough. In case of the lower workloads the numbers of repetitions or strength maintenance times will grow fast irrespective of the maximal strength' [5].

Objective of the study was to analyze the grip strength correlation with muscular endurance in men's mass wrestlers versus their unsporting peers, plus arm muscle fatigue and recovery rates in the sport-specific maximal tension and workout till muscular failure tests.

Methods and structure of the study. We sampled for the study North-Eastern Federal University (NEFU) students (n=54, males only) on their informed consent, and split up the sample into the unsporting Group 1 (n=30, aged 19.3±1.4 years, 175.1±6.8cm tall and 64.3±8.2kg heavy on average) formally qualified with the academic main health group, with their physical activity limited by the standard 90-min physical education classes 2 times a week; and the mas-wrestling Group 2 (n=24 aged 20.2±1.8 years, 173.5±4.0cm tall and 71.7±8.0kg heavy) with the 2-year-plus mas-wrestling experience, qualified Class I-III (n=14) to CMS and MS (n=10).

Carpal strength and fatigue were tested by an electronic carpal dynamometer "DMER-120" (made in Russia) as follows: the subject standing with the dynamometer in the straight dominant (writing) arm was given 12 attempts of a 3-second maximal strength test with 5-second rest breaks. The muscular endurance and recovery rates were obtained by a Rotating Bar Hang (RBH) test. The 32mm thick rotating bar butts were fixed in bearings. The subject was given 2 attempts to hang on the bar as long as possible on straight hands with the grip being shoulders-wide, with 60-second rest breaks in between the two attempts (RBH1, RBH2) to attain the individual best result [4].

The test data were processed to obtain the following arm strength and muscular endurance test rates: CDmax, CDmin, CDa, CDb - the individual best, lowest, and average for the first and last 3 attempts, respectively, in 12 carpal dynamometry tests; AFR - arm fatigue rate; RBH1, RBH2 – first and second rotating bar hang test rates, respectively; and AMR – arm muscles recovery rate. We used the following formulas to compute arm fatigue rate and arm muscles recovery:

$$AFR = [(CDa - CDb)/ CDa] \times 100 \quad (1)$$

$$AMR = (RBH1/ RBH2) \times 100 \quad (2)$$

The test data were statistically processed and analyzed using the arithmetic mean (Mean) and standard deviation (SD), with the significance of mean differences rated by the Student's t-test. Differences were rated significant at 95% ($p < 0.05$) and 99% ($p < 0.01$) probabilities. Correlations of the data arrays were rated using the Pearson correlation ratios. The statistical analysis was made using IBM SPSS Statistics version 22.0 software tools.

Results and discussion. Given in Table 1 hereunder are the group carpal strength and muscular endurance test rates.

Table 1. *Group carpal strength and muscular endurance test rates*

Test rate	Group 1, n= 30, Mean ± SD	Group 2, n=24, Mean ± SD	p
CDmax, daN	47,7±7,0	61,2±9,5	<0,01
CDmin, daN	36,0±6,1	49,6±8,50	<0,01
CDa, daN	45,4±6,7	59,3±9,2	<0,01
CDb, daN	38,4±6,0	51,5±8,2	<0,01
AFR, points	**15,3±6,4**	**13,0±5,4**	**>0,05**
RBH1, s	57,6±16,3	65,6±11,3	<0,05
RBH2, s	25,8±9,2	39,3±8,3	<0,01
AMR, points	44,9±11,4	60,4±11,0	<0,01

The analysis found statistically significant intergroup differences in the following test rates: CDmax, CDmin, CDa, CDb, RBH2 ($p < 0.01$), with the RBH1 data arrays found significantly different with $p < 0.05$. The intergroup arm muscles recovery rates were also statistically significantly different with $p < 0.01$. However, the intergroup arm fatigue rates were found insignificantly different with $p > 0.05$.

Correlation analysis found statistically significant correlations between the arm strength test rates (CDmax, CDmin, CDa, CDb) and RBH2 versus RBH1 ($r=0.751^{**}$). We also found a moderate correlation between the RBH2 and arm fatigue rate ($r=0.552^{**}$). And the arm strength and endurance tests found in a moderate correlation between the RBH2 and CDmax ($r=0.404^{*}$) and RBH2 and CDa ($r=0.432^{*}$). Correlation analysis of the results of Croup 2 (mas-wrestling) test data found statistically significant correlations between the arm strength rates (CDmax, CDmin, CDa, CDb); and a moderate correlation between RBH2 versus RBH1 ($r=0.605^{**}$).

Of special interest, in our opinion, were the intergroup differences and correlations in the arm muscles recovery rates. Thus in sporting Group2 the arm muscles recovery rates were found in a moderate negative correlation with the arm fatigue rates ($r = -0.448^{*}$) and in a moderate positive correlation with RBH2 ($r= 0.586^{**}$), and insignificant correlation with RBH1 ($r = -0.283$). In the unsporting Group 1, the arm fatigue rates was found in a moderate correlation with the RBH2 ($r = 0.552^{**}$) and in insignificant correlation with RBH1 although the correlation between arm

fatigue rates and arm muscles recovery was found insignificant (r=0.163).

Conclusion. Local fatigue of the arm muscles in the maximal-strength trainings with repetitions was found independent of the actual strength and sporting experiences. There are also good reasons to assume that the local arm fatigue rates in sub-maximal-strength trainings largely depend on the arm muscle fitness rates. Correlation analysis found no significant correlations between the arm strength rates (CD tests) and muscular endurance (rotating bar hang tests). This means that high arm strength may not necessarily be associated with high arm muscular endurance in the sport-specific grip tests.

We found a moderate negative correlation between the arm fatigue rates and arm muscle recovery rates in the sporting group (r = -0.448 *) and an insignificant correlation of both in the unsporting group (r = 0.163) – that may be indicative of the mas-wrestling sport facilitating growth of this correlation. This finding may be explained by the sports on the whole and mas-wrestling developing the arm muscle recovery ability after high-intensity workouts till refusal. We would, therefore, recommend further studies to clarify the arm muscles recovery mechanism performance versus the training workloads and the trainees' physical fitness rates.

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COMPARATIVE ANALYSIS OF PHYSICAL DEVELOPMENT RATES IN BOYS AND ADOLESCENTS LIVING IN DIFFERENT REGIONS OF RUSSIA

UDC 613[955+956]; 572.087

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Abstract

Objective of the study was to obtain physical development data of the 7-18 year old males living in different regions of the Russian Federation to make a comparative age-specific physical progress analysis.

Methods and structure of the study. We sampled for the study the 7-18 year old Moscow males (n = 243) dominated by the comprehensive school students plus the first-year university students. The sample was tested for the following anthropometric characteristics: body mass; body length; and body mass index. The test data were averaged for the age groups with the resultant data matched with the representative body mass / body length rates reported for Moscow, St. Petersburg, Omsk Oblast, Saratov Oblast and Chuvash Republic residents. The comparative analysis was supplemented by the relevant physical development standards and physical development screening reports.

Results and conclusions. Our sample was tested different from the reference tests of 2010-2012, with the significantly different body length rates in the 7-10 and 13-15 year groups; body mass rates in the 9, 10, 13 and 18 year groups; and body mass indices in the 10, 13 and 18 year groups. Since the regional affiliation of the reference data is rather general and the regional/ Chuvash Republic data lacks indications of the sampled cities and villages, the physical development rates could not be accurately analyzed on an ethnic basis; although the Chuvash Republic sample was generally tested lower on the body mass and body mass index scales than the peers from other regions – that may be interpreted as typical for the Chuvash ethnic age groups. The study data and analyses may be beneficial for the comparative regional children's physical development rating studies in the Russian Federation.

Keywords: *physical development, anthropometric characteristics, physical health, 7-18 year old males, body length, body mass and body mass index.*

Background. Body length, body mass and body mass index are widely used as the child's health indicators both in clinical practices and for the group health standards rating purposes in the local population studies [1, 2]. Many researchers have made attempts to develop regional children's physical development standards on small samples. As argued by S.G. Makarova (2017), the efforts to develop some regional children's physical development standards (dominated by body length and body mass rates) are generally impractical and such studies may be beneficial only in the regional hygienic contexts.

Multiple and contradictory regional children's physical development standards are also known to complicate practical pediatric services as the doctors are unable to fairly rate the physical development and diagnose potential developmental conditions. The individual physical development rating analyses shall give a special priority to the genetic factors, habitual family/ ethnic diets and other factors of influence on such underage deviations from the physical development standards including excessive body length, predispositions to overweight, obesity, etc. It may be beneficial to be governed by the WHO age-specific

Table 1. *Regional physical development test rates of the 7-18 year old males: medians with arithmetic means (M±σ)*

Age	Our tests, Moscow (n=243)	Moscow (n=26604)	St. Petersburg n=2893)	Omsk Oblast (n=13079)	Saratov Oblast (n=7493)	Chuvash Republic (n=6724)
Body length, cm						
7	129,5±5,5	**122,1±4,4**	**121,2±4,9**	**121,0**±5,1	**123,7±4,9**	**119,6±4,3**
8	131,5±4,3	**127,7±4,8**	**127,4±5,2**	**126,8±5,4**	**129,1±5,3**	**125,8±4,8**
9	139,0±4,2	**133,0**±5,3	**133,7±5,6**	**132,4±5,6**	**134,4±5,7**	**131,4±5,2**
10	143,0±6,9	**138,3±5,8**	**139,8±6,1**	**138,0**±5,9	**139,8±6,2**	**136,9±5,8**
11	148,0±6,9	**143,9±6,3**	145,9±6,5	**143,8±6,4**	145,5±6,8	**142,4±6,3**
12	153,5±8,2	149,9±6,8	152,0±6,8	149,8±7,0	151,3±7,4	**148,0**±6,9
13	166,0±7,1	**156,4±7,4**	**157,9±7,1**	**156,2±7,5**	**157,1±8,0**	**153,4±7,3**
14	167,5±9,3	**163,0**±7,6	**163,5±7,2**	**162,3±7,9**	**162,6±8,4**	**158,6±7,5**
15	174,0±9,4	**168,6±7,5**	**168,1±7,2**	**167,8±7,9**	**167,3±8,4**	**163,3±7,5**
16	174,0±4,7	172,7±7,1	171,8±7,0	172,0±7,7	**171,0**±8,2	**167,2±7,4**
17	178,0±7,5	175,1±6,8	**174,5±6,9**	174,9±7,3	**173,7±7,8**	**170,4±7,2**
18	175,5±6,0	176,5±6,6	176,4±6,7	176,8+7,0	175,5±7,4	172,8±7,0
Body mass, kg						
7	29,5±9,6	23,6±3,4	**23,4±4,0**	23,7±4,7	27,4±5,6	**22,0**±3,1
8	28,3±4,9	26,8±4,2	26,2±4,8	26,6±5,3	30,6±6,6	**25,0**±3,9
9	34,0±6,8	**30,1±5,2**	**29,4±5,6**	**29,6±6,0**	34,3±7,7	**28,0**±4,9
10	38,9±11,6	**33,6±6,2**	**33,2±6,6**	**32,9±6,8**	38,5±9,0	**31,2±5,8**
11	39,0±11,2	37,5±7,4	37,5±7,7	36,5±7,8	43,1±10,6	34,7±6,9
12	47,0±13,0	41,9±8,5	42,2±8,8	40,7±8,7	47,8±12,1	**38,5±7,8**
13	56,0±7,1	**47,2±9,5**	**47,3±9,8**	**45,6±9,7**	**52,5±13,5**	**42,7±8,6**
14	54,3±16,0	53,0±10,2	52,4±10,6	51,0±10,6	56,9±14,6	**46,9±9,2**
15	57,5±12,5	58,4±10,3	57,0±11,0	56,3±11,2	60,7±15,2	**51,2±9,5**
16	59,0±13,9	62,7±10,0	60,9±11,2	61,0±11,5	63,8±15,2	55,1±9,6
17	64,8±7,4	65,7±9,7	64,2±11,2	64,9±11,9	66,1±14,6	**58,6±9,7**
18	74,0±10,6	**67,7±9,4**	**66,8±11,3**	**67,9±12,3**	**67,9±13,6**	**61,5±9,7**
Body mass index						
7	18,6±5,1	15,9±1,7	15,9±2,0	16,2±2,2	17,7±2,8	15,4±1,6
8	16,5±2,1	16,5±1,9	16,2±2,2	16,5±2,3	**18,2±3,1**	15,8±1,8
9	17,3±2,8	17±2,1	16,6±2,4	16,9±2,5	**18,8±3,4**	16,2±2,0
10	19,2±3,8	**17,5±2,4**	**17,1±2,6**	**17,2±2,6**	19,4±3,7	**16,6±2,2**
11	17,4±3,5	18±2,7	17,7±2,7	17,6±2,7	**20,1±4,0**	17,1±2,4
12	18,5±4,9	18,6±2,8	18,3±2,9	18,1±2,8	20,6±4,2	17,6±2,5
13	20,3±2,1	**19,2±2,9**	**18,9±3,0**	**18,6±2,8**	21,0±4,4	**18,0**±2,5
14	18,9±4,6	19,9±2,9	19,5±3,1	19,2±2,9	**21,3±4,4**	18,6±2,6
15	19,0±3,3	**20,4±2,8**	20,0±3,1	19,9±2,9	**21,5±4,4**	19,1±2,6
16	20,2±3,8	21±2,8	20,5±3,2	20,5±3,0	21,7±4,3	19,6±2,6
17	20,7±1,9	21,4±2,7	21,0±3,2	21,1±3,1	**21,9±4,1**	20,1±2,6
18	24,9±3,5	**21,7±2,6**	**21,4±3,2**	**21,6±3,3**	**22,0**±3,9	**20,5±2,7**

Note: bolded are the statistically significant (p<0.05) differences of our test data from the reference data

standards in the children's physical development rating and unification studies and for the regional physical development data matching and analyzing purposes.

Objective of the study was to obtain regional physical development data of the 7-18 year old males to make a comparative age-specific physical progress analysis.

Methods and structure of the study. We sampled for the study the 7-18 year old Moscow males (n = 243) dominated by the comprehensive school students plus the first-year university students. The sample was tested for the following anthropometric characteristics: body mass (BM, kg) tested by VEM-150 electronic medical scales; body length (BL, cm) tested by Martina anthropometer; and the body mass index computed as recommended in study [5] (kg/ m2). The test data were averaged for the age groups with the resultant data matched with the representative body mass / body length rates reported for Moscow, St. Petersburg, Omsk Oblast, Saratov Oblast and Chuvash Republic residents [4]: see Table 1. The comparative analysis was supplemented by the relevant physical

development standards [3] and physical development screening reports [4].

Results and discussion. The study data and analyses were found consistent with the reported age-specific (for three age periods of ontogenesis) growth and physical development statistics [1].

The study found the growth process being slowed down in the 8-12 year ('second childhood') period, with the annual body length growth estimated at 4-5 cm in the 9-12 year period. It should be emphasized that the 9 and 10 year body length growth rates were found significantly higher than the physical development standards. The body length growth was found to peak up to 13 cm per year in the 12-13 year period (pubertal peak). The 13-year-old group was tested with the relatively higher body mass and body length rates due to the high proportion of relatively tall and heavy children since this age period is known as an uneven growth time. In the 14-15 year period the body length growth rate was tested to fall to only 7 cm per year.

In the early adolescence (13-16 year) period, the musculoskeletal growth processes are known to speed up to peak in the mid-period and slow down by the end of the period [1]. Adolescent period is the time when the body growth and maturation processes are completed, with the body length growing only by 1.5cm in the 16-18 year period; although the muscles still grow to a degree as verified by the 5 kg and 9 kg body mass growth in the 16-17 and 17-18 year periods, respectively. Average body mass index were found within the WHO norms [3] for every age group, save for the 7 and 11 year-olds who were tested with the "above average" body mass index progress.

The comparative analysis found significant body length differences in the 7-10 and 13-15 year Moscow groups versus their peers from other regions of the Russian Federation. The 12 year-olds were tested with the significantly higher body length than their Chuvash Republic peers; the 16 year-olds were significantly taller than the Saratov Oblast and Chuvash Republic peers; and the 17 year-olds taller than the St. Petersburg, Saratov Oblast and Chuvash Republic peers. The 18 year-olds were tested with the insignificant interregional body length progresses. The body mass rates in our study were found significantly different from every age group in the Chuvash Republic subsample, save for the 11 and 16 year olds; and different for the 9, 10, 13 and 18 year groups in the Moscow, Omsk Oblast and St. Petersburg groups. Comparative analysis of the reference body mass data for the 7-18 year old Moscow, St. Petersburg and Omsk Oblast males found no significant differences. Note that the Chuvash Republic peers were tested with the lowest body length, body mass rates and body mass index in the sample under analysis.

Conclusion. Our sample was tested different from the reference tests of 2010-2012, with the significantly different body length rates in the 7-10 and 13-15 year groups; body mass rates in the 9, 10, 13 and 18 year groups; and body mass indices in the 10, 13 and 18 year groups. Since the regional affiliation of the reference data is rather general and the regional/ Chuvash Republic data lacks indications of the sampled cities and villages, the physical development rates could not be accurately analyzed on an ethnic basis; although the Chuvash Republic sample was generally tested lower on the body mass and body mass index scales than the peers from other regions – that may be interpreted as typical for the Chuvash ethnic age groups. The study data and analyses may be beneficial for the comparative regional children's physical development rating studies in the Russian Federation.

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BENEFITS OF COORDINATION TRAINING MOTIVATION MUSIC FOR FEMALE FITNESS AEROBICS GROUPS

UDC 796.011.3

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Abstract

Objective of the study was to rate benefits of a coordination training motivation music model for different female fitness service versions applicable at universities.

Methods and structure of the study. The coordination training motivation music model for elective female fitness groups was tested by an experiment in 2018-19 academic year at the Surgut State University's Physical Education Department. We sampled for the study the second-year female students of non-sporting bachelor specialties (n=41) and split up the sample into Experimental Group (EG, n=19) subject to a sports-emphasizing physical education; and Reference Group (RG, n=22) subject to a fitness training.

As a coordination abilities rating test students were to repeat a dance combination made of basic steps of classical aerobics; repeat the proposed rhythmic patterns after listening to them.

Research results and conclusions. The experiment resulted in a statistically significant progress in the perception and repeating of the rhythmic pattern of an increased complexity level in the Experimental Group compared to the Reference one.

The pre-experimental dance routine repeating tests found none individual in the EG and RG capable of repeating the demo combination in Attempt 1, whilst 37.2% and 41.6% of the EG and RG was able to cope with the test in Attempt 2; 36.7% and 35.2% in Attempt 3; and 26.1% and 23.2% failed the test, respectively. The post-experimental tests found progress in both of the groups, with every EG girl being able to cope with the test, and with the Attempt 1 success rate in the EG found to grow from 0% to 15.7%.

The coordination training motivation music model was tested more beneficial for the sports-emphasizing physical education model versus the traditional fitness training model as verified by the movement coordination, rhythmic ability and rhythmic pattern repeating progress tests.

Keywords: *coordination training, motivation music, female students, fitness aerobics, rhythmic ability, rhythmic pattern.*

Background. Motivation music is known to be of special benefits for the physical training goals in many aspects including the rhythmic ability improvement ones (K.V. Gorbuzova, 2011). Feel of rhythm may be defined as the inborn skill that may grow with the living experience when specially trained to contribute to the harmonic development process. It is largely through the individual rhythmic abilities that one masters a wide variety of motor skills.

A range of motivation music versions has long been traditional for different fitness schools. Thus the traditional fitness training models normally use background music to partially offset monotony and fatigue and/ or control the workout intensity. Modern fitness aerobics models use motivation music as a process leader, i.e. for setting the training process rhythm, mood and pace, with the musical rhythm helping control the movements and lift up spirits. Positive emotions trig-

Table 1. *Samples of the rhythmic ability rating rhythmic pattern used in the tests*

Rhythmic pattern 1	Rhythmic pattern 2	Rhythmic pattern 3	Rhythmic pattern 4
1st 2nd 3rd 4th 	1st 2nd 3rd 4th 	1st 2nd 3rd 4th 	1st 2nd 3rd 4th 

gered by the motivation music keep up enthusiasm and energy of the trainees, secure faster progress in their working capacity, with health improvement benefits and better rehabilitation in the active rest phases. Music may be also beneficial for the training process as it helps memorize the movement sequences. Furthermore, musical illustrations are widely used for the fitness aerobics routine design purposes in the following two aspects: (1) to design a specific routine; and (2) to control the movement pace/ rhythm in the execution process.

It should be mentioned that the motivation-music-driven fitness aerobics pace/ movement structure control is widely used among the key training tools, with the performance pace slowed down or increased depending on the individual progress in the routine element mastering process. When a training pace is too fast for a beginner trainee, he/she may be exposed to the overstrain risks being often unable to understand and/ or repeat the movement sequence. On the other hand, too slow pace may be also detrimental to the cardiorespiratory system performance and, hence, the trainees' health.

Objective of the study was to rate benefits of a coordination training motivation music model for different female fitness service versions applicable at universities.

Methods and structure of the study. The coordination training motivation music model for elective female fitness groups was tested by an experiment in 2018-19 academic year at the Surgut State University's Physical Education Department. We sampled for the study the second-year female students of non-sporting bachelor specialties (n=41) and split up the sample into Experimental Group (EG, n=19) subject to a sports-emphasizing physical education; and Reference Group (RG, n=22) subject to a fitness training. The group motivation music was different in the following aspects:

RG (fitness)	EG (Physical Education)
Training intensity, physical and mental state control motivation music	Lead motivation music, i.e. rhythm, mood and pace control motivation music

We used the following tests to rate the individual progress in coordination skills: (1) *Dance routine repeating test*, with the routine including basic steps of classical aerobics demonstrated by the instructor. The progress was rated by the total number of attempts for success (three at most); and attempts claimed for the error-free execution (three at most; and (2) *Rhythmic pattern repeating test* upon listening (see Table 1), with the progress rated by the listening attempts (four at most) claimed for an error-free repeating. The error-free repeating in Attempts 1, 2, 3 and 4 was scored by 4, 3, 2 and 1 point, respectively.

Table 2. *Group progresses rated by the rhythmic pattern repeating skills tests*

Rhythmic Pattern	Group	Pre-experimental test±σ (n=19, 22)	Post-experimental tests ±σ (n=19, 22)	p≤0,05
RP1	EG	3,7±0,5	3,7±0,4	p>0,05
	RG	3,8±0,7	3,8±0,5	p>0,05
	p	p >0,05	p>0,05	
RP2	EG	3,5±0,5	3,9±0,2	**p<0,05**
	RG	3,8±0,4	3,9±0,4	p>0,05
	p	**p<0,05**	p>0,05	
RP3	EG	2,8±0,4	3,2±0,4	**p<0,05**
	RG	2,9±0,5	3,1±0,4	p>0,05
	p	p>0,05	p>0,05	
RP4	EG	1,9±0,7	2,5±0,5	**p<0,05**
	RG	1,8±0,9	1,9±0,8	p>0,05
	p	p>0,05	**p<0,05**	

Results and discussion. The group progresses tested by the pre- versus post-experimental rhythmic pattern repeating tests are given in Table 2.

The above pre- versus post-experimental test data showed significant ($p < 0.05$) progress in the rhythmic pattern repeating skills in the EG versus RG. We should also note the significant ($p<0.05$) progress in the EG training as verified by the pre- versus post-experimental rhythmic patterns 2, 3 and 4 tests.

The dance routine repeating test included the basic steps of classical fitness aerobics, with the trainees required to repeat the dance routine demonstrated by the instructor (three attempts at most): see the test data on Figure 1 hereunder.

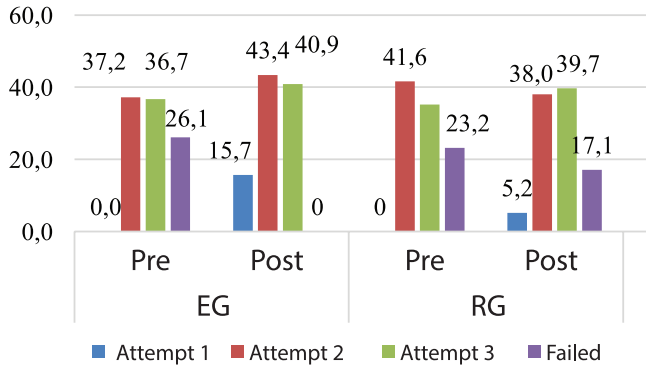

Figure 1. *Dance routine repeating test data: success percentages and numbers of attempts for success*

The pre-experimental dance routine repeating tests found none individual in the EG and RG capable of repeating the demo combination in Attempt 1, whilst 37.2% and 41.6% of the EG and RG was able to cope with the test in Attempt 2; 36.7% and 35.2% in Attempt 3; and 26.1% and 23.2% failed the test, respectively. The post-experimental tests found progress in both of the groups, with every EG girl being able to cope with the test, and with the Attempt 1 success rate in the EG found to grow from 0% to 15.7%.

Conclusion. The coordination training motivation music model was tested more beneficial for the sports-emphasizing physical education model versus the traditional fitness training model as verified by the movement coordination, rhythmic ability and rhythmic pattern repeating progress tests.

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LABOR MARKET DEMAND FOR SPORTS UNIVERSITY GRADUATES: CURRENT SITUATION AND PROSPECTS

UDC 796.077.5

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Abstract

Objective of the study was to analyze the labor market demand situation and prospects for the university physical education and sports specialists.

Methods and structure of the study. We made, for the purposes of the study, an employment statistics analyses for the physical education and sports university graduates [5]; analyzed the individual professional progress agendas of the physical education and sports university graduates based on a questionnaire survey data; and outlined the ways to improve their employment options.

Results and conclusions. The physical education and sports specialist employment profiling and facilitation studies shall be designed based on a theoretically sound high-quality data flows and labor market monitoring system with a comprehensive market demand forecast capacity for every physical education and sports specialty, with due account of the regional specifics. A special priority shall be given to the professional determination and agenda forming efforts to provide effective vocational guidance and facilitate the professional identification of the uncertain part of the students to facilitate their employment. The existing cross-sector volatility of the physical education and sports specialists may be scaled down by additional target professional training services including professional retraining courses for the former sport elite willing to progress in other knowledge fields. As a result, the national physical education and sports sector will be fully stuffed by the highly motivated and knowledgeable specialists with healthy value systems, priorities and professional agendas.

Keywords: *physical education and sports, employment, labor market demand, physical education and sport specialists, physical education and sports university graduate, professional mobility, higher education institution.*

Background. The current national physical education and sports system gives a special priority to the market demand for the physical education and sports university graduates in different physical education and sports service domains. The graduates' employment statistics are indicative of the educational institution service quality on the whole and give answers to the following questions in particular: what physical education and sports specialties are in special demand on the physical education and sports service market; what specialists are less demanded; and what response policies need to be taken to improve the physical education and sports university service to meet the market demand. Such statistics should be available on a timely basis for the physical education and sports specialist training system to be sensitive to the labor market. This data flow will enable the students and graduates to adjust their individual educational trajectories and progress agendas including the advanced and special vocational education options.

Objective of the study was to analyze the labor market demand situation and prospects for the university physical education and sports specialists.

Methods and structure of the study. We made, for the purposes of the study, an employment statistics analyses for the physical education and

sports university graduates [5]; analyzed the individual professional progress agendas of the physical education and sports university graduates based on a questionnaire survey data; and outlined the ways to improve their employment options.

Results and discussion. As things now stand, university education in 49.00.00 physical education and sports group specialties is offered by 14 physical education and sports universities and more than 100 other universities, with most of them located in the European part of the country and only three physical education and sports universities found in Siberia and the Far East. The obvious need in the eastern federal regions for the high quality physical education and sports university education is underlined by many factors including the still poor coverage of the local population by regular physical education and sports services and the still low supply of accessible physical education and sports facilities. Thus for 2017 the habitually sporting federal population was reported at 36.8% of the total versus 25.5% in the Irkutsk Oblast, 19.3% in Amur Oblast, 22.7% in the Jewish Autonomous Region, and 26.1% in the Altai Republic [4].

The employed-to-unemployed physical education and sports university graduates' ratio for the first calendar year upon graduation may be used as an objective indicator of the physical education and sports service quality. This ratio, as reported by the Ministry of Sports of the Russian Federation in its Higher Education Institutions Performance Monitoring Reports, varies from 75% for Russian State University of Physical Education, Sport, Youth and Tourism (Moscow), Volga Region State Academy of Physical Culture, Sport and Tourism (Kazan) and some other physical education and sports universities to 55% for Smolensk State Academy of Physical Culture, Sport and Tourism [1]. These ratios, however, are deemed to be incomplete due to the existing drawbacks in the employment tracking and reporting mechanisms, as argued by the Pension Fund experts. Thus, the foreign undergraduate students from the CIS countries in the Smolensk State Academy of Physical Culture, Sport and Tourism are reported at 21.3% of the total although they are screened out by the formal statistics. In addition, the formal employment reports often fail to indicate the professional service domain. Therefore, the shortage of accurate employment statistics for the physical education and sports university graduates needs to be offset by the relevant questionnaire survey tools.

The professional employment opportunities for the physical education and sports graduates are further limited by the underdeveloped physical education and sports infrastructure and low wages unappealing for the graduates. The efforts to analyze the labor market demand for the physical education and sports specialists may be facilitated by the questionnaire surveys of the physical education and sports bachelors'/ masters' professional progress agendas versus the actual market situations and their professional mobility rates. The 2018 questionnaire survey of the physical education and sports university alumni and statistical data analyses made it possible to profile the Lesgaft National State University of Physical Education, Sport and Health alumni professional progress options and expectations.

We sampled for the questionnaire survey the full-time (n=379) and part-time (n=137) Lesgaft National State University of Physical Education, Sport and Health undergraduate students specialized in 49.03.01 physical education service [2]. The questionnaire survey forms for the both subsamples were somewhat different as dictated by their natural differences. Thus, the 20-30 year-olds accounted for 99.4% and 70.8% of the full-time and part-time subsamples, respectively; with 12.7% and 48.2% of both reported to have secondary vocational or higher education, respectively; and with the relevant differences in the sports qualifications, titles, experiences, marital statuses etc.

The questionnaire survey of the physical education and sports university sample professional progress agendas yielded the following data: see Tables 1, 2. Most of the sample was found willing to make a professional career in the national physical education and sports sector; with 12.7% and 10.9% of full- and part-time subsamples (respectively) reporting some other career expectations: see Table 1. Many students were found still hesitating in their plans, and this share shall be taken into account by the employment statistics optimizing scenarios [3].

Table 1. *2018 Lesgaft National State University of Physical Education, Sport and Health alumni responses to the question "Are you going to make career in the physical education and sports sector?" (%)*

Subsample	Yes	No	Uncertain
Full-time	65,1	12,6	22,1
Part-time	58,9	10,9	29,1

Probes of the professional agendas on a more specific basis found 36.9% and 12.4% of the full- and part-time subsamples (respectively) going to advance their master education in 49.04.01 physical education and 49.04.03 Sports specialties. We also found 59.9% and 37.5% of the part- and full-time subsamples, respectively, going to work at physical education and sports organization or combine their physical education and sports studies with jobs.

Table 2. *2018 Lesgaft National State University of Physical Education, Sport and Health alumni responses to the question "What are your expected positions in the physical education and sports sector?" (%)*

Subsample	Coach	University teacher	School teacher	Sports referee	Physical education and sports service manager	Physical education and sports regulatory agency manager	Researcher	Other
Full-time	56,2	1,8	5,3	1,5	10,0	5,8	1	18,3
Part-time	56,9	5,2	9,4	5,2	10,2	2,1	0,73	10,3

Analysis of the above career expectations showed 56% of the sample hoping to serve in coaching positions. At the same time, as demonstrated by Table 3, 73% and 49.3% of the full- and part-time subsamples are already employed in the physical education and sports sector, with 46.0% and 41.6% (respectively) holding coaching positions. It should be emphasized that upon graduation these numbers will likely to grow.

On the whole, the questionnaire survey data may be interpreted as indicative of the sample being strongly motivated for the professional coaching service in the university education period, in agreement with the objectives set forth by the National Physical Education and Sports Sector Progress Strategy for the period up to 2020.

Conclusion. The physical education and sports specialist employment profiling and facilitation studies shall be designed based on a theoretically sound high-quality data flows and labor market monitoring system with a comprehensive market demand forecast capacity for every physical education and sports specialty, with due account of the regional specifics. A special priority shall be given to the professional determination and agenda forming efforts to provide effective vocational guidance and facilitate the professional identification of the uncertain part of the students to facilitate their employment. The existing cross-sector volatility of the physical education and sports specialists may be scaled down by additional target professional training services including professional retraining courses for the former sport elite willing to progress in other knowledge fields. As a result, the national physical education and sports sector will be fully stuffed by the highly motivated and knowledgeable specialists with healthy value systems, priorities and professional agendas.

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Table 3. *2018 Lesgaft National State University of Physical Education, Sport and Health alumni responses to the question "If you work in the physical education and sports sector, what is your position at present?" (%)*

Subsample	Coach	Physical education instructor	Sports instructor	Physical education teacher	Other
Full-time	41,6	1,8	5,8	1,8	48,8
Part-time	46	6,6	8	8	31,4

HIGHER EDUCATION IN TERMS OF SUSTAINABLE DEVELOPMENT: PHYSICAL EDUCATION, SPORTS AND RECREATIONAL ACTIVITIES

UDC 378.1

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Abstract

Objective of the study was to overview the recent foreign study reports with concern to the sustainable-development-focused higher physical education, sports and recreation service policies and practices.

Methods and structure of the study. We analyzed the relevant publications in the leading international journals (including "Sports, Education and Society"), with a special attention to the following aspects: (1) focus on some specific higher education service mission (e.g. didactics); and (2) sustainable-development-specific issues.

Results of the study and conclusions. A brief analysis of the key study reports on the sustainable-development-prioritizing higher physical education, sports and recreation service issues found 4 key dimensions that need to be designed on a multidisciplinary and interconnected basis, plus require an interdisciplinary approach. However, the relevant study reports analyzed herein are still rather special and discipline-unspecific – and this is the reason why an interdisciplinary analysis is still difficult.

The sustainable development related issues are global albeit their international research and discussions are still limited. Although the key subject of our study was different, it may be pertinent to mention that most of the relevant studies have been run in the developed countries, whilst a few research initiatives in developing countries have been focused rather on specific 'sports for development' issues. In Russia, the sustainable development issues still need to be addressed by the research community.

One of the key practical findings of our analysis is that the sustainable development initiatives need to be put on a systemic basis. As demonstrated by the ongoing research discussions, the sustainable development awareness and reflection in the student communities will be advanced mostly by humanities including history, sociology, cultural studies and philosophy – since these disciplines help form communication and creativity among the other key skills.

Keywords: *higher education, physical education, sports and recreation service, sustainable development, sustainable development policy goals.*

Background. The national higher education system persistently sets and optimizes its sustainable development polices, with a special attention to the sustainable-development-focused higher physical education, sports and recreation service polices – that still prioritize purely economic benefits in many countries [5] often at sacrifice of the social and natural environmental aspects, and with little if any consideration for the long-term national socio-economic progress goals. Sustainable higher education service may be defined as the knowledge generation and employment sector driven by the relevant social demand system [14]. The sustainable development goals of the higher education system appear to be "beyond the scope of narrow utilitarianism and practical economics" as they have effect on "many human progress aspects" [8, 14]. University physical education specialist (athlete, instructor, coach) training curricula are reported to grow and expand in many countries. The research communities still disagree on how the traditional higher physical education, sports and recreation service may be designed on a sustainable-

development-prioritizing basis and how universities may contribute to the social sustainable development policies and practices by their didactic, research and social ("third mission") missions.

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Methods and structure of the study. We analyzed the relevant publications in the leading international journals (including "Sports, Education and Society"), with a special attention to the following aspects: (1) focus on some specific higher education service mission (e.g. didactics); and (2) sustainable-development-specific issues [13].

Results and discussion. The sustainable-development-focused higher physical education, sports and recreation service will be designed to 'facilitate the students' progress in learning (knowledge), practice (skills) and socio-economic (wellbeing, free progress and social solidarity)' domains [11, 14]. Educational policies within these domains will be both economically and environmentally sustainable and socially equitable [4]. As far as the university research domain is concerned, sustainable development will be designed to expand the available knowledgebase, its accessibility and inclusivity [9].

Dimension 1: accessibility and inclusivity. Some studies analyze the higher physical education, sports and recreation service accessibility for women, people with disabilities, seniors and ethnic minorities (e.g. a quantitative study by British research team [7]). Sports universities will facilitate access for these groups by the efforts to improve the curricula, learning environments and infrastructure [7]. Non-sports universities will encourage inclusivity in the university sports teams to facilitate the social integration of disabled students, women and ethnic minorities with a special attention to their academic progress and comfort (as reported, e.g. in a study report of the US research team [8]). Universities may cooperate in these initiatives with the local communities to attain their sustainable-development-3 policy goal (that is "to improve health and well-being of every age group").

Dimension 2: social and individual agendas. Some studies analyze the ways to facilitate the relevant skills mastering by practicing specialists, students, researchers, university administrators and managers [Barrett, et al., 2019]. Skills and behavioral models and priorities are viewed as a basis for the sustainable-development-focused agendas including the professional 'green skills' and general environmental literacy.

The sustainable-development-focused higher physical education, sports and recreation service will help students challenge the traditional unsustainable practices including unfair competition, doping etc. Students will become more responsible and well-informed for the decision-making (see review [2]). The researchers give a special priority to the grassroots innovative activity and physical education, sports and recreation service based on the efforts "to develop the relevant qualities in students including willpower, responsibility and social activity to effectively contribute to the communal progress and change people, events and circumstances for the better", as well as to develop the social networking [3, 12]. These studies analyze the environmental footprints of some universities including the relevant student initiatives such as sustainable practices on campus (see a case study that gives a qualitative analysis of the sustainability policies of 47 US universities [3]).

Dimension 3: academic cooperation and knowledgebase. Some studies analyze the germeneutic justice related issues – i.e. demands for different knowledge fields from industries and other sectors, including academic knowledge, local knowledge, practical knowledge and unprofessional knowledge. Good cases in point are: (1) qualitative study of cultural diversity in physical education specialist training service by a Norwegian team, with a special focus on intercultural knowledge integration in the academic curriculum [10]; and (2) local physical education knowledge study by an Australian research team [15]. Researchers recommend that the accessibility of the physical education, sports and recreation knowledge for different public groups should be improved, to make them aware of the new sustainable technologies in sports competitions, new training methods, relevant environmental and social implications etc.

Dimension 4: sustainable university education service. Studies in this field may be generally classified into the following two higher education sustainability analyzing approaches. First approach is a subject-specific. Such focus – e.g. on the subject of sports management – helps proceed from the specific situations in analyses of environmentally unsafe practices, imbalances etc. (A study by a US university demonstrates that more sustainable practices may be successfully promoted in the student communities by the discipline-specific curricula [4]). And the second approach implies the universities being encouraged to prioritize sustainable development in a wide range of disciplines for every of them tackling the sustainable development / environmental issues rather on a practical than "incorporeal" theoretical basis [4].

Special physical education, sports and recreation / physical education universities (like Lesgaft National State University of Physical Education, Sport and Health, St. Petersburg) may be highly success-

ful, in our opinion, in combining both of the above approaches, particularly when they still hold to a sort of an "implicit curriculum" to strengthen and legitimize unsustainable consumption/ production systems (see a theoretical analysis in study [6]). Therefore, sustainable-development-prioritizing physical education, sports and recreation university education will be designed to overcome the narrow disciplinary mentality and integrate the knowledge sharing experiences and skills for joint solutions [6].

One of the most promising methodologies is an action research model, with the teachers encouraging the students to report their sustainable development visions for critical examination of the nature-and-culture relationship issues and to effectively integrate the disciplinary knowledge into the broader knowledgebase and practices [11]. As demonstrated in this context by a study of a Portuguese research team, progress in such a model may be limited by a shortage of philosophical knowledge and low environmental awareness in the student communities [1].

Conclusion. Our brief analysis of the key study reports on the sustainable-development-prioritizing higher physical education, sports and recreation service issues found 4 key dimensions that need to be designed on a multidisciplinary and interconnected basis, plus require an interdisciplinary approach. However, the relevant study reports analyzed herein are still rather special and discipline-unspecific – and this is the reason why an interdisciplinary analysis is still difficult.

It should also be emphasized that the sustainable development related issues are global albeit their international research and discussions are still limited. Although the key subject of our study was different, it may be pertinent to mention that most of the relevant studies have been run in the developed countries, whilst a few research initiatives in developing countries have been focused rather on specific 'sports for development' issues. In Russia, the sustainable development issues still need to be addressed by the research community.

One of the key practical findings of our analysis is that the sustainable development initiatives need to be put on a systemic basis. As demonstrated by the ongoing research discussions, the sustainable development awareness and reflection in the student communities will be advanced mostly by humanities including history, sociology, cultural studies and philosophy – since these disciplines help form communication and creativity among the other key skills.

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DIGITALIZATION OF PHYSICAL EDUCATION AND SPORTS EDUCATIONAL PROCESS AT UNIVERSITY

UDC 796.011

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Abstract

Objective of the study was to analyze progress of the university physical education and sports digitalization efforts with a special emphasis on the personality progress, physical activation, fitness and individual health agenda related aspects.

Methods and structure of the study. The study was designed to analyze, among other things, benefits of the university physical education and sports service digitalizing process in the socialization, teamwork, communication, physical activation and sports club domains – with support from a questionnaire survey of the university physical education and sports experts and students with psychological and educational priorities.

Results of the study and conclusions. 32% of physical education and sports experts emphasized the need to improve their professional IT skills, while 68% of respondents did not understand the process of digitalization of general education and physical education and sports educational process in particular. At the same time, 60% of coaches were at the critical level in the use of modern data collection techniques, information processing and storing technologies. 79% of the sample reportedly use the Internet search engines although only 3.8% of the teachers keep their own online courses or have an online education service certificate. 32% of the sample reported the need for an IT skills advancement course; 68% was found innocent in the university physical education and sports service digitalization matters; and 60% of trainers reported a critical need for modern data mining, processing and storing tools.

The study demonstrated the need for the physical education and sports specialist training in modern digital physical education and sports service issues to equip them with the modern IT/ digital services knowledge and skills.

Keywords: *digital services, mobile application, education, science, university physical education and sports, educational establishments.*

Background. Presently the national government takes efforts to implement the National Program 'Digital Economy of the Russian Federation' (2018-2024) that supports, among other things, new educational service improvement initiatives, models and priorities [4]. The efforts to advance the digitalization projects need to be focused on the challenges and prospects of every specific sector including science, education, and physical education and sports service [4-6, 8] so that to establish the new physical education and sports knowledge industry, expand the relevant software platforms, communication and data processing toolkits, offer new physical activation models for students with efficient physical progress testing, analyzing and data processing tools. As things now stand, 85% of student communities habitually mine information in the Internet; albeit the applicable data processing, prioritization and categorization tools need to be advanced to improve the grassroots innovative activity in the physical education and sports service sector.

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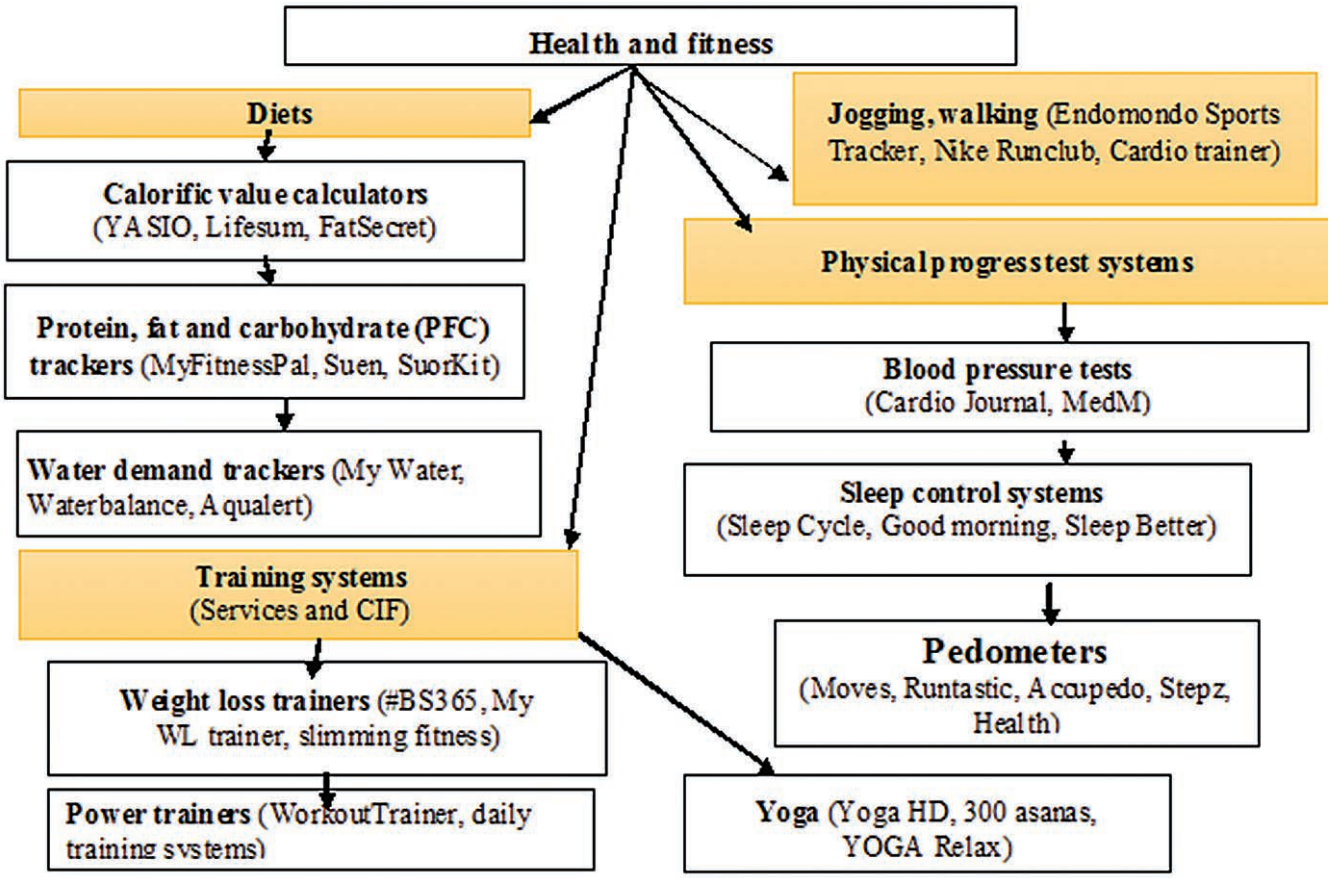

Figure 1. *Classified popular Health and Fitness mobile application*

vice digitalizing process in the socialization, teamwork, communication, physical activation and sports club domains – with support from a questionnaire survey of the university physical education and sports experts and students with psychological and educational priorities.

Results and discussion. The university physical education and sports service digitalizing projects are presently supported by Universarium Digital Platform with its curricula tested by a few universities, successful fitness companies and business trainers. Thus Stepik Platform offers a wide range of educational courses including six physical education courses tested by a few educational establishments. Udemy Service System offers a range of health and fitness courses with the relevant diet, meditation and Pilates exercises, training models etc., including specific physical education courses recommended by a few educational establishments. We would also mention Lektorium, Eliademy and Eduardo.studio service systems. It should be emphasized, however, that the users are still in need of a comprehensive theoretically grounded search engine for the physical-education-and-sports-related digital platforms, online courses, mobile application, databases and software tools. The digitalization project entities are still not knowledgeable and skillful enough in the data screening, processing, presentation, physical progress test and analysis tools that may be digitalized for electronic applications. As things now stand, the national universities have made progress only in the digital educational environment establishment aspects including the electronic documents, student/ teacher personal accounts, electronic logbooks, manuals and textbooks.

Digital technologies applicable in the university physical education and sports service include Sport 3.0 and Sport 4.0 systems by Aksenov M.O. [1]; Polar system; Excel toolkit; Garmin Connect system; My Fitness Pal Service Platform; Bioimpedance Test system; Garmin-based personal offices of athletes; Esteck Test System [7]; and Omega-sport system.

A.A. Drobyshevsky (2013) offers electronic lecture notes, control test forms, multilevel training quasi-professional tasks, self-reliant progress tests and individual pages on the university department website to effectively digitalize the learning process. Modern computer technologies make it possible to monitor progress in the self-reliant trainings and effectively process, analyze and store the physical education and sports progress test data [2]. It should be mentioned that the physical-education-and-sports-specific digital services and mobile application are lately growing very fast year to year [3]. The popular Health and Fit-

ness mobile application may be classified as follows: see Figure 1 hereunder.

The popular Health and Fitness mobile applications are generally classified into diets, jogging and walking, training systems and physical progress tests [3]. The Diets mobile applications include the calorie intake calculators (YAZIO, Lifesum, Fat Secret); protein, fat and carbohydrate (PFC) and water demand trackers ("My Water", Waterbalance, Aqualert). In addition, Diets offer ready-made meals, restaurant menus with calorific values, with foods- and dish-specific counters.

The Physical Progress Test Systems include 1) blood pressure tests ("Cardio", MedM); 2) sleep control: Sleep Cycle, Goodmorning, Sleep Better; 3) pedometers: Health, Moves, Runtastic, Accupedo, Stepz; and the popular detailed jogging/ walking: Endomondo Sports Tracker, Nike Run Club, Cardio Trainer (see Figure 1). The trainer mobile applications include 1) weight loss systems; 2) power trainers; and 3) yoga. Weight Loss Applications: # BS365, My Weight Loss Trainer, Weight Loss Fitness; and power trainers Workout Trainer, daily training.

Furthermore, we run a questionnaire survey of the physical education and sports experts (n=173) to analyze challenges for the university physical education and sports service digitalization initiatives, with the sample including 48.7% of non-sports university experts; 35.8% elite athletes; 14.1% secondary vocational education service experts; and 7.6% of the fitness, mass sports and children's sports experts. The sample ranked the top digitalization problems as follows: Excel files processing issues (19.6%); and digital reporting issues (17.5%). It should be noted that 79% of the sample reportedly use the Internet search engines although only 3.8% of the teachers keep their own online courses or have an online education service certificate. 32% of the sample reported the need for an IT skills advancement course; 68% was found innocent in the university physical education and sports service digitalization matters; and 60% of trainers reported a critical need for modern data mining, processing and storing tools.

Having analyzed the university digital physical education and sports courses, we found shortages of professional and theoretically grounded data, with many educational establishments only learning the ropes of modern digital education service having little if any knowledge of the digitalization process benefits, content and goals. At the same time, students were found to highly appreciate the available online courses. Thus the Stepik Fitness physical education service course offered since June 2019 reports 1156 trainees, 128 positive comments and is ranked 4.8 points high on a 5-point scale. The course persistently improves the independent/ distance work tools, expands the theoretical database, creates individualized physical education service models, offers fast progress test tools, facilitates social networking of the students and teachers, sharing of practical experience, search for innovations; and feedbacks from students.

Conclusion. The study demonstrated the need for the physical education and sports specialist training in modern digital physical education and sports service issues to equip them with the modern IT/ digital services knowledge and skills. The ongoing university physical education and sports service digitalization initiatives shall facilitate the practical and theoretical physical education and sports service methods by innovative and efficient data mining, processing, categorizing, analyzing and applying tools.

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