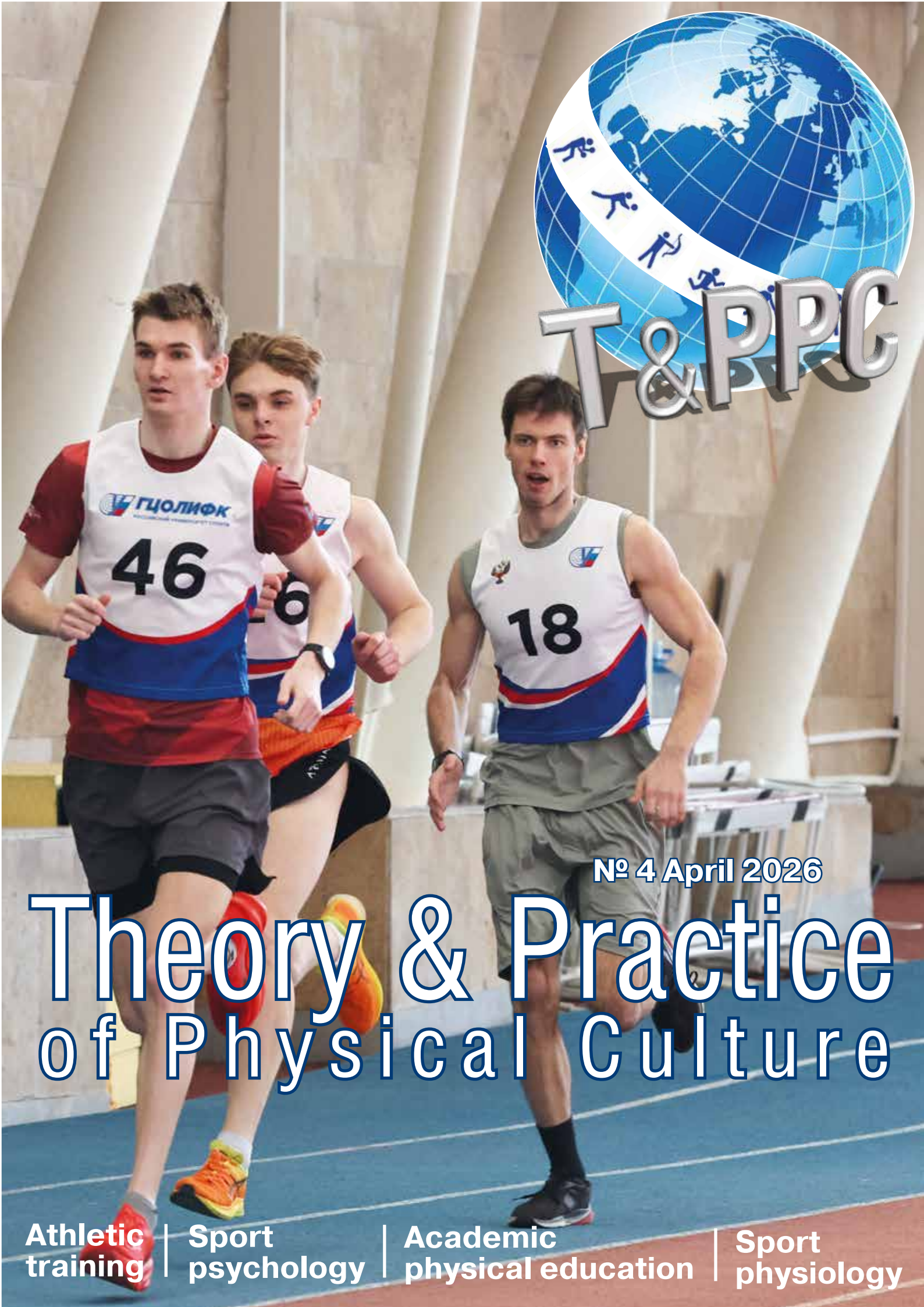

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Contents

Development of a concept for the individualisation of the training process for female pentathletes

UDC 796.412.22

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Abstract

Objective of the study is to develop and verify a conceptual framework for the individualization of training for elite female athletes specialising in modern pentathlon.

Methods and structure of the study. The research was conducted at the Olympic Sports Laboratory of Skorina Gomel State University. Personalised training models were developed for female pentathletes and tested in the training process of six highly qualified athletes (Master of Sport – International Master of Sport). Model effectiveness was assessed by the magnitude of statistically significant improvements in physical and functional fitness, as well as performance gains in pentathlon disciplines.

Results and conclusions. A conceptual framework for the individualization of female athletes' training in modern pentathlon was developed, incorporating personalised models of competitive activity, annual training cycle structure, and projected dynamics of specialised fitness levels for individual pentathletes, oriented towards achieving target values by the time of major competitions. The practical application of the developed models, based on consideration of individual competitive activity characteristics, morphofunctional and biorhythmological features of a specific athlete's body, contributed to statistically significant improvements in fitness levels, performance gains in modern pentathlon disciplines, and successful performances at major national and international competitions in the 2024–2025 season.

Keywords: *conceptual framework, elite female athletes, pentathlon, training individualization.*

Introduction. Modern pentathlon is one of the most complex and dynamically evolving multisport events. Traditionally, Russian and Belarusian female athletes rank among the strongest in the world. To increase spectator appeal, social attractiveness, economic efficiency and animal welfare, the Union Internationale de Pentathlon Moderne (UIPM) modified the competition rules. Equestrian show jumping was removed from modern pentathlon and replaced by a new discipline involving an obstacle course race, which altered the competition format. Consequently, specialists need to modernise classical approaches to training planning for pentathletes.

Objective of the study is to develop and verify a conceptual framework for the individualization of training for elite female athletes specialising in modern pentathlon.

Methods and structure of the study. The research was conducted at the Olympic Sports Laboratory of Skorina Gomel State University. Personalised training models for female pentathletes were developed and tested in the training process of six highly qualified athletes (Master of Sport – International Master of Sport). Model effectiveness was assessed by the magnitude of statistically significant improvements in physical and functional fitness, as well as performance gains in pentathlon disciplines.

Results of the study and discussion. The conceptual framework for the individualization of female athletes' training involves the development of personalised models of competitive activity, annual training cycle structure, and projected dynamics of specialised fitness levels [3, 4].

Previously, the authors identified two types of group competitive activity models in modern pentathlon [5]; however, following changes to competition rules (based on the 2024–2025 competitive season results), three main types of group models can now be distinguished. The first type (38.5%) comprises athletes demonstrating excellent results in the combined event of modern pentathlon; the second (23.1%) includes athletes showing top-class achievements in the combined relay and obstacle course; the third (19.2%)

Table. Model of individualized training construction for the athlete (second macrocycle of the annual cycle)

Macrocycle		II									Training volume per macrocycle, km, hours
Periods		Preparatory			Competitive					Transit.	
Stages		General training		Spec. training	Main competition stage						
Mesocycles		B	CP	PC	C	IT	CP	PC	C	R	
Months / Training resources		III		IV V	VI		VII		VIII	IX	
Aerobic-restorative focus	Running, km, %	58,3 9,8		155,8 26,2	380,5 64,0						594,6 100
	Swimming, km, %	7,0 20,1		6,8 19,5	21,1 60,4						34,9 100
Aerobic-developmental focus	Running, km, %	114,0 22,8		104,5 20,9	281,6 56,3						500,2 100
	Swimming, km, %	12,3 14,9		20,2 24,5	49,9 60,6						82,3 100
Mixed, aerobic-anaerobic focus	Running, km, %	13,0 24,0		13,0 24,0	28,2 52,0						54,2 100
	Swimming, km, %	6,2 15,0		9,3 22,7	26,8 65,3						41,1 100
Glycolytic anaerobic focus	Running, km, %	3,5 14,4		1,5 6,3	19,2 79,3						24,2 100
	Swimming, km, %	2,2 13,3		2,1 13,0	11,9 73,7						16,2 100
Mixed, alactate-glycolytic focus	Running, km, %	-		0,6 2.4	22,8 97,6						23,4 100
	Swimming, km, %	0,8 7,0		5,4 50,2	4,6 42,8						10,8 100
Fencing (sparring, lessons and partner work), hours, %		24,0 30,8		16,0 20,5	38,0 48,7						78,0 100
Obstacle course (specialised training), hours, %		12,0 15,8		28,0 36,8	36,0 47,4						76,0 100
Shooting (specialised training), hours, %		30,0 38,9		21,0 27,3	26,0 33,8						77,0 100
General physical training (jumping, specialised and isometric exercise routines), hours, %		12,0 24,0		20,0 40,0	18,0 36,0						50,0 100

Note: B – Basic, CP – Control-Preparatory, PC – Pre-Competitive, C – Competitive, R – Recovery, IT – Introductory mesocycle

consists of athletes with strong results in fencing and obstacle course racing. Within the study, each pentathlete participating in the experiment was matched with the group model most closely corresponding to her individual competitive activity characteristics.

The annual training cycle structure model was built on the basis of traditional theoretical-methodological approaches to training planning, taking into account the forthcoming competition calendar [1, 2, 3]. Practical implementation of the developed model involved a general approach to load distribution across macro- and mesocycles for all athletes participating in the experiment. At the same time, the volume and intensity of loading were determined individually, based on morphological, psychological and biorhythmological characteristics, levels of physical and functional fitness, and the competitive activity model of the specific athlete.

The developed annual training cycle structure comprised two sequentially implemented macrocycles. The first included a preparatory period consisting of three general-preparatory and two specialised-preparatory mesocycles, as well as competitive and transition periods (one mesocycle each). The second macrocycle combined one general-preparatory and two specialised-preparatory mesocycles, as well as competitive (five mesocycles) and transition (one mesocycle) periods.

The construction of training macrocycles was based on a rational combination of primary training methods and an optimal distribution of their volumes, taking into account the parameters achieved in the previous annual cycle. During observations, individual changes in the athletes' specialised fitness indicators were recorded, depending on the content, volume and intensity of the training load, as well as the influence of the biorhythmological cycle phases of the specific athlete.

The training process encompassed a wide range of preparatory tools: running at various intensities (at speeds below and at anaerobic threshold level – at distances from 800 to 2,000 m, and at competitive intensity – from 200 to 1,000 m), swimming at intervals from 25 to 2,000 m (depending on the training stage), fencing (bout practice, individual lessons and pair work), shooting, and specialised obstacle course training. Additionally, specially developed sets of plyometric, isometric and specific physical exercises were employed.

The developed model for the annual training cycle structure of elite female athletes was previously tested in prior competitive seasons, and the data obtained, reflecting consistently high participant results, confirmed its effectiveness [4, 6]. On this basis, its organisational-methodological principles were integrated as a key element into the individualized training models for specific female athletes specialising in modern pentathlon. The table presents such an individualized training model (using the example of one macrocycle of the annual cycle) for a leading Belarusian pentathlete (V.G.).

The proposed conceptual framework also provides for constructing a model of the projected dynamics of specialised physical, functional fitness and psychophysiological state indicators for a specific athlete within each macrocycle of the annual training cycle, oriented towards achieving target values by the time of major competitions. This model includes the most informative indicators characterising specialised fitness and demonstrating a high correlation with competitive performance (relative oxygen consumption at anaerobic threshold (VO2(AT)), running speed at anaerobic threshold (VHR), 1,000 m run, 50 m swim, simple visual-motor reaction (SVMR)) [7].

These indicators served as benchmarks for monitoring the effectiveness of the training process through feedback, the function of which consisted of regular assessment of the athlete's current state, comparison of actual values with model values, and, where necessary, the introduction of operational programme corrections.

Figure. Individual model of projected dynamics of specialised physical, functional and psychophysiological fitness levels of athlete V.G.

Physical fitness was assessed once a month, while functional fitness monitoring was conducted once per stage of the annual training cycle, which is related to the complexity of measurements (in particular, the use of gas analysis equipment). The practical role of the developed model lay in its function as a methodologi-

cal foundation for the individualization of the training process of a specific athlete.

Experimental verification of the effectiveness of the developed individualized training models for elite female athletes was carried out within their training process in 2024–2025. Upon completion of the annual training cycle, a comparative analysis of competitive results achieved by the athletes at major international competitions was conducted.

Statistically significant improvements were revealed in combined relay results, obstacle course performance and the overall pentathlon score ($p<0.05$). In swimming and fencing, pronounced positive dynamics were recorded, approaching the level of statistical significance.

Furthermore, the implemented content and differentiated distribution of training stimuli ensured statistically significant ($p<0.05$) improvements in physical and functional fitness across the majority of investigated indicators (VO2(AT), VHR, 1,000 m run, 50 m swim).

Conclusions. A conceptual framework for the individualization of female athletes' training in modern pentathlon, adapted to the conditions of competitive structure transformation, was developed and experimentally substantiated. It was established that the implementation of models based on consideration of individual competitive activity characteristics, morphofunctional and biorhythmological features of the athletes' bodies, as well as differentiated load planning within the annual training cycle structure, ensures enhanced training process effectiveness without increasing the aggregate volumes and intensity of training stimuli.

The practical effectiveness of the proposed approach was confirmed by consistent competitive performance improvements and the athletes' successful performances at international competitions of the 2024-2025 season, including World Cup stages and the "Pavel Lednyov Cup" final.

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Analysis of the influence of peripheral vision indicators on blocking effectiveness in qualified volleyball players

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Abstract

Objective of the study is to substantiate the influence of peripheral vision on the effectiveness of blocking in qualified volleyball players.

Methods and structure of the study. During the experimental research, an assessment was made of the effectiveness of the blocking actions of volleyball players from youth teams participating in the Saint Petersburg Championship 2024-2025. The analytical processing of data was carried out on the basis of 22 matches. At the first stage, the initial peripheral vision indicators of the volleyball players and the effectiveness of their actions at the block were determined. The Foerster perimeter method (white marker) was used as the main method for assessing peripheral vision. At the second stage, the experiment participants were offered specially developed sets of exercises aimed at improving the capacity of their peripheral vision and the influence of these indicators on blocking effectiveness. The study involved 22 volleyball players from the teams of the 'Ekran' Specialised Children's and Youth Sports School of the Olympic Reserve and the V.A. Platonov Specialised Children's and Youth Sports School of the Olympic Reserve No. 1 of the Kalininsky District, Saint Petersburg.

Results and conclusions. (1) The results of the study revealed the homogeneity (similarity) of the initial peripheral vision indicators of the volleyball players in both teams across eight control measurement points for the left and right eye. (2) Three main thematic sets of exercises aimed at the development of peripheral vision were identified (for the expansion of the field of vision without motor actions; for actions with two balls; and for movements with the ball). (3) It was revealed that an increase in the indicators characterising the development of the volleyball players' peripheral vision across all eight measurements for both eyes significantly improves the effectiveness of their blocking in the course of competitive activity. (4) The implementation of special exercises for the development of peripheral vision made it possible to achieve a significant increase in the effectiveness of blocking: the effectiveness indicator in the experimental group increased from 24.6±0.77% to 27.3±0.78%. At the 0.05 significance level, the statistical reliability of the differences between the average final values of the experimental (27.3±0.78%) and control (24.65±0.81%) groups was confirmed.

Keywords: *analysis, peripheral vision, means, blocking effectiveness, qualified volleyball.*

Introduction. In order to move quickly to the block and to make accurate decisions during a jump, a volleyball player needs well-developed peripheral vision. Limited peripheral vision deprives the volleyball player of tactical flexibility and impoverishes their technical capabilities, since by concentrating only on objects directly in front of them, they miss information for decision-making [3]. For this reason, its development is one of the key factors of volleyball players' success, and 'the development of physical qualities and technique alone is becoming insufficient' [1, 4].

Researchers note that, on average, indicators of visual estimation in players of game sports are two and a half times more accurate than those of athletics competitors, swimmers or gymnasts [5]. At the same time, the task of developing peripheral vision in athletes in game sports remains 'extremely sought-after and relevant' [2]. The narrowly focused sets of exercises identified in the course of the study contribute to the solution of this task. The effectiveness of blocking in highly qualified volleyball players is directly dependent on the dynamics of the improvement in their pe-

ripheral vision. These results may be used as a basis for setting goals when planning training sessions.

Objective of the study is to substantiate the influence of peripheral vision on the effectiveness of blocking in qualified volleyball players.

Methods and structure of the study. During the experimental research, an assessment was made of the effectiveness of the blocking actions of volleyball players from youth teams participating in the Saint Petersburg Championship 2024–2025. The analytical processing of data was carried out on the basis of 22 matches. At the first stage, the initial peripheral vision indicators of the volleyball players and the effectiveness of their actions at the block were determined. The Foerster perimeter method (white marker) was used as the main method for assessing peripheral vision. At the second stage, the experiment participants were offered specially developed sets of exercises aimed at improving the capacity of their peripheral vision and the influence of these indicators on blocking effectiveness. The study involved 22 volleyball players from the teams of the 'Ekran' Specialised Children's and Youth Sports School of the Olympic Reserve and the V.A. Platonov Specialised Children's and Youth Sports School of the Olympic Reserve No. 1 of the Kalininsky District, Saint Petersburg.

Results of the study and discussion. According to the analysis of indicators of blocking effectiveness, physical and technical fitness, the youth volleyball teams that took part in the study showed statistically homogeneous results. The absence of significant differences between the teams in peripheral vision indicators, established at the initial stage, served as the basis for the subsequent pedagogical experiment. As part of the experiment, specially developed exercises for the development of peripheral vision were introduced, structured into three target blocks: Block 1. Expansion of the field of vision without motor actions. Block 2. Expansion of the field of vision in actions with two balls. Block 3. Expansion of the field of vision in movements with the ball. Within the framework of a training session, the exercises were performed according to a set algorithm: first, before the running warm-up, a 2-minute exercise from Block 1 (in a sitting position) was performed. Then, in the main part of the session, 12–15 minutes were allocated for the performance of two exercises from each of the three methodological blocks [6].

An example of an exercise from the first block: while maintaining visual fixation on the central cell of the Schulte–Gorbov table, without shifting the gaze, sequentially detect and identify all numbers. The ex-

Table 1. Peripheral vision indicators of volleyball players after the experiment

Peripheral vision indicator	X±Sx, (n=11)		Student's t-test	P-value	Conclusion on difference
	EG after	CG after			
Peripheral vision of the right eye (degrees)					
Lower	75.63±0.65	73.09±0.39	3.35	0.003	p<0.01
Upper	41.18±0.78	38.45±0.41	3.07	0.005	p<0.01
Outer	89.63±0.92	87.54±0.38	2.09	0.04	p<0.05
Inner	67.09±0.88	64.36±0.64	2.85	0.01	p<0.01
At 5 o'clock	90.9±1.19	88.90±0.57	2.50	0.04	p<0.05
At 1 o'clock	71.81±0.72	68.81±0.42	3.57	0.001	p<0.01
At 7 o'clock	62.0±1.01	60.18±0.58	2.47	0.04	p<0.05
At 11 o'clock	60.6±1.0	58.09±0.39	2.36	0.02	p<0.05
Peripheral vision of the left eye (degrees)					
Lower	75.18±0.72	73.27±0.46	2.21	0.03	p<0.05
Upper	42.45±0.82	40.09±0.47	2.48	0.02	p<0.05
Outer	91.09±1.01	88.63±0.49	2.17	0.04	p<0.05
Inner	66.9±0.81	64.9±0.45	2.14	0.04	p<0.05
At 5 o'clock	91.63±1.02	88.90±0.57	2.30	0.03	p<0.05
At 1 o'clock	50.63±1.1	48.18±0.5	2.09	0.04	p<0.05
At 7 o'clock	61.18±1.07	59.45±0.66	2.30	0.04	p<0.05
At 11 o'clock	51.81±0.97	49.45±0.91	2.86	0.003	p<0.01

Note: critical value 2.086 (p<0.05); 2.845 (p<0.01).

ercise includes two tasks: searching for Arabic numerals from 1 to 25 and Roman numerals from I to XXIV in ascending order. An example of an exercise from the second block: the players are positioned in groups of four, forming a square. Diagonal pass of the ball in pairs, with two balls per pair. An example of an exercise from the third block: two players organise an attack after a pass, one strikes the ball, while the second shows a number on his fingers. The blocking player performs the movement and blocks the strike, and must see and call out the number on the second player's fingers.

The peripheral vision indicators of the volleyball players after the experiment are reflected in Table 1. Based on the results obtained, the effectiveness of the means of developing peripheral vision has been demonstrated. Their application in training led to positive dynamics and an increase in values across all eight control measurement points for each eye.

During the competitions, the dynamics of blocking effectiveness indicators were recorded in both groups under study, which is reflected in Table 2.

Table 2. Dynamics of blocking effectiveness indicators of volleyball players

Indicator	Group	(X±Sx)	
		Before	After
Blocking effectiveness, %	Experimental (n=11)	24.6±0.77	27.3±0.78
P-value		0.02	
Conclusion on difference		p≤0.05	
Blocking effectiveness, %	Control (n=11)	24.63±0.82	24.65±0.81
P-value		0.97	
Conclusion on difference		p>0.05	

Statistical analysis of the data confirmed a significant increase in the indicator of blocking effectiveness in the group of qualified volleyball players, which is a direct consequence of the introduction into their training of special exercises aimed at the development of peripheral vision.

Conclusions. (1) The results of the study revealed the homogeneity (similarity) of the initial peripheral vision indicators of the volleyball players in both teams across eight control measurement points for the left and right eye. (2) Three main thematic sets of exercises aimed at the development of peripheral vision were identified (for the expansion of the field of vision without motor actions; for actions with two balls; and for movements with the ball). (3) It was revealed that an increase in the indicators characterising the development of the volleyball players' peripheral vision across all eight measurements for both eyes significantly improves the effectiveness of their blocking in the course of competitive activity. (4) The implementation of special exercises for the development of peripheral vision made it possible to achieve a significant increase in the effectiveness of blocking: the indicator of blocking effectiveness in the experimental group increased from 24.6±0.77% to 27.3±0.78%. At the 0.05 significance level, the statistical reliability of the differences between the average final values of the experimental (27.3±0.78%) and control (24.65±0.81%) groups was confirmed.

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Assessment of the statokinetic stability of athletes in various sports

UDC 796.925

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Abstract

Objective of the study is to determine the level and identify neuromotor mechanisms of statokinetic stability regulation in elite athletes across different types of sporting activity.

Methods and structure of the study. The research was conducted at the Research Institute of Physical Culture and Sport at Volga Region State University of Physical Culture, Sport and Tourism. A total of 227 male subjects actively engaged in sport, with at least 9 years of experience and sporting qualifications ranging from second adult rank to Master of Sport of the Russian Federation, were examined. Statokinetic stability was assessed using a stabilometric platform with biofeedback in a state of relative rest.

Results and conclusions. A comparison of statokinetic stability indicators was conducted among elite athletes representing cyclic, precision, and situational sports, as well as non-athletes. Athletes in cyclic sports demonstrated higher mean linear velocities of centre of pressure oscillation and greater rates of change in the statokinesiogram area compared with representatives of precision and situational sports. Simultaneously, they exhibited the lowest values of the integrative "balance function quality" indicator. This is explained by more refined regulation of the statokinetic system and lower centre of pressure oscillation velocity in athletes from precision and situational sports.

Keywords: *statokinetic stability, postural control, balance, neuromotor mechanisms.*

Introduction. The process of maintaining body balance is an active one, during which the human body is continuously subjected to balance-disrupting influences associated with linear, angular, and combined accelerations, as well as with the activity of the respiratory and circulatory systems [5]. The oscillatory nature of body movement reflects the process of balance regulation under these conditions. Evidently, the lower the velocity or amplitude of body oscillation, the better the individual manages the task of maintaining balance [1]. Currently, the control of vertical body posture is no longer viewed as a simple summation of postural-static reflexes implemented at different levels of the hierarchical organisation of the neuromuscular system. Statokinetic stability is a complex of skills formed on the basis of the interaction of dynamic sensorimotor processes of body orientation and balance in space [2]. A high level of statokinetic stability is essential for achieving high sporting results across many sports disciplines.

Objective of the study is to determine the level and identify neuromotor mechanisms of statokinetic stability regulation in elite athletes across different types of sporting activity.

Methods and structure of the study. The study was conducted in the first half of the day at the Research Institute of Physical Culture and Sport at Volga Region State University of Physical Culture, Sport and Tourism (Kazan). A total of 227 male subjects actively engaged in sport, with at least 9 years of experience, were examined. Sporting qualifications ranged from second adult rank to Master of Sport of the Russian Federation. Sports represented included cyclic (middle- and long-distance running, cross-country skiing,

swimming, and rowing), precision (clay pigeon shooting), and situational (basketball, badminton, volleyball, football, tennis, ice hockey, and wrestling) disciplines. The control group comprised 50 non-athletes.

Postural control was assessed using the "Stabilan-01" stabilometric analyser with biofeedback (ZAO OKB Ritm, Taganrog). The following indicators were used: balance function quality (BFQ, %), confidence ellipse area (ELLS, mm), and linear velocity of centre of pressure displacement (Vavg, mm/s).

Data were processed using SPSS 27. Distribution normality was assessed, and parametric and non-parametric methods were applied accordingly to evaluate the statistical significance of differences.

Results of the study and discussion. Athletes in cyclic sports demonstrated higher mean linear velocities of centre of pressure oscillation and rates of change in the statokinesiogram area compared with representatives of precision and situational sports ($p<0.05–0.01$). Simultaneously, they exhibited significantly lower values of the integrative "balance function quality" indicator. This is associated with lower centre of pressure oscillation velocity and more refined statokinetic system regulation in athletes from precision and situational sports (Table 1). At the same time, the absence of significant differences in most stabilographic indicators among athletes of different sports is likely related to insufficient activation of postural maintenance systems in standard (non-specific) tests, which enables easy compensation of one regulatory system through others [3].

In non-athletes, the efficiency of statokinetic system functioning was significantly lower than in athletes ($p<0.05–0.001$). Centre of pressure oscillation velocity was more pronounced, indicating a lower level of vertical posture regulation.

Among athletic groups, the integrative "balance function quality" indicator showed significant differences depending on the specificity of sporting activity (Figure 1). The highest BFQ among athletic groups was found in ice hockey players and wrestlers, significantly higher ($p<0.05–0.001$) than in runners, skiers, rowers, volleyball players, and football players. Clay pigeon shooters, basketball players, and badminton players had significantly higher BFQ ($p<0.05–0.001$) than skiers, rowers, runners, and volleyball players. The lowest BFQ was found in skiers and rowers, significantly lower ($p<0.05–0.001$) than in football players, swimmers, tennis players, and others.

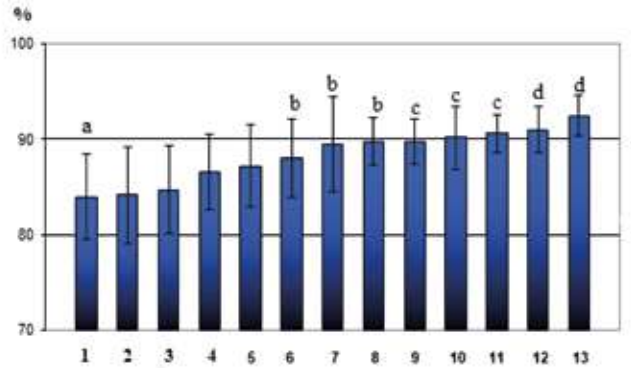

Figure 1. Integrative "balance function quality" indicator in athletes depending on the specificity of sporting activity

1 – Non-athletes, 2 – Skiers, 3 – Rowers, 4 – Runners, 5 – Volleyball players, 6 – Footballers, 7 – Swimmers, 8 – Tennis players, 9 – Badminton players, 10 – Basketball players, 11 – Archers, 12 – Wrestlers, 13 – Ice hockey players.

Note: a – differences from the values for runners, volleyball players, footballers, swimmers, tennis players, badminton players, basketball players, shooters, wrestlers and ice hockey players ($p < 0.05–0.001$); b – differences from the indicators for skiers and rowers ($p < 0.05–0.01$); c – differences from the indicators for skiers, rowers, runners and volleyball players ($p < 0.05–0.001$); d – differences from the indicators for skiers, rowers, runners, volleyball players and footballers ($p < 0.05–0.001$).

The stabilographic indicators of statokinetic stability regulation in athletes are largely linked to the nature of the movements in the sports we have studied. The higher level of body balance maintenance observed in athletes participating in situational sports appears to be due to the predominance in their training of specif-

Table 1. Stabilographic indicators of statokinetic stability in subjects (M±s)

Parameters	Non-athletes	Cyclic sports	Precision sports	Situational sports
Vavg, mm/s	7.54±1.67	7.37±2.08 #	5.63±0.86	5.69±2.09
SELLS, mm^2	99.48±18.76 *	77.65±19.98	66.93±9.46	70.96±16.13
BFQ, %	83.97±4.49 *	86.08±5.01 #	90.59±2.00	89.85±3.54

*Note: * – significant differences from athletes' indicators ($p<0.05–0.001$); # – significant differences from situational and precision sport athletes' indicators ($p<0.05–0.001$).*

ic exercises involving a variety of turns and rotational movement elements, which are stronger stimuli for the statokinetic system compared to linear exercises performed in cyclic sports. In turn, the specific nature of an athlete's activity in target sports is linked to the need to maintain a stable static posture, which can be complicated by the weight of the weapon, which the shooter must not only lift repeatedly but also hold for a relatively long time to aim at the target. It is clear that with a low level of stability in the shooter's upright posture, it is impossible to achieve high sporting results in trap shooting, as accuracy when hitting a moving target is reduced. Therefore, athletes in precision sports also demonstrate higher levels of static posture maintenance and a lower rate of centre of pressure fluctuation compared to athletes in cyclic sports.

There is a trend towards an increase in the 'KFR' integral indicator as athletes' qualifications improve – it is slightly higher among Masters of Sport and Candidates for Master of Sport (89.71±4.22% and 87.77±5.03% respectively, $p>0.05$) than in first-class athletes (86.89±4.07%). In non-athletes, however, the 'KFR' index is significantly lower (83.97±4.49%, $p<0.05$) than in athletes (Fig. 2). As other studies show, athletes with low sporting proficiency exhibit a large amplitude of centre of gravity fluctuations, a low frequency of corrections and a short duration of body balance maintenance [4]. As athletes' technical proficiency increases, the amplitude of body oscillations decreases, whilst the frequency of corrections and the duration of body balance maintenance increase, along with an improvement in statokinetic stability during the performance of simple and complex motor tasks [1, 5].

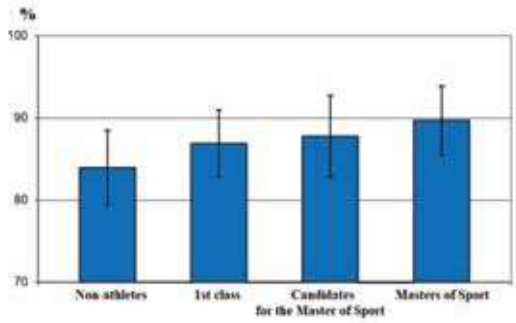

Figure 2. "Balance function quality" indicator in athletes of different qualification levels

Consequently, through systematic training, athletes develop enhanced stability of body balance regulatory mechanisms due to more effective use of proprioceptive information from the skin and muscles of the ankle and hip joints [4]. This in turn leads to the development of voluntary and involuntary correction capacity for general centre of mass oscillations, ultimately expanding the reserves for maintaining vertical body stability.

Conclusions. Athletes demonstrate a higher level of statokinetic stability compared with non-athletes. Balance maintenance indicators in athletes are largely related to the nature of movements in their chosen sports. Representatives of situational and precision sports possess higher balance function quality than athletes in cyclic sports, which is reflected in lower centre of pressure oscillation velocity in the former. Meanwhile, the absence of substantial differences in some stabilographic indicators among athletes of different sports in standard tests may be related to insufficient activation of postural maintenance systems under non-specific conditions, enabling easy compensation of their work.

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Analysis of the dynamics of maximum oxygen consumption during continuous and interval swimming

UDC 797.21

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Abstract

Objective of the study is to compare the nature of physiological responses to continuous and interval training regimes in swimming to exhaustion.

Methods and structure of the study. Eleven qualified male swimmers were tested in continuous and interval swimming at maximum aerobic speed to exhaustion. Respiratory parameters, VO2max, heart rate, blood lactate concentration and ratings of perceived exertion were measured. The nature of physiological responses to continuous and interval training regimes in swimming to exhaustion was assessed by comparing these indicators.

Results and conclusions. Continuous and interval training regimes at maximum aerobic speed are both able to elicit the maximum VO_{2max} response prior to exhaustion. Interval swimming consisting of 100-metre series with 15-second rest periods is an effective means of increasing the time during which maximum VO2 values are sustained and contributes to an increase in maximum oxygen uptake.

Keywords: *swimming, dynamics, physiological responses, oxygen consumption.*

Introduction. Maximum aerobic speed corresponding to maximum oxygen uptake is one of the most significant characteristics of an athlete's performance, since it links movement economy and maximum VO_2 values into a single factor [3]. Maximum aerobic speed values are commonly used to plan training intensity. For this reason, studying the time to exhaustion in interval swimming at maximum aerobic speed is extremely important for obtaining information about athletes' capabilities [1].

It is generally recognised that training intensity at a level of between 70% and 100% of VO_{2max}, as well as interval swimming at $VO_{2max,}$ improves aerobic performance. It is known that the more rapidly an athlete reaches the level of VO_{2max}, the better this corresponds to their energy demands, reducing the accumulation of metabolites and delaying fatigue [2]. In this regard, faster initial gas-exchange responses are linked with a higher level of pulmonary ventilation and a longer time spent close to maximum VO_2 values during interval training [4].

The mechanisms of oxygen uptake during interval training in swimming have not been sufficiently studied. Studies aimed at examining the tolerance of physical loads at the level of maximum aerobic speed have established an inverse relationship between the time to exhaustion in interval swimming at maximum aerobic speed and the time required to reach the second ventilatory threshold, which may indicate athletes' insufficient ability to adapt to relatively low-intensity work [5].

There is a lack of research concerning the characteristics of time to exhaustion that could be applied in interval swimming training.

Objective of the study is to compare the nature of physiological responses to continuous and interval training regimes in swimming to exhaustion.

Methods and structure of the study. Eleven qualified male swimmers aged 18.6±1.2 years took part in the testing. At the time of the study, the swimmers were performing six training sessions per week

with a total swimming volume of approximately 30 km, in addition to dry-land training.

The tests were carried out in a 25-metre pool at the start of the second macrocycle of the competitive period after a two-week training period. All swimmers performed two test tasks at intervals of no less than two days between testing sessions: continuous swimming at maximum aerobic speed; and interval swimming at maximum aerobic speed comprising 100-metre segments with 15-second breaks and passive rest between them. All tests were performed in the front crawl with a water start and open turns without underwater gliding. The test was terminated when the time tolerance limit of 5% was exceeded, and also when individual voluntary exhaustion was observed.

To measure respiratory parameters, a portable telemetric breath gas analyser was used, connected to the swimmer by means of a breathing tube and a valve system.

Heart rate (HR) was recorded telemetrically during the exercise using a heart rate monitor. To analyse blood lactate concentration [La-], an Accutrend lactate portable biochemical analyser was used; capillary blood samples were taken from the earlobe before the start of each test, during the breaks of the step test, and at 1, 3 and 5 minutes after completion of the tests.

The level of perceived exertion was recorded on the basis of the Borg CR-10 scale (Borg, 1990).

To check for differences between the results of the time-limit tests, an independent Student's t-test was used. Statistical significance was set at $p<0.05$. All statistical comparisons were carried out using a statistical package (version 25.0; SPSS).

Results of the study and discussion. In the continuous swimming test, no significant VO_{2max} was recorded, in contrast to the interval-mode test; however, the percentage of VO_{2max} was higher during continuous swimming. In the interval test, the athletes demonstrated higher values for time spent at the level of VO2max and for the maximum distance covered before the exhaustion phase. As regards the percentage ratio of time spent close to VO_{2max} to the total swimming duration, no differences between the test results were identified.

Maximum blood lactate concentration reached identical values in both continuous and interval swimming; however, the subjective rating of the load was lower for continuous swimming.

The results of the study show that, compared with continuous swimming, in interval swimming athletes are able to maintain maximum aerobic speed for longer with the same level of accumulated blood lactate and perceived exertion. This is confirmed by the fact that both time-limit tests promote high VO_2 values over a long period.

Interval swimming promotes a longer time to exhaustion, which results in a significantly greater amount of time spent at or above the time required to reach the second ventilatory threshold and 90% of VO2max.

The results obtained confirm that interval training, to a greater extent than continuous swimming, contributes to the development of aerobic mechanisms of energy supply. Despite the fact that a higher percentage of VO_{2max} was recorded in continuous swimming, and that the time spent in both training regimes at the

Table. Indicators of physiological responses during the continuous and interval tests

Indicator	Training regime		p
	Continuous	Interval	
VO_{2max}, ml/kg/min	54.5±5.3	52.8±4.1	<0.05
% VO_{2max}	99.8±7.6	95.3±6.2	<0.05
Mean VO_{2max} value, ml/kg/min	-	49.1±3.3	-
Percentage of mean VO_{2max} value	-	90.6±8.8	-
HRmax, bpm	181.7±9.4	180.8±8.6	>0.05
Maximum lactate concentration, mmol/l	6.6±1.7	6.5±1.8	>0.05
Subjective rating of load, points	7.8±0.6	8.6±0.6	<0.05
Maximum distance, m	416.2±27.1	977.3±31.5	<0.05
Maximum time achieved by swimmers, s	337.1±19.7	775.4±22.4	<0.05
Time swimming at the VO_{2max} level, s	142.7±8.3	437.3±37.0	<0.05
Time swimming at 90% of VO_{2max}, s	129.2±5.7	319.8±28.2	<0.05

level of maximum VO_{2max} values was approximately the same, the swimmers were able to maintain the required intensity for a longer time during interval training, which contributed to a significantly greater time spent at the level of VO_{2max}. These data indicate that interval training is the best means of stimulating the oxidative system that determines the aerobic endurance of swimmers.

The inverse correlation between the time to exhaustion at maximum aerobic speed and the time required to reach the second ventilatory threshold demonstrated that swimmers with higher aerobic performance were unable to perform exercise at the same intensity for as long a period as swimmers with a lower level of fitness. This is probably because higher speed implies more strenuous effort, leading to fatigue at an earlier stage as a consequence of a high requirement for anaerobic energy. This can be explained by various phenotypes that influence patterns of motor unit recruitment in different work regimes. To improve aerobic performance, swimmers with higher second lactate threshold and maximum aerobic speed values should use short distances in the interval regime in order to avoid a premature decrease in speed due to fatigue in the first segments of interval training.

The results obtained, as well as the inverse relationship between time to exhaustion and maximum aerobic speed, indicate that a lower level of aerobic metabolism in swimmers may be associated with greater adaptation to this intensity.

Conclusions. The results of the study indicate that continuous and interval training regimes at maximum aerobic speed are both able to elicit the maximum VO_{2max} response prior to exhaustion. In this regard, both training regimes may be applied to improve the maximum aerobic performance of swimmers.

Interval swimming consisting of 100-metre series with 15-second rest periods is an effective means of increasing the time over which maximum VO_2 values are sustained and contributes to an increase in VO_{2max}.

The time spent swimming at maximum aerobic speed to exhaustion serves as a valid indicator of tolerance to specific loads, allowing the effectiveness of the training process to be improved and the necessary adjustments to be made for successful adaptation to high-intensity aerobic work.

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Comparative analysis of organisational forms of students' learning activities in university physical education (using the elective discipline "badminton" as an example)

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Abstract

Objective of the study is to conduct a comparative analysis of organisational forms of learning activities – frontal, group, flow-based, pair, and individual-independent – and to systematise the organisational-methodological conditions ensuring the implementation of physical education and health-enhancing activities in higher education institutions.

Methods and structure of the study. Observations were conducted during badminton training sessions over 15-minute intervals, applying various organisational forms of learning activities in elective "Badminton" classes with first-year students at Zhengzhou University, Henan Province, China.

Results and conclusions. It was established that frontal, group, flow-based, pair, and individual-independent forms create fundamentally different conditions for the implementation of health-enhancing and pedagogical objectives within the "Physical Education" discipline. This provides a methodological basis for instructors to select organisational forms depending on students' fitness levels, material and technical resources, and educational objectives of the university.

Keywords: *physical education, students, university, elective discipline, badminton.*

Introduction. The modern educational system of physical education at universities faces an increasing demand for personalised learning while simultaneously maintaining the effectiveness of group instruction. The main contradictions in physical education practice are associated with a standardised approach to students with varying levels of physical fitness, as well as the predominance of formal academic indicators over genuine health outcomes [1, 2]. This contradiction highlights the importance of investigating traditional and innovative forms of organising training sessions that serve as the structural foundation of the physical education pedagogical process. The search for a balance between individualisation of learning trajectories and collective dynamics, given the large class sizes (up to 30 students) dictated by contemporary higher education standards, is of particular significance, as it directly affects student motivation and the quality of knowledge, skill, and competency acquisition.

Objective of the study is to conduct a comparative analysis of organisational forms of learning activities – frontal, group, flow-based, pair, and individual-independent – and to systematise the organisational-methodological conditions ensuring the implementation of physical education and health-enhancing activities in higher education institutions.

Methods and structure of the study. Analysis of the organisational forms of learning activities in physical education was carried out through time-study (chronometry), recording time expenditures on various types of activities and the duration of student actions during physical education classes. The following indicators were recorded: time allocated to formation, time for explanation and demonstration of exercises, time spent on exercise performance, idle time, and rest time.

Observations were conducted during badminton training sessions over 15-minute intervals, applying

various organisational forms with first-year students at Zhengzhou University, Henan Province, China. Observations and chronometry were carried out for the following organisational forms: frontal, group, individual-independent, flow-based, and pair. A total of 5 sessions involving 50 first-year students were documented and analysed.

The criteria for evaluating the effectiveness of organisational forms were student engagement (overall class density) and the degree of material assimilation (motor density or physical activity, as well as the number of strokes performed), regarded as primary indicators of educational effectiveness. Resource efficiency indicators (rest pauses) and temporal efficiency (idle time) served as operational criteria for analysing the organisational component and enabled assessment of the practical feasibility of different approaches.

Results of the study and discussion. A time-based analysis of various forms of organising students' learning activities within the elective module 'Badminton' revealed that the frontal teaching method was associated with the highest level of student engagement in the learning process, with an overall class attendance rate of 95.27% (Fig. 1). It should also be noted that the group, continuous and pair forms of organising classes have almost identical overall class attendance rates, in contrast to the individual-independent form, where the overall attendance rate is 6.05% lower than that of the frontal form of organising students' learning activities. This is explained by the fact that this form of organisation allows students to regulate the pace of learning in accordance with their personal educational needs [3].

At the same time, a higher degree of material assimilation (motor density or motor activity) is observed in the paired method of organising lessons, where motor density is 70.33% (Fig. 1), as the 'multi-volley' method was used in the lessons.

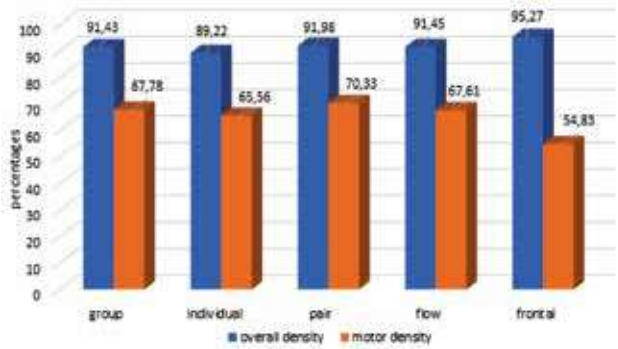

Figure 1. Ratio of overall and motor density depending on the organisational form of learning activities (%)

The lowest engagement rate in a lesson was found in the traditional lecture-style format – 54.83%, as this demonstrates lower individual student engagement due to limited opportunities for personalised interaction and requires more time for explanation and correction of errors when mastering complex motor skills, such as playing badminton.

The higher degree of material retention in the paired form of lesson organisation is also confirmed by the students' motor activity (Fig. 2), where, within the standard time allocated for the tasks, students performed an average of 91 strokes in a 15-minute lesson. The lowest number – 61.3 strokes – was recorded in the frontal form of lesson organisation.

Students also demonstrated high physical activity in the group-based format, performing an average of 83.5 strokes (Fig. 2). With appropriately selected groups, this form of organisation demonstrates higher indicators of long-term retention and deep mastery of motor skills and abilities, as well as high adaptability to various training tasks whilst maintaining structural integrity.

When analysing the motor activity of students playing badminton and assessing the number of strokes, statistically significant differences ($p<0.001$) were found in the application of different forms of organising the students' training activities (Table 1).

Table 1. Significance of differences in stroke volume across different organisational forms

Forms	Group	Individual	Pair	Flow	Frontal
Group	X	-	-	-	-
Individual	< 0,001	X	-	-	-
Pair	= 0,031	< 0,001	X	-	-
Flow	-	-	=0,015	X	-
Frontal	< 0,001	-	< 0,001	= 0,010	X

Note: The differences in the indicators are statistically significant ($p < 0.001$) (method used: Welch's F-test).

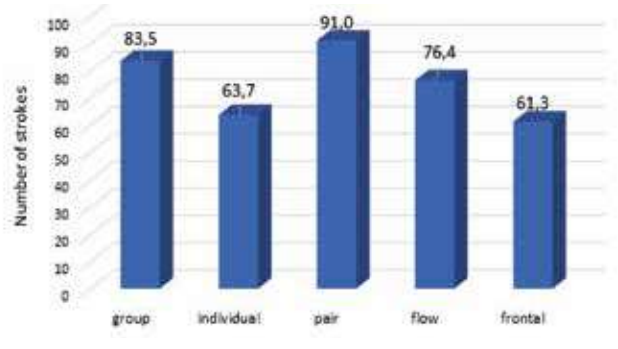

Figure 2. Student physical activity depending on the organisational form in badminton classes (average number of strokes per unit of time)

Analysis of time allocation across different parts of classes revealed that the frontal form required the highest percentage of time (32.5%) for explanation, demonstration, and motor skill correction. Other forms averaged from 13.3% (individual-independent) to 15.1% (flow-based). The pair form required the least time for formations and transitions (2.8%), while the individual-independent form required the most (6.6%) (Figure 3).

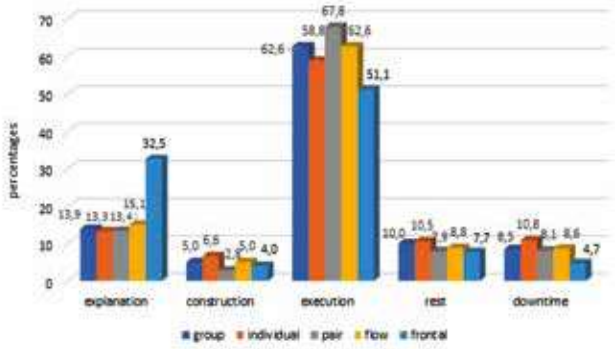

Figure 3. Percentage distribution of different class components across various organisational forms

The results of the study on the physical activity of participants, measured by the time spent performing exercises during badminton sessions, confirm the high effectiveness of the partner method (67.8%), with the group and continuous methods each at 62.6% (Fig. 3). The lowest level of physical activity was observed when using the frontal form of organisation – 51.5%.

When assessing students' physical activity based on the duration of exercises in various forms of class organisation, significant differences ($p<0.001$) were found between the group and frontal forms, the paired and individual-independent forms, the paired and frontal forms, and the flow and frontal forms (Table 2).

Table 2. Statistical significance of differences in students' physical activity levels based on exercise duration across different forms of organised learning activities

Forms	Group	Individual	Pair	Flow	Frontal
Group	X				
Individual		X			
Pair		< 0,001	X		
Flow				X	
Frontal	< 0,001		< 0,001	< 0,001	X

Note: The differences in the indicators are statistically significant ($p < 0.001$) (method used: Kruskal–Wallis test).

In terms of resource efficiency, the frontal teaching method proved to be the most economical, with 7.7% of time spent on breaks, followed by the pair work method at 7.9%, as these methods allow a significantly greater amount of teaching material to be covered in less time compared to other teaching methods (Fig. 3). The longest rest breaks among learners were observed in the individual self-directed and group forms of organisation, accounting for 10.5% and 10.0% of the time respectively. This is confirmed by statistically significant differences ($p < 0.001$) (Table 3).

Table 3. Statistical significance of differences in resource consumption in terms of the duration of rest breaks during lessons conducted using different forms of teaching organisation

Forms	Group	Individual	Pair	Flow	Frontal
Group	X				
Individual		X			
Pair		< 0,001	X		
Flow		=0,005		X	
Frontal	= 0, 023	< 0,001			X

Note: The differences in the indicators are statistically significant ($p < 0.001$) (method used: Kruskal–Wallis test).

In terms of time efficiency, as measured by downtime, an analysis of different teaching methods reveals that the most efficient is the lecture-based approach – accounting for 4.7% of downtime – whilst the least efficient is the independent study approach, where an average of 10.8% of downtime is observed (Fig. 3).

Table 4. Statistical significance of differences in time efficiency based on the duration of downtime in classes with different forms of teaching organisation

Forms	Group	Individual	Pair	Flow	Frontal
Group	X				
Individual	< 0,001	X			
Pair		< 0,001	X		
Flow		< 0,001		X	
Frontal	< 0,001	< 0,001	< 0,001	< 0,001	X

Note: The differences in the indicators are statistically significant ($p < 0.001$) (method used: Fisher's F-test).

This is because the classroom-based form of teaching is characterised by minimal time spent on

organising students, whilst simultaneously increasing the lecturer's teaching workload. The individual self-directed form, however, requires additional resources for organising interaction, coordinating roles and supporting learning activities.

A comparison of the time efficiency of classes depending on their organisational format revealed statistically significant differences ($p<0.001$) between almost all the formats analysed (Table 4).

Conclusion. The effectiveness of the physical education process largely depends not only on the tools and methods used but also on the competent organisation of students, which directly influences their motivation, quality of motor skill acquisition, and adaptation to physical loads, particularly in groups with heterogeneous fitness levels. The rational selection of a pedagogical strategy for applying organisational forms of student learning activities becomes a key factor in the success of the physical education and health-enhancing process.

The analysis established that frontal, group, flow-based, pair, and individual-independent forms create fundamentally different conditions for the implementation of health-enhancing and pedagogical objectives within the "Physical Education" discipline. This provides a methodological basis for the instructor to select organisational forms depending on student preparedness, the university's material and technical capabilities, and educational objectives.

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Features of technical and tactical combinations in competitive kickboxing

UDC 796.052

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Abstract

Objective of the study is to identify the specific nature of technical and tactical combinations in kickboxing under situational conditions of competitive activity.

Methods and structure of the study. By means of the observation method, indicators were recorded for three categories of technical actions reflecting the level of situational and motor skills of kickboxers: hand strikes, kicks and defensive actions. The recorded data were entered into a special observation protocol, the form and structure of which were determined by the tasks, subject and aims of the study.

Results and conclusions. It has been established that the success of kickboxers' competitive activity is determined both by their technical and tactical training in the course of preparation, and by the influence of certain situational conditions arising during a competitive bout. The structuring of seven factors of competitive activity determines the directions for improving the situational effectiveness of kickboxing athletes.

Keywords: *kickboxing, factors, effectiveness, technical actions, training, situational conditions.*

Introduction. According to sports classification, kickboxing belongs to the group of polystructural acyclic sports in which physical opposition and the defeat of an opponent predominate. In this regard, it is advisable for a kickboxer to possess a wide arsenal of specialised techniques and actions, perfected through training and performed automatically in competition conditions with a high degree of selectivity and effectiveness. Accordingly, kickboxing is characterised by the constant changing of the structure of movements, variable intensity and duration of load under variable competition conditions [5].

It is generally recognised that the quality of mastery of tactical and technical techniques and actions in kickboxing manifests itself most objectively in real competition conditions when solving situational and motor tasks [1]. The content of the techniques and actions of kickboxing includes attack, counter-attack, defence, and defensive-attacking combinations, the successful command of which is determined by the kickboxer's technical and tactical training [2].

Owing to the fact that practice has shown a substantial discrepancy between the technical and tactical preparedness achieved during training and the requirements of real competitions for athletes' technique [4], the past decade has been marked by an expansion of research into situational effectiveness in combat sports.

Objective of the study is to identify the specific nature of technical and tactical combinations in kickboxing under situational conditions of competitive activity.

Methods and structure of the study. Thirty-three highly qualified athletes from all weight categories, specialising in the ring disciplines of full-contact and low-kick, took part in the scientific work. The identification of indicators of athletes' competitive success was based on the application of factor analysis [3].

By means of the observation method, indicators of three categories of technical actions reflecting the level of kickboxers' situational and motor skills were recorded: hand strikes (jab, cross, uppercut); kicks

(front-kick, side-kick, low-kick, round-kick, kakato-geri, ushiro-geri, ushiro mawashi-geri); and defensive actions (hand and leg blocks, evasions of strikes). The recorded data on the main characteristics were entered into a special observation protocol, the form and structure of which were determined by the tasks, subject and aims of the study.

Data were recorded using a Sony HVR-Z-5E digital video camera.

Results of the study and discussion. The high value of correlation of variables indicates the technological soundness of the conducted study. From the total number of isolated latent variables, seven significant factors were formed, which explain 76.3% of the total sample variance.

The first factor is represented by the elements of actions performed with the left limbs closer to the opponent: a straight punch with the left hand (jab) (0.713); a low rotational kick (low-kick) with the left leg (0.673); a left-hand block from kicks (0.545); an uppercut with the left hand (0.424); evasion (0.416). Since the left limbs are closer to the opponent, athletes prepare to deliver strikes with the dominant right hand and leg, first using the left limbs.

The second factor includes attacking actions to the central part of the torso: a straight punch (jab) with the right hand (0.708); a straight punch (jab) with the left hand (0.651); a straight kick (front-kick) with the left leg (0.654); a side-kick with the right leg (0.593); a straight power punch (cross) with the left hand (0.535). From the tactical point of view, the listed actions are used in order to weaken the defence and create conditions for an attack to the head by means of strong strikes of the limbs to the opponent's torso.

The third factor is determined by attacking actions along long trajectories based on maintaining body balance using the lower right limb: a high rotational kick (round-kick) with the right leg (0.743); a reverse roundhouse kick (ushiro mawashi-geri) with the right leg with a turn (0.645); a back kick (ushiro-geri) with the right leg (0.524); a low rotational kick (low-kick) with the right leg (0.453). The presented techniques represent arc-shaped kicks used against an opponent's closed positions, as well as against fighters of low height. From a biomechanical point of view, the application of a series of rotational techniques is sufficiently effective, since this provides a high speed of kicks owing to the use of angular rotation. In tactical terms, the reverse roundhouse kick with the right leg with a turn (ushiro mawashi-geri) can be used as a feint with a view to potentially exposing the opponent, after which the right high rotational kick with the right leg (round-kick) is usually performed.

The fourth factor is represented predominantly by striking actions of the left lower limb, which increase the athlete's attacking activity: a side-kick with the left leg (0.752); a side-kick with the right leg (0.721); a chopping kick (kakato-geri) with the left heel (0.694); a high rotational kick (round-kick) with the left leg (0.516); a back kick (ushiro-geri) with the left leg (0.424).

The fifth factor is described by combinational actions that constitute active defence and include the placement of blocks with the subsequent execution of strikes by the limbs: a right-leg block from kicks (0.724); a left-hand block from punches (0.628); a straight kick (front-kick) with the right leg (0.636); a chopping kick (kakato-geri) with the right heel (0.537); a right-hand block from punches (0.455); a left-leg block from kicks (0.423); a side-kick with the left leg (0.409). The combinations of techniques characterising this factor are applied in situations where it is necessary to place a block from a kick and create conditions for an attacking strike. The structure of movements of both kicks and punches makes it possible to implement the scheme of defence followed by attack – a strike is preceded by the placement of a block.

The sixth factor is determined by close-combat techniques – a turning right-hand punch (0.743); a straight power punch (cross) with the left hand (0.664); a straight power punch (cross) with the right hand (0.614); a left-hand block from kicks (0.532); an uppercut with the right hand (0.517); a straight kick (front-kick) with the right leg (0.450); a right-hand block from kicks (0.387).

The description of the seventh factor is best characterised by attacking actions with the right hand, supported by the left hand – an uppercut with the right hand (0.767); a straight power punch (cross) with the left hand (0.632); an uppercut with the left hand (0.543); a straight punch (jab) with the right hand (0.540); a straight power punch (cross) with the right hand (0.421).

The conducting of factor analysis leads to a systematic description of the factor structure of the special competitive actions of kickboxers that are insufficiently mastered in the course of training. The results obtained provide an opportunity to correct the training process on the basis of constructing regression mod-

els of athletic preparation and forecasting the competitive results of kickboxers.

Conclusions. The success of the competitive activity of kickboxers is determined both by their technical and tactical training in the course of preparation, and by the influence of certain situational conditions arising during a competitive bout. The structuring of seven factors of competitive activity determines the directions for improving the situational effectiveness of kickboxing athletes. The combinational actions that constitute the basis of the identified effectiveness factors require integrated improvement under conditions of training and competition. The interrelationship of the factor conditions of competitive situations and training tasks shapes the ability to apply the mastered techniques and actions effectively.

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Criteria for the specialised training of highly skilled midfielders and forwards in football

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Abstract

Objective of the study is to establish criteria for the specific fitness of highly skilled midfielders and forwards in football based on factor analysis data.

Methods and structure of the study. The study was conducted in 2024/2025. Thirty-two highly skilled footballers from the Russian youth team took part in the study. The players' ages ranged from 19 to 21. The study examined the indicators of the individual fitness profile of highly skilled footballers from the Russian youth team in preparation for short-term tournaments, as well as the prospects for optimising training and competitive activities based on the identification of factors that enabled the establishment of key criteria for the fitness of highly skilled midfielders and forwards.

Results and conclusions. As a result of factorising the intercorrelation matrix of the initial indicators, grouped according to playing position, a factor model was obtained, presented in Tables 1–2.

Analysis of the results of factor analysis among midfielder footballers showed that the physical fitness factor predominates. This factor explains 38.4% of the total variance and has the highest loadings on the following indicators: maximum lower-body strength; lower-body strength gradient; deadlift; and sit-ups. This component can be designated as the speed-strength training factor for midfielders. In this regard, it can be assumed that the structure of the training process for highly skilled footballers should be adjusted to increase the role of speed-strength and technical training, with training regimens focused on achieving an optimal level of development of the dominant aspects of fitness for players in various positions.

Keywords: *football, highly skilled players, midfielders, forwards, specific fitness.*

Introduction. Achieving high sporting results in competitive sport depends on a player's individual fitness profile and their ability to solve various group and team tactical tasks whilst competing against an opponent. In football, a player's individual fitness profile is defined by specialists [3, 4] as the characteristics and parameters unique to a specific athlete, which enable the development of a specific training programme tailored to their role on the pitch.

The process of training footballers must be carried out taking into account factors characterising the athletes' morphofunctional, motor and psychological characteristics, which are the primary determinants of success in their chosen sporting activity [1]. Individual indicators characterising an individual's morphofunctional and specific characteristics may be of significant importance when developing methods to predict their sporting aptitude. However, the fundamental principle is that the assessment of specific motor fitness is optimal only when it forms an integral part of the assessment and prediction of the player's overall potential [2, 5].

Objective of the study is to establish criteria for the specific fitness of highly skilled midfielders and forwards in football based on factor analysis data.

Methods and structure of the study. The study was conducted in 2024/2025. Thirty-two highly skilled players from the Russian youth team took part in the study. The players' ages ranged from 19 to 21. The study examined the individual fitness profiles of highly

skilled players from the Russian youth team in preparation for short-term tournaments, as well as the prospects for optimising training and competition activities by identifying factors that enabled the establishment of key fitness criteria for highly skilled midfielders and forwards.

Results of the study and discussion. Factorial analysis of the intercorrelation matrix for the initial indicators, grouped according to playing position, yielded the factor model presented in Tables 1-2.

Analysis of the factor analysis results for midfielders revealed that the physical fitness factor predominates. This factor explains 38.4% of the total variance and has the highest loadings on the following indicators: maximum lower-body strength; lower-body strength gradient; deadlift; and sit-ups. This component can be described as the speed-strength training factor for midfielders.

The second factor accounts for 33.8% of the total variance. It includes the indicators of maximum strength, strength gradient and bench press strength, which have the highest factor loadings. We interpret this component as a factor of speed-strength training.

The third component explains 13.7% of the total variance and is associated with the level of technical fitness. High load values are found in the results for long-range shooting, juggling and ball control.

As a result of conducting a factor analysis of the results of the forwards, we obtained a model of the fitness of athletes in this position (Table 2).

In this case, the three most significant components accounted for 89.3% of the total variance in the initial characteristics. In this factor model, a principal component was identified which explains 39.5% of the total variance and has the highest (in absolute terms) loadings in the following tests: lower limb strength gradient; time to maximum effort; and lower limb muscle relaxation time. This component can be interpreted as a factor of speed-strength and coordination fitness in footballers.

The second factor determines the specific physical fitness of forwards; its contribution to the total sample variance is 32.4%. The indicators included in it with the highest factor loadings were shuttle run, 50 m sprint, standing long jump and standing high jump.

The third factor accounts for 17.4% of the total variance. It comprises: accuracy and distance in shooting, juggling and ball control.

Thus, the results of the factor analysis indicate the significant role of indicators of speed-strength fitness and technical skill in athletes. At the same time, there is a correlation between the structure of footballers' specialised fitness and their playing position.

Conclusions. In this regard, it can be assumed that the structure of the training process for highly skilled footballers should be adjusted to place greater emphasis on speed-strength and technical training, with training regimens designed to achieve an optimal level of development in the dominant aspects of fitness for players in various positions.

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Table 1. Results of the factor analysis of fitness indicators for elite footballers (midfielders)

No.	Factor	Indicators	Factor loading
1	Physical training 38,4	Standing long jump	0,854
		Cooper test	0,772
		7 x 50 m shuttle run	0,720
		50 m sprint	0,671
2	Speed and strength training 33,8	Lower-body strength gradient	0,712-0,785
		Maximum lower-body strength	0,664-0,752
		Deadlift	0,645
3	Technical training 13,7	Ball juggling	0,742
		Long-range kicks	0,602
		30 m straight-line dribbling	0,511

Table 2. Results of factor analysis of fitness indicators for highly skilled footballers (strikers)

No.	Factor	Indicators	Factor loading
1	Speed and strength training 39,5	Lower-body strength gradient	0,809-0,866
		Force development time	0,815-0,839
		Lower-body muscle relaxation time	0,622-0,768
2	Physical training 32,4	7 x 50 m shuttle run	0,855
		50 m sprint	0,715
		Standing long jump	0,679
		High jump	0,718
3	Technical training 17,4	Accuracy kicks	0,801
		Distance kicks	0,726
		30 m straight-line dribbling	0,681
		Ball juggling	0,628

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Distortion of athletic potential assessment in young football players under conditions of age-related heterogeneity

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Abstract

Objective of the study is to identify the features of distortion in the assessment of sporting potential of young football players under conditions of age-related heterogeneity and to substantiate the necessity of accounting for this factor when conducting sports selection.

Methods and structure of the study. The empirical basis of the study comprised data from the official team rosters participating in the competition "Moscow City Football Championship among sports school teams 'Club League' of the 2026 season". The study involved 1,261 football players born between 2012 and 2016, representing 14 leading football academies of Moscow. The analysis was conducted based on data from the Regional Public Organisation "Moscow Football Federation". The study employed methods of statistical analysis, grouping and comparative assessment of the distribution of athletes by quarters of the calendar year. The methodological basis comprised provisions on the heterogeneity of biological development rates and their influence on the manifestation of motor abilities in the youth age group.

Results and conclusions. A pronounced shift in the distribution of football players by birth quarters was established: the share of players born in the first quarter was 52.2%, while the share of fourth-quarter representatives was 8.4%. The identified disproportion indicates the presence of a systematic distortion in the sports selection procedure caused by age-related heterogeneity. It was shown that athletes with a higher level of morphofunctional development at the current stage gain an advantage, which leads to the underestimation of potentially promising players. The obtained results confirm the necessity of introducing organisational-methodological approaches oriented towards accounting for individual developmental rates and improving the objectivity of sporting potential assessment.

Keywords: *sports selection, young football players, age-related heterogeneity, athletic potential, selection processes, football.*

Introduction. The modern system of sports reserve preparation in football is characterised by high competition at the stages of early selection, which necessitates the most accurate possible assessment of the sporting potential of young athletes. However, in the practice of youth football, a number of factors persist that can significantly distort the objectivity of selection decisions. One of these factors is age-related heterogeneity within the calendar year, leading to differences in the level of biological and functional development of children of the same passport age.

The relevance of the study is determined by the fact that under conditions of mass selection, priority is often given to athletes demonstrating a higher level of physical fitness at the current moment, without accounting for individual developmental rates. This creates prerequisites for the premature exclusion from the preparation system of promising players whose capabilities may be realised at later stages of ontogenesis.

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Results of the study and discussion. The analysis of the study results, devoted to the problem of distortion in the assessment of the potential of young football players, indicates its significant influence on the formation of the contingent of young athletes in the preparation system of football academies.

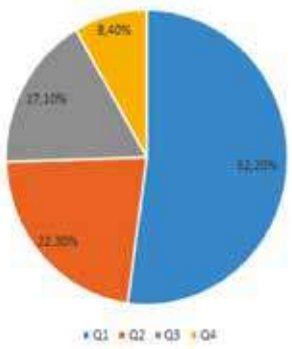

Figure 1. Distribution of football players by birth quarters in the preparation system of Moscow football academies

The analysis of the obtained data indicates a pronounced unevenness in the distribution of players by birth quarters. It was established that the share of football players born in the first quarter of the year is 52.2%, while the share of players born in the fourth quarter does not exceed 8.4%. Thus, a more than sixfold predominance of representatives of the beginning of the calendar year over players born at its end is observed.

The identified disproportion points to the presence of a systematic shift in the process of sports selection. Children born in the first months of the year possess a relative age advantage, which manifests in higher indicators of height, body mass, as well as the level of physical and coordination fitness. These differences are especially significant at the age of 7–12 years, when the rates of biological development vary substantially.

Under conditions of competitive selection, coaches, focusing on current indicators, more often give preference to more physically developed players, which leads to the underestimation of the potential capabilities of children lagging in maturation rates. As a result, a distorted model of selection is formed, in which the current level of development substitutes for the prognosis of sporting potential. It should be noted that the identified patterns are of a stable nature and are reproduced in the most competitive preparation environment – among the leading football academies. This indicates the systemic nature of the problem and the necessity of revising existing approaches to assessing the prospects of young athletes.

Conclusions. Age-related heterogeneity is a significant factor influencing the objectivity of sports selection. Ignoring this factor leads to a decrease in the effectiveness of the sports reserve preparation system and the loss of potentially gifted players.

In conclusion, it should be emphasised that increasing the objectivity of selection procedures requires the introduction of organisational-methodological approaches that take into account the individual developmental rates of children. A promising direction is the development of models for predicting motor abilities based on a comprehensive assessment of the morphofunctional and age-related characteristics of young football players.

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Morphofunctional model characteristics of ice hockey players across different playing positions

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Abstract

Objective of the study is to examine and substantiate model morphofunctional characteristics of ice hockey players across different playing positions.

Results and conclusions. As a result of analysing the height indicators of young ice hockey players with regard to the player's position, it was revealed that the shortest players are goalkeepers; however, these values are not statistically significant, as the sample for this position was small. Forwards possess higher body length indicators.

Long-term preparation of young ice hockey players is impossible without knowledge of the morphofunctional characteristics of body development. The development of model characteristics is a priority task in organising the training process of young players in ice hockey across different positions, which creates all the necessary conditions for improving sporting mastery in training and competitive activities.

Keywords: *ice hockey, playing position, model characteristics, morphofunctional indicators.*

Introduction. One of the main tasks of the theory and methodology of sports training is the identification of the leading factors that to the greatest extent determine the achievement of high results in the chosen sport. The most significant factor influencing the achievement of results in the majority of sports is external morphological characteristics [2, 3]. In many sports, sufficiently clear concepts of the morphological characteristics of athletes have been developed; however, this topic, as it relates to ice hockey with regard to the player's position, has been insufficiently developed.

Model characteristics of athletes can serve as a certain ideal for athletes at the stage of preparing young athletes, as they allow a significant increase in the effectiveness of selection, choice of position, and the correct construction of the training process [1, 4].

Objective of the study is to examine and substantiate model morphofunctional characteristics of ice hockey players across different playing positions.

Results of the study and discussion. As a result of analysing the height indicators of young ice hockey players with regard to the player's position, it was revealed that the shortest players are goalkeepers; however, these values are not statistically significant, as the sample for this position was small. Forwards possess higher body length indicators. This may be related to the fact that forwards must demonstrate the greatest speed qualities in game situations. Defenders in this sample have average body length indicators, which is most likely related to the fact that, unlike forwards, they have more physical confrontation. The average body length of all athletes, regardless of position, was 181 cm (Figure 1).

As a result of analysing the weight indicators of young ice hockey players with regard to the player's position, it was revealed that the highest body mass indicators are observed in goalkeepers; however, these values are not statistically significant, as the sample for this position was small. The lightest were forwards. The average body mass indicators of all athletes, regardless of position, were 82 kg (Figure 2).

As a result of analysing the vital capacity of the lungs in young ice hockey players with regard to the

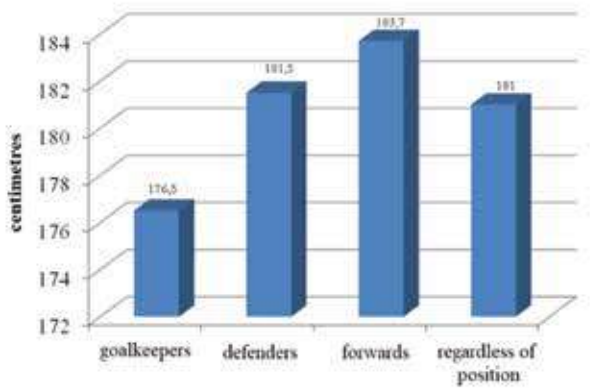

Figure 1. Body length indicators of young ice hockey players with regard to the player's position

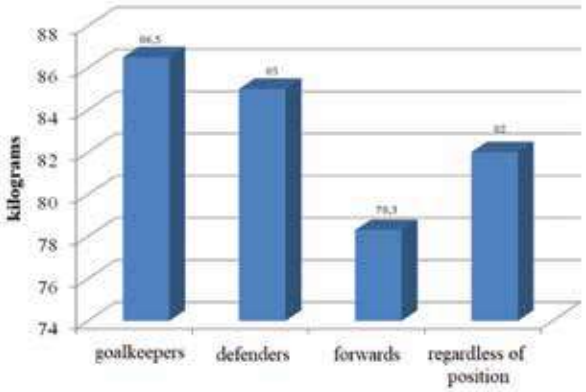

Figure 2. Body mass indicators of young ice hockey players with regard to the player's position

player's position, it was revealed that the highest indicators are observed in defenders. Goalkeepers have average indicators; however, these values are not statistically significant. Forwards have the lowest indicators of vital capacity of the lungs. The vital capacity of the lungs indicator for all young ice hockey players, regardless of position, was 4756.3 cm (Figure 3).

As a result of analysing the vital index in young ice hockey players with regard to the player's position, it

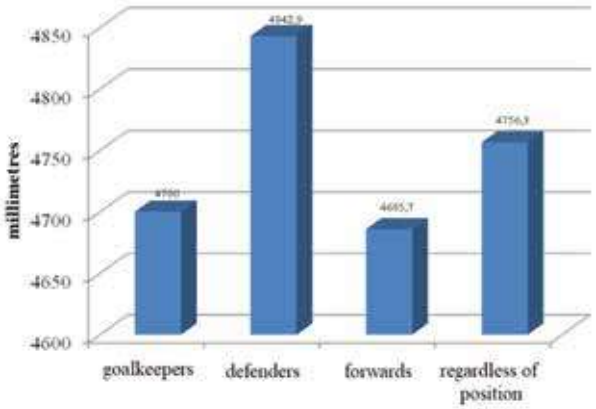

Figure 3. Vital capacity of the lungs indicators of young ice hockey players with regard to the player's position

was revealed that the highest indicator is observed in forwards. Defenders have an average indicator. Goalkeepers have the lowest indicator; however, these values are not statistically significant. The vital index indicator for all athletes, regardless of position, is 57.9 conventional units (Figure 4).

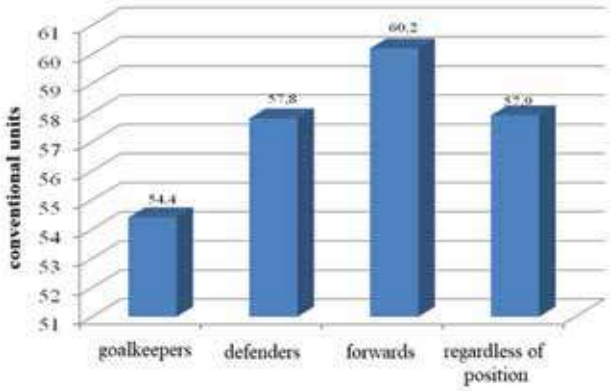

Figure 4. Vital index of young ice hockey players with regard to the player's position

Thus, statistically significant differences between players of different positions were identified in the indicators: body length, body mass, vital capacity of the lungs. The values of these indicators were significantly higher in defenders.

Conclusion. Thus, model morphofunctional characteristics will significantly increase the effectiveness of selection, choice and clarification of the player's position, correct construction of the training process and correction of individual morphological indicators at different stages of long-term sports preparation in ice hockey.

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Forecasting speed-strength abilities in young chinese volleyball players

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Abstract

Objective of the study is to examine and substantiate a system for predicting speed-strength abilities of young Chinese volleyball players.

Results and conclusions. Predicting physical qualities and abilities in volleyball during the process of selecting children should be carried out using indicators of a two-legged standing vertical jump and a seated medicine ball throw (1 kg). The preparation of a sports reserve in volleyball is associated with a system of effective prediction of physical qualities and abilities that determine the patterns of forming rational motor actions. The development of criteria for predicting the most important aspects of volleyball players' preparedness subsequently determines the success of athletes' participation in the training and competitive processes.

Keywords: *volleyball, training and competitive process, physical qualities and abilities, prediction.*

Introduction. In volleyball, as in any sport, the activity of the coach, doctor, psychologist and other specialists in conducting selection and orientation is aimed at a comprehensive study and identification of the aptitudes and abilities of athletes. Determining a set of indicators characterising the properties and qualities of a person is one of the main aspects in the work of a specialist in the selection of young athletes [2, 5].

Any ability has a structure that includes certain processes, properties and qualities. As a rule, the structure of sports abilities includes a set of morphological, motor, functional, psychophysiological and psychological indicators that serve as criteria for selection and sports orientation. Sports abilities can be characterised not only from a qualitative but also from a quantitative point of view, i.e., during selection it is necessary to pose the question not only "what is the individual capable of" but also "how capable", "who is more capable in the chosen sport" [1, 3, 4].

Objective of the study is to examine and substantiate a system for predicting speed-strength abilities of young Chinese volleyball players.

Results of the study and discussion. Predicting physical qualities and abilities in volleyball during the process of selecting children should be carried out using indicators of a two-legged standing vertical jump and a seated medicine ball throw (1 kg). When predicting the jumping ability of young volleyball players, an evaluation scale was used (Table 1).

Table 1. Scale for predicting jumping ability of young volleyball players based on standing vertical jump performance (cm)

Age, years	Grade		
	Satisfactory	Good	Excellent
9	22 – 27	28 – 31	32 and above
10	24 – 29	30 – 34	35 and above
11	25 – 30	31 – 35	36 and above
12	28 – 33	34 – 38	39 and above
13	31 – 36	37 – 41	42 and above
14	33 – 39	40 – 45	46 and above

Based on the vertical jump test, athletes were divided into three categories: those with ratings of

"satisfactory", "good" and "excellent". The following questions were investigated: how stable is the result over time, from which group does the greatest dropout occur, and is it possible for an athlete to transition from one category to another.

According to the available data, it can be stated that those young volleyball players who show results at the ages of 9–10 corresponding to the ratings "satisfactory", "good" and "excellent", at the age of 18 will have indicators corresponding to these same ratings or higher. Due to the stability of this physical quality, it can be considered that the participants maintain their indicators ("excellent", "good", "satisfactory") at an older age as well.

Furthermore, studies have shown that the greatest "dropout" occurs among athletes who show a rating of "satisfactory". Those athletes who already at the age of 10 show results at the level of "good" and "excellent".

As a result of the study, it was established that the indicators of the vertical jump test from the age of 10 show a tendency to increase. It was revealed that the model level was achieved by athletes who had high results at the age of 10. Those who had a rating of "good" did not reach the model level, but the results at the age of 17 are quite close to them. The majority of athletes whose result was satisfactory at the age of 10, by the age of 17 also had a low level of jumping ability. Moreover, the results were such that achieving the normative level in the future does not appear possible.

Thus, the results of predicting the level of jumping ability based on the data of the vertical jump test at the age of 10 are sufficiently accurate, and they can be used for predicting this component of preparedness of young volleyball players.

Based on the 1 kg ball throw test from a seated position, athletes were divided into three categories: those with ratings of "satisfactory", "good" and "excellent". In this case, we also determined how stable the result is over time, from which group the greatest dropout occurs, and how the transition from one category to another occurs.

As a result of the study, the dynamics of results in ball throwing at control points corresponding to the selection stages (9, 12, 15 and 17 years) were determined. It was established that, as in the "vertical jump" test, the model level was achieved by athletes who had high results at the age of 10. The majority of athletes whose result was satisfactory at the age of 10, by the age of 17 had a low level or had ceased training. Those who had a rating of "good" did not reach the model level, but its achievement is possible.

Based on the obtained results, it can be concluded that athletes with a low level of speed-strength quali-

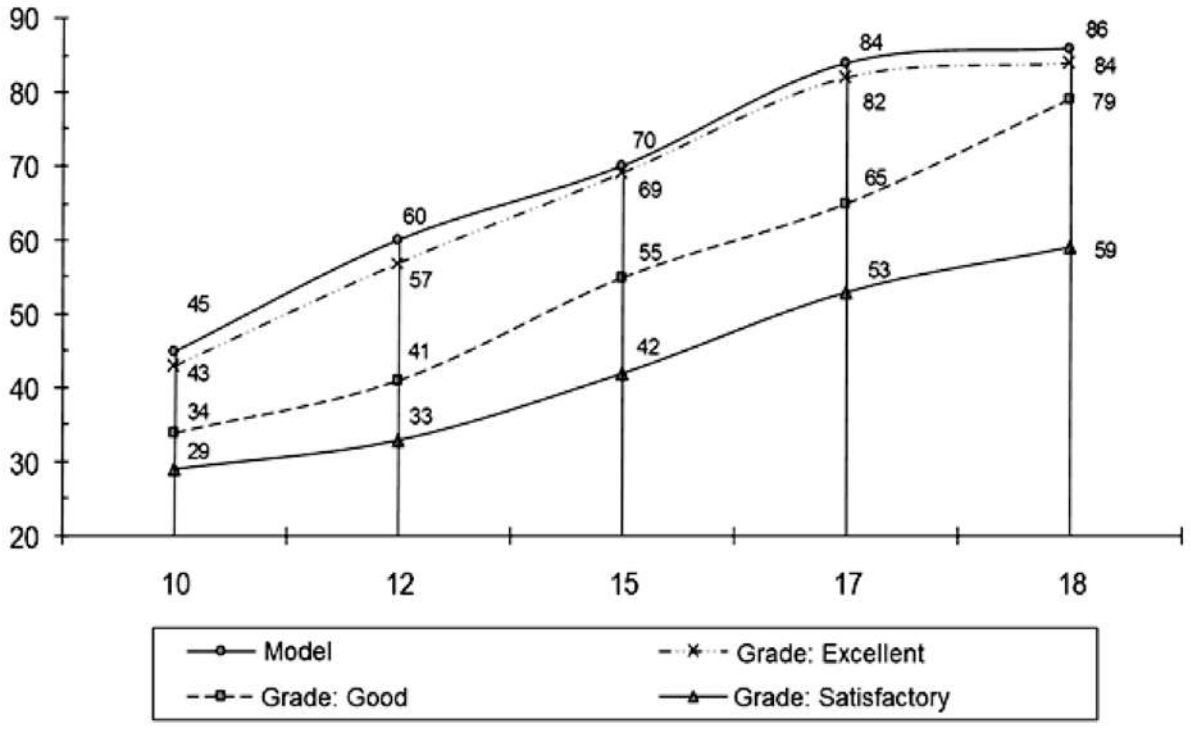

Figure 1. Dynamics of changes in vertical jump results depending on the category

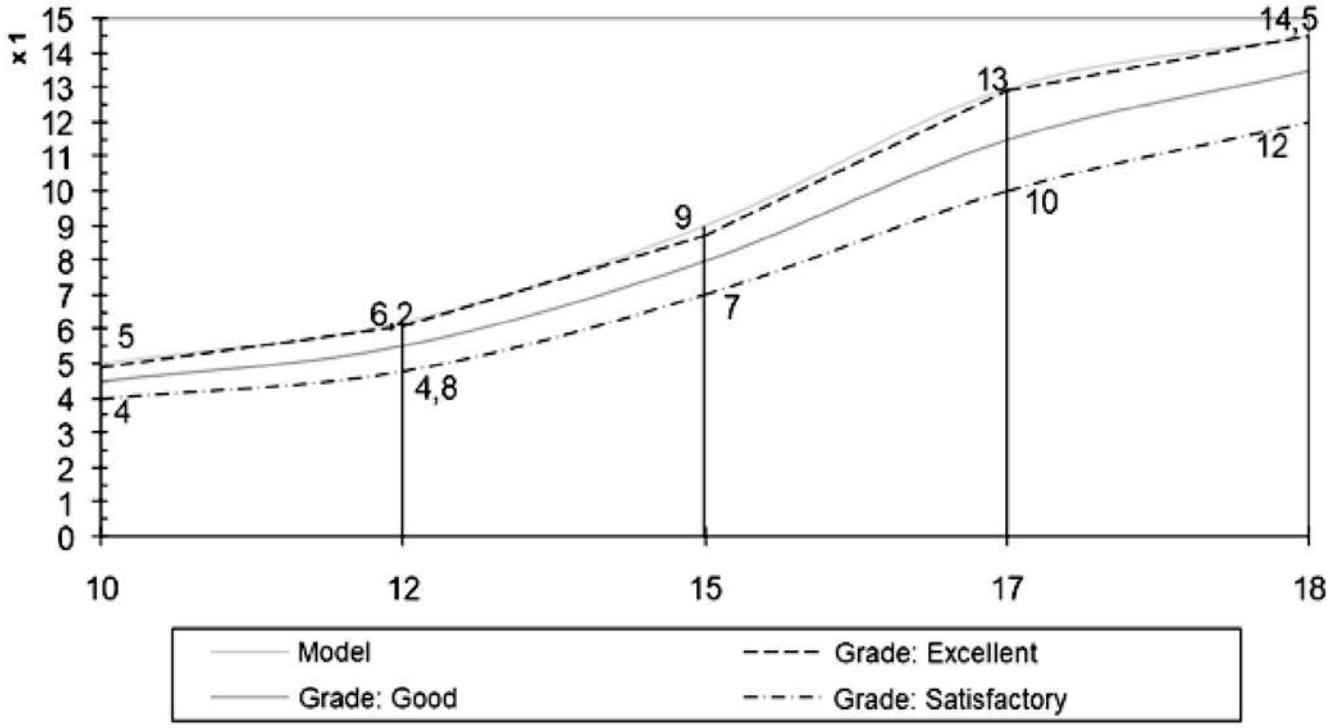

Figure 2. Dynamics of changes in ball throwing indicators depending on the category

ties, as a rule, remained at the same level or ceased training. Athletes with results at the level of "excellent" and "good" subsequently turned out to be more prepared.

Conclusion. Analysis of the data from the conducted study made it possible to establish that for the effective preparation of qualified volleyball players, it is currently necessary to develop a system for predicting selection criteria and the orientation of children for participation in the chosen sport.

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Analysis of morphometric and haemodynamic indicators of cardiac function in high-performance handball players during the competitive season

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Abstract
This article analyses informative morphometric and haemodynamic parameters of cardiac function in highly skilled handball players competing in the Russian Super League. Attention is drawn to selected anthropometric data of the athletes in relation to morphometric and specific haemodynamic components of left ventricular function. Additionally, at rest, indicators are examined that reflect the heart's ability to effectively withstand loads of various types.

Keywords: *adaptation, left ventricle, stroke volume, ejection fraction, heart rate variability, elite athletes.*

Introduction. The effectiveness of sporting results is associated with increasing intensity of physical loads, whereby it is important not to overlook the phenomena of overexertion and overtraining in the athlete's body, which are accompanied by impaired adaptation to various types of physical loads and the development of an overtraining state [1]. Endurance training, according to a number of authors, leads to autonomic remodelling of heart rhythm in favour of the cardioprotective properties of the vagus nerve, resulting in decreased heart rate below 60 beats per minute (bradycardia) and increased parasympathetic influence on cardiac function [8]. In our view, an important component in assessing athletes' readiness for high-volume and high-intensity physical loads is a comprehensive assessment of cardiovascular system parameters combining mutually informative methods. Therefore, the need arises to focus not only on heart rate variability indicators but also on the study of morphometric and haemodynamic parameters of myocardial function, since, according to L.A. Bockeria (2009), the prognostic significance of heart rate variability in the prevention of cardiovascular diseases increases in combination with other research methods, including echocardiography (with particular attention to ejection fraction) [2], as marker values of overstrain on echocardiography may be diagnosed as decreased ejection fraction and stroke volume, the determination of which requires monitoring athletes over time [1]. Therefore, in this publication we examine morphometric and haemodynamic myocardial parameters throughout the annual training cycle, with the aim of identifying marker morphometric and haemodynamic systolic-diastolic cardiac parameters during heart rate deceleration to bradycardia (heart rate below 60 bpm) or with a tendency towards heart rate decrease below 65 bpm [6, 7].

Objective of the study is to identify the dynamics of cardiac morphometric and haemodynamic parameters during the competitive period of the annual training cycle in an elite men's handball team.

Methods and structure of the study. The study involved 19 elite athletes competing in the main squad of a team regularly participating in the Russian Men's

Handball Superleague Championship (EG – experimental group). Athletes' ages ranged from 18 to 32 years. The average age of the elite team was 24.7±5.6 years. The average duration of sporting activity ranged from 10 to 20 years. All athletes participating in the experiment held clearance for professional sport in accordance with Russian Federation legislation.

Individual physical development indicators were studied, including anthropometric data: body mass index (BMI, kg/m^2) and body surface area (BSA, m^2) [7]. Assessment of cardiac morphometric and haemodynamic parameters was conducted using echocardiography (ECHO-CG) as part of the Superleague team's medical support, employing diagnostic ultrasound equipment "Mindray Z60". Left ventricular (LV) remodelling parameters were measured: left ventricular myocardial mass (LVMM, g); LVMM index (LVMMI, g/m^2); ejection fraction (EF, %); stroke volume (SV, ml). Normal LV geometry was defined as relative wall thickness (RWT) < 0.42 with normal LVMMI values below 115 g/m^2 for men and below 95 g/m^2 for women [4, 9].

An additional parameter proposed for assessing LV remodelling is the sphericity index (SI). According to the classification by V.S. Aleksandrov and A.P. Makhnov (2002), the normative sphericity index falls within the range of 0.6–0.7 a.u. Values within 0.71–1.0 a.u. indicate moderate SI elevation [5].

Results of the study and discussion. The results of individual anthropometric data (BMI and body surface area) and myocardial morphometric parameters in athletes during the autumn and spring competitive periods are presented in Table 1. According to the calculated data, no statistically significant differences were identified between athletes at different stages of the competitive period ($p<0.05$). The myocardial parameters of the tested athletes at different stages of the competitive period correspond to normal LV geometry, and no significant differences between the autumn and spring competitive periods were found [6, 9].

Athletes with functional changes characteristic of an exercise-adapted athletic heart at rest may possess a high level of sporting fitness while maintaining normal LV geometry parameters prospectively, as assessed according to recommendations for quantitative evaluation of cardiac structure and function (Table 1) [9]. This is confirmed by both our research and the analysis of results from other studies with large samples of athletes across various sports [3, 6, 7].

The data in Table 1 show that LVMMI and LV RWT fall within the parameters of normal LV geometry. The assessment was performed taking into account body surface area and body mass index [7]. According to the studies by V.S. Aleksandrov and A.P. Makhnov (2002), the SI indicators fall within the normal range [5]. It can be seen that there is a slight increase in the mean values of LVMM and LVMMI over the course of the one-year competitive period (with no statistically significant differences between the autumn and spring competitive periods), which indicates the adaptive nature of myocardial changes when subjected to loads of varying intensity. However, the above parameters fall within the normal LV geometry range according to the recommendations [9].

Based on the ejection fraction (%) and stroke volume (SV, ml) data, a tendency towards increasing mean values can be noted (despite the absence of statistically significant differences), which may be considered as a variant of adaptive changes during the annual competitive cycle. From the perspective of overtraining assessment, it can be noted that the morphometric and haemodynamic cardiac parameters of the athletes are in a stable state throughout the annual cycle and may be used for monitoring athletes' condition [1]. Correlation analysis revealed a high correlation between SV and end-diastolic dimension (EDD) of 0.87, and between SV and end-diastolic volume (EDV) of 0.86 (these parameters are included in the LVMM calculation [9]). Ejection fraction (EF, %) showed a moderate negative correlation with end-systolic dimension (ESD) of -0.65 and with end-systolic volume (ESV) of -0.65; these values are also recommended for quantitative assessment of cardiac structures and chambers [9].

Conclusions. The dynamics of cardiac morphometric and haemodynamic parameters in professional handball players during the annual competitive cycle remained stable with a tendency towards increased efficiency, characterising their readiness to tolerate loads of various orientations. Correlation analysis in the quantitative assessment of cardiac structures and chambers should be taken into account in the individualisation of the training process and in monitoring athletes' condition throughout the annual competitive cycle.

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Table 1. Selected physical development indicators and myocardial morphometric parameters (Xavg ± SE)

No.	Parameters	EG Autumn 2024 (n=19)	EG Spring 2025 (n=19)
1	BMI	25.4±2.6	25.6±2.4
2	Body surface area, m^2	2.27±0.18	2.27±0.17
3	LVMM, g	202.97±41.72	210.3±34.96
4	LVMMI, g/m^2	89.75±15.77	92.42±12.17
5	LV RWT	0.35±0.03	0.35±0.03
6	SI	0.65±0.07	0.65±0.067
7	Resting HR, bpm	57.9±3.6	56.6±3.7
8	EF, %	64.9±5.6	65.7±5.1
9	SV, ml	96±21.2	101.9±18.7

Note: * denotes significant difference between EG over time (p<0.05).

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Features of the functional state of athletes in various high-performance sports

UDC 796

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Abstract

Objective of the study is to identify the functional state of athletes in various sports, characterising adaptation to increased physical and psycho-emotional overloads and to social environmental factors.

Methods and structure of the study. An analysis was carried out of the features of the professional sporting activity of representatives of various sports, based on the analysis of certain psychophysiological indicators in the inter-competitive period. For this purpose, the standard Lüscher and Cattell methods and the Ehlers questionnaire were used.

Results and conclusions. The study of the functional state of athletes in terms of indicators of anxiety, conflict and tension revealed their predominance in athletes of complex-coordination sports. High performance indicators have been established in representatives of game sports. The athletes of the martial arts group exhibited a higher motivation to achieve success.

Keywords: *high-performance sport, functional state, indicators, psychophysiology, emotional tension, social factors.*

Introduction. At the present time, high-performance sport is a significant social phenomenon and is of enormous importance in the development of our society. The sporting achievements of high-level sport are a means contributing to the formation of the world-view of contemporary young people, distracting them from a way of life associated with bad habits and deviant behaviour. Sporting victories and achievements play a great role in raising the prestige of the country on the international stage as a whole. In addition, professional sport contributes to the perfection of the personality of the athletes themselves: in the process of constant and intensive training, character and willpower are formed, along with the ability to achieve the necessary result, perseverance and determination [3, 7].

There is also another side to high-performance sport, namely the fact that the entire period of participation in professional sport may present a real danger for the athlete of receiving an injury or some deviation in their state of health caused by physical overloads, by disturbances in the processes of adaptation as a result of stresses associated with high nervous tension during competitive activity, and by stresses caused by responsibility for the outcome of competitions, by sharp competitive struggle within one's own team and by competition with rivals. Stresses may also be linked with frequent flights to competition venues, with changes of time zone and with disturbances of the body's biorhythms [2].

A feature of the psychological and functional adaptation of athletes in high-performance sport is the performance of professional activity in the preparation of athletes against a background of high psycho-emotional tension and the necessity of maintaining a high level of performance under conditions of progressive fatigue [5].

As is known, the optimal or effective performance of an athlete is directly linked with the corresponding level of the functional state of the athlete's body, which is conditioned by the level of the body's adaptive processes, and namely by the duration of the period before the onset of fatigue.

The effectiveness of sporting activity depends on the level of adaptation to the loads imposed. The func-

tional state of the body is an indicator of response, that is, of the level of adaptation to the increased physical or mental load that an athlete experiences in high-performance sport. From the standpoint of occupational medicine, monitoring of the level of the functional state of the professional athlete's body is necessary for the timely recognition of overtraining and for the earlier identification of signs of developing overstrain in order to prevent possible disturbances in the body.

Objective of the study is to identify the functional state of athletes in various sports, characterising adaptation to increased physical and psycho-emotional overloads and to social environmental factors.

Methods and structure of the study. An analysis was carried out of the features of the professional activity of high-performance sport participants holding, in accordance with the requirements of the Unified All-Russia Sports Classification, the sporting titles of Master of Sport, International Class, Master of Sport and Candidate for Master of Sport, in groups by type of sport – speed-strength, combat sports, cyclic, complex-coordination and game sports (20 men aged 20-30 years in each group). The studies were conducted by analysing their functional state and determining psychophysiological indicators during the inter-competitive period of sporting activity. For this purpose, the standard Lüscher and Cattell methods and the Ehlers questionnaire were used [1, 4, 6].

Results of the study and discussion. It is known that motivation to achieve success is the basis of victory in any kind of activity. Only a purposeful person striving to attain some high goal is able to achieve the desired result. The comparison of the indicators of testing of the values of types of motivation according to the Ehlers test was carried out on the following point scale: 1-10 – low level, 11-16 – average level, 17-20 – moderately high, 21-32 – very high level of motivation.

The analysis of indicators of various types of motivation according to the results of the Ehlers typological questionnaire made it possible to establish that athletes in speed-strength sports and martial arts demonstrated the highest indicators of motivation to win victory, contributing to the achievement of the necessary result; their indicators of motivation to avoid failure also had high values.

No reliable difference between the determined indicators of motivation to achieve success and motivation to avoid failure has been established, either in each sport individually, or between these indicators across various sports. However, a reliable difference is identified in indicators of motivation to achieve success between the control group and representatives of combat sports ($p<0.05$; Table 1).

Determination was also carried out of the values of anxiety, performance, conflict, emotional instability and tension, as the results of the action of increased physical and psycho-emotional loads on the body, in all the sports under study, with the help of the standard Lüscher and Cattell testing methods. As is known, the probability of a decline in the effectiveness of the body's adaptation and the occurrence of transient or persistent disturbances in it grow with the increase in the level of anxiety and tension that indicate the action of stress.

The results of the Lüscher and Cattell tests for the athletes examined in the sports under study were determined in stens (standard tens) according to the value of one or another psychological indicator, on the following levels: 1-3 – low, 4 – below average, 5-6 – average, 7 – above average, 8-10 – high (Table 2).

Table 1. Indicators of types of motivation according to the Ehlers typological questionnaire in athletes (points)

Examination groups	Ehlers test indicators	
	Motivation to achieve success (M±m)	Motivation to avoid failure (M±m)
Speed-strength	19.2 ± 4.5	18.8 ± 6.5
Combat sports	21.3 ± 3.4*	17.4 ± 4.5
Cyclic	17.4 ± 6.3	16.1 ± 4.1
Complex-coordination	15.9 ± 4.6	16.2 ± 4.6
Game sports	17.3 ± 3.7	17.2 ± 6.2
Control	11.1 ± 1.6*	10.9 ± 2.0

*Note: * – differences are statistically reliable, $p<0.05$.*

Table 2. Functional indicators of athletes by type of sport

Examination groups	Indicators in stens (M±m)					
	Lüscher colour-choice test			Cattell questionnaire		
	Performance	Anxiety	Conflict	Emotional instability	Self-control	Tension
Speed-strength	6.4 ± 1.7	6.0 ± 1.1	5.7 ± 1.1	3.7 ± 1.4	5.9 ± 1.3	6.2 ± 1.4
Combat sports	6.8 ± 1.5	5.1 ± 1.2	5.5 ± 1.2	4.0 ± 1.2	5.9 ± 1.1	6.8 ± 1.5
Cyclic	6.1 ± 1.3	4.8 ± 1.9	5.5 ± 2.1	4.0 ± 1.2	5.2 ± 1.8	7.0 ± 1.6
Complex-coordination	4.8 ± 1.4	7.5 ± 1.4*	7.2 ± 1.4*	3.8 ± 1.5	7.2 ± 1.6	7.6 ± 1.5*
Game sports	7.5 ± 1.3	5.5 ± 1.6	5.6 ± 1.3	4.4 ± 1.8	4.7 ± 1.5	5.4 ± 1.9
Control	5.8 ± 1.4	3.4 ± 1.4*	3.9 ± 1.8*	5.7 ± 1.4	4.3 ± 1.5	3.2 ± 1.1*

*Note: * – differences are statistically reliable, $p<0.05$.*

It was established that the indicators studied for athletes in various sports according to the Lüscher and Cattell tests had similar levels of the values examined. Practically, in representatives of most of the sports studied, values of levels of anxiety, tension, emotional instability and conflict were at the level of 3-6 stens (average level and below).

In representatives of complex-coordination sports, anxiety and conflict amounted to 7.5 ± 1.4* and 7.2 ± 1.4* stens, and tension to 7.6 ± 1.5* stens, which was higher than the analogous indicators in athletes of the control group ($p<0.05$).

In representatives of game sports, high indicators of performance were recorded (7.5 ± 1.3 stens); however, no reliable difference was established either with other sports or with the control group (Table 2).

Conclusions. It should be noted that, according to the test results, in professional athletes of comparable groups by sport – speed-strength, combat sports, cyclic and game sports – low levels of anxiety, conflict and tension were determined. An increase in these values was diagnosed in representatives of complex-coordination sports. Higher performance had a tendency in game sports. Considerably higher levels of motivation for victory were determined in the group of combat sports.

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A comparative evaluation of the psychophysiological state of trainers

UDC 796

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Abstract

Objective of the study is to identify the psychophysiological qualities of coaches who have not previously participated in high-performance sport and of high-class athletes who have moved to coaching work after the completion of their career in high-performance sport, in terms of the level of their stress resistance, self-control, motivation, anxiety and performance in their subsequent professional activity.

Methods and structure of the study. An analysis of the features of the professional activity of coach-instructors was carried out on the basis of the results of our own studies and data from the scientific literature. In coaches of both groups, psychophysiological indicators were studied that characterise their state of adaptation to loads, using the following methods: Lüscher, Cattell, the Ehlers questionnaire, the proofreading test, the tapping test and the simple visual-motor reaction (SVMR). Levels of their anxiety, tension, conflict and other indicators were studied.

Results and conclusions. The study of psychophysiological indicators reflecting the state of adaptation of the body to physical and mental loads in coaches holding high sporting titles and amateur coaches who had not previously participated in high-performance sport, indicated a reliably higher level of anxiety and a certain decrease in physical performance in coaches of the main group compared with the control.

Since the level of adaptation of the body of those engaged in high-performance sport to increased loads is not unlimited, this gives rise to the necessity for strict medical monitoring of their health, both in their participation in sport and on transition to coaching and instructional activity.

Keywords: *high-performance sport, indicators, psychophysiology, emotional tension, coaches.*

Introduction. There can be no doubt that sport at the present time is a most important and most popular social phenomenon. On the whole, sport effects intercultural and friendly ties between people and states, and is a powerful means of ideology, advertising and PR technologies. The development of the sporting movement leads to the attraction of substantial financial inflows from large industrial and trading organisations into the development of the sports industry, to the provision of necessary support for the development of children's and youth sport, and to the conduct of research into the prevention of morbidity in sport, the methods of effective recovery of athletes who have suffered impairment of health and injuries during training and competitions, and so on.

As S.Yu. Shchetinina and S.S. Popova note, a significant problem at the current stage of development of high-performance sport is that the intensive loads oriented towards the achievement of record results impose extreme demands on the functional systems of the human body. Adaptive reserves have certain limits conditioned by genetic factors and the personal features of the infrastructure of the mechanisms regulating the human body. For this reason, high-performance sport is a source of professional risks that lead to the impairment of working capacity, to the reduction of quality of life and frequently to disability and death [2, 7].

It should be noted that competitive activity is highly intensive. In our view, the high intensity of sporting activity is associated with the increased responsibility of athletes and coaches for the results of competitive struggle, and with the requirements of stability and reliability of sporting achievements for the prestige of a sports club or sports organisation.

The high psycho-emotional intensity of competitive activity, associated with the keen struggle for a

winning result, the presence of conflicts in team relations, instability in personal life and harsh competition – all this cannot fail to have an impact on the health of athletes [4]. According to the data of M. Bakhmeyer, high-performance sport is a source of professional risks that lead to the impairment of working capacity, to the reduction of quality of life and frequently to disability and death [2].

A serious question is the preservation of good health and effective adaptation of athletes after their transition to coaching and instructional activity following the completion of their sporting career. A feature of the activity of coaches of the highest qualification is the conducting of professional work against a background of high psycho-emotional tension and the necessity of preserving a high level of performance with the possibility of progressive fatigue in preparing athletes for important competitions [2, 4].

Objective of the study is to identify the psychophysiological qualities of coaches who have not previously participated in high-performance sport and of high-class athletes who have moved to coaching work after the completion of their career in high-performance sport, in terms of the level of their stress resistance, self-control, motivation, anxiety and performance in their subsequent professional activity.

Methods and structure of the study. An analysis of the features of the professional activity of coach-instructors was carried out on the basis of the results of our own studies and data from the scientific literature. In coaches of both groups, psychophysiological indicators were studied that characterise their state of adaptation to loads, using the following methods: Lüscher, Cattell, the Ehlers questionnaire, the proofreading test, the tapping test and the SVMR (sensorimotor or simple visual-motor reaction). Levels of their anxiety, tension, conflict and other indicators were studied [1, 5, 6].

The studies of the body's adaptation to physical and mental loads were carried out among 30 men aged 40-50, athletes who had previously participated in high-performance sport and held the sporting titles of 'Master of Sport, International Class' and 'Master of Sport', and who had moved to coaching and instructional activity after the completion of their career as athletes. The control group also consisted of 30 male coaches of the same age, generally without high sporting titles, employees of the sports faculties of educational institutions of the higher education system in the city of Ufa.

Results of the study and discussion. The values of the qualities studied were characterised in stens (standard tens) by the level of the following gradations: 1-3 – low level, 4 – below average, 5-6 – average, 7 – above average, 8-10 – high. As is known, the probability of a decline in the effectiveness of mental adaptation and the occurrence of transient or persistent disturbances in it grow with an increase in the intensity of levels of tension and anxiety.

The psychophysiological indicators of the level of adaptation studied in coaches of both groups according to the Lüscher and Cattell tests had similar values and were at the level of average and above average (Table 1).

It should be noted that the result obtained for the indicator of anxiety in coaches who had completed their career in high-performance sport was higher than that in the control group; however, no reliable difference was established. In the main group, a tendency towards a lower level of performance was also noted, but here too no reliable difference was established.

In the analysis of the results of the survey using the Ehlers test, in coaches who had previously participated in high-performance sport and coaches without high sporting titles, it was revealed that in the main group there were higher levels both of motivation to succeed and of motivation to avoid failure, while the differences were statistically reliable ($p<0.05$; Table 2).

Based on the results of the proofreading test in coaches who were high-class athletes and amateur coaches, indicators of fatigue were determined as indicators of the body's adaptation to loads. No reliable

Table 1. Psychophysiological indicators of coaches according to the Lüscher test and Cattell questionnaire

Examination groups	Indicators in stens (M±m)					
	Lüscher colour-choice test			Cattell questionnaire		
	Performance	Anxiety	Conflict	Emotional stability	Self-control	Tension
Coach- athletes	5.8 ± 1.5	7.2 ± 1.2	4.5 ± 1.6	5.0 ± 1.1	4.7 ± 1.5	5.5 ± 1.4
Coaches – control	7.1 ± 1.6	3.8 ± 1.9	5.5 ± 1.5	4.5 ± 2.0	5.7 ± 1.9	7.1 ± 1.3

Table 2. Indicators of motivation of coaches according to the Ehlers typological questionnaire

Examination groups	Ehlers test indicators	
	Motivation to achieve success (M±m)	Motivation to avoid failure (M±m)
Coach-athletes	18.8 ± 3.0*	17.4 ± 4.2*
Coaches – control	13.0 ± 3.1	11.6 ± 3.0

Note: * – differences are statistically reliable, p<0.05.

Table 3. Indicators of performance of the proofreading test in coaches

Observation group	Test indicators			
	Proofreading test (M±m)			
	Number of errors		Working time, min	
	Before the working day	After the working day	Before the working day	After the working day
Coach-athletes	9.9 ± 1.9	10.7 ± 1.7	6.7 ± 1.2	8.3 ± 1.1
Coaches – control	4.9 ± 1.5	9.8 ± 1.7*	5.7 ± 1.1	7.1 ± 1.3

*Note: * – differences are statistically reliable, p<0.05.*

Table 4. Results of the tapping test and the simple sensorimotor reaction in coaches

Observation group	Test indicators			
	Tapping test, frequency of touch		Simple sensorimotor reaction, time, ms	
Coach-athletes	5.4 ± 1.8	3.9 ± 1.1	250.2 ± 26.2	335.6 ± 44.4
Coaches – control	5.0 ± 1.3	4.0 ± 0.9	292.3 ± 37.8	298.5 ± 27.5

differences were identified in the level of the number of errors and the duration of test performance before the start of the working day and after, which would have indicated the presence in representatives of any group of more pronounced fatigue by the end of the working day. Nevertheless, a statistically reliable difference was determined in the number of errors in the proofreading test at the end of the working day in coaches without high sporting titles (Table 3).

Levels of adaptation and fatigue before and after work were also studied in coaches who were high-class athletes and in coaches without high sporting titles, on the basis of the results of the tapping test and the simple sensorimotor reaction (Table 4).

The results obtained did not reveal reliable differences in indicators in either group under study that would indicate excessive fatigue by the end of the working day after work, or in comparison with each other.

Conclusions. The study of psychophysiological indicators reflecting the state of adaptation of the body to physical and mental loads in coaches holding high sporting titles and amateur coaches who had not previously participated in high-performance sport, indicated a reliably higher level of anxiety and a certain decrease in physical performance in coaches of the main group compared with the control.

Since the level of adaptation of the body of those engaged in high-performance sport to increased loads is not unlimited, this gives rise to the necessity for strict medical monitoring of their health, both during their participation in sport and on transition to coaching and instructional activity.

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Impact of shuai jiao wrestling training on temperament and volitional self-regulation of university students

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Abstract

Objective of the study is to conduct a comparative assessment of the impact of Chinese Shuai Jiao wrestling training on the temperament and volitional self-regulation of first-year university students.

Methods and structure of the study. Chinese Shuai Jiao wrestling was introduced and tested within the physical education curriculum to experimentally examine its effect on temperament traits and volitional self-regulation. The study involved 120 male first-year students from Patrice Lumumba Peoples' Friendship University of Russia. The experiment was conducted over one academic year, with sessions held twice a week for two academic hours each.

Results and conclusions. No statistically significant differences were found between the groups at the start of the experiment. At its conclusion, it was established that the use of Chinese Shuai Jiao wrestling in the physical education of university students effectively and positively influences the development of temperament traits. Similar results were obtained when examining the levels of volitional self-regulation, as confirmed by statistically significant indicators across all measured parameters.

Keywords: *university students, self-regulation, Shuai Jiao, wrestling training.*

Introduction. Contemporary scientific and methodological literature contains a substantial body of research dedicated to the study of temperament characteristics and volitional self-regulation among university students [2, 5]. It has been established that temperament properties and traits such as flexibility, plasticity, energy, general activity and psychomotor speed are crucial factors of psychological adaptability. The presence of these properties enables students to adapt more easily to social environments, overcome life challenges and find their place in life [1]. It is also noteworthy that, according to many authors, a relationship between temperament and volitional self-regulation has been confirmed, and this is viewed as a process of learning self-regulation skills that is inextricably linked with other personal characteristics of young people [1, 2]. In most studies on volitional self-regulation, authors identify the fundamental forms of behaviour in diverse life and stressful situations. Therefore, the younger generation needs to develop and cultivate self-regulation skills and abilities in various life situations [5].

To attract university students to physical education, higher education institutions employ a wide range of physical activities, which is constantly being supplemented with new sports that were not previously used in the physical education of students [4]. Chinese Shuai Jiao wrestling is an unconventional type of physical activity that promotes the development of not only physical qualities, but also the ability to confront an opponent in a bout, and facilitates the development of self-control and perseverance [3].

Objective of the study is to conduct a comparative assessment of the impact of Chinese Shuai Jiao wrestling training on the temperament and volitional self-regulation of first-year university students.

Methods and structure of the study. The study involved 120 male first-year students from Patrice Lumumba Peoples' Friendship University of Russia. The students were divided into two groups: the first group

practised Shuai Jiao wrestling (n=60) and the second group followed a general physical training programme (n=60) over the course of one academic year. No statistically significant differences were found between the groups at the beginning of the experiment. To determine temperament traits, the Russian-language version of the DOTS questionnaire was used, which identified the degrees of temperament traits: 1 – general activity level; 2 – flexibility; 3 – mood; 4 – rhythmicity of habits; 5 – distractibility; 6 – persistence; 7 – sensitivity. To study the influence of Chinese Shuai Jiao wrestling elements on students' volitional self-regulation, the 'Study of Volitional Self-Regulation' test-questionnaire by A.V. Zverkov and E.V. Eidman was used. At the beginning and end of the academic year, each student was asked to complete the test-questionnaire containing 30 statements, marking them as 'plus' (+) if true or 'minus' (-) if false. The results for volitional self-regulation were processed according to the items on the general scale (V) and the indices of 'persistence' (P), 'self-control' (S), and the 'autonomy–dependence' (AD) scale. Standard methods of mathematical statistics were used to analyse the experimental data.

Results of the study and discussion. Analysis of temperament structure after one year of training revealed that the general activity indicator in the experimental group was 11.3% ($p<0.05$) higher than in the control group. A similar pattern was observed in flexibility and mood indicators at 10.3% ($p<0.01$) and 20.5% ($p<0.001$), respectively. Higher indicators in the experimental group were also found in rhythmicity of habits at 10.8% ($p<0.05$), distractibility at 15.8% ($p<0.001$) and persistence at 18.6% ($p<0.001$); only the sensitivity indicator was higher in the control group, corresponding to 14.2% ($p<0.01$) (Table 1).

When examining volitional self-regulation indicators after one year of training, the following results were obtained (see Figure). Based on the resulting histogram, higher results can be noted across all scales in the experimental group, with the greatest gap between groups observed on the general volitional self-regulation scale.

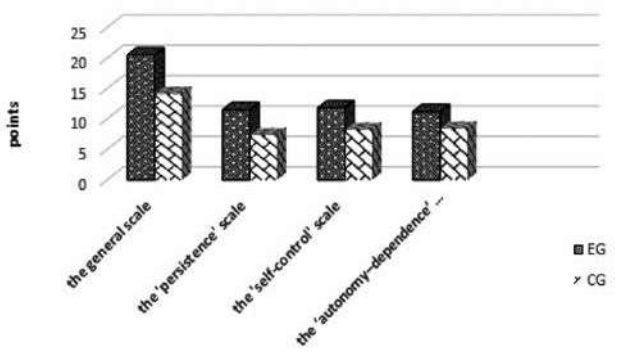

Figure. Volitional self-regulation indicators of students in the experimental and control groups

When examining the scale values by level (Table 2), a predominance of higher levels of volitional self-regulation was observed among students in the experimental group who practised Shuai Jiao wrestling: this indicator corresponded to 45% (<0.001); identical data were obtained for persistence at 57.5% (<0.001), self-control at 44% (<0.001), and autonomy-dependence at 33% (<0.001).

Conclusions. Thus, comparing the results of the experimental and control groups, it can be stated that the use of Chinese Shuai Jiao wrestling in the physical education of university students effectively and positively influences the development of temperament and the level of volitional self-regulation, as confirmed by statistically significant indicators across all measured parameters.

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Table 1. Temperament traits of students in the experimental and control groups

Temperament traits	EG n = 60	CG n = 60	Significance of differences P0
General activity	18.7±0.6	16.8±0.5	<0.05
Flexibility	18.2±0.5	16.5±0.4	<0.01
Mood	23.2±0.5	19.2±0.6	<0.001
Rhythmicity of habits	12.3±0.4	11.1±0.3	<0.05
Distractibility	13.2±0.5	11.4±0.3	<0.001
Persistence	10.2±0.2	8.6±0.2	<0.001
Sensitivity	18.2±0.6	21.2±0.3	<0.01

Table 2. Differences in volitional self-regulation levels between students in the experimental and control groups

Indicators	EG n = 60	CG n = 60	Significance of differences P0
General volitional self-regulation scale	20.5±0.8	14.1±0.6	<0.001
Persistence scale	11.5±0.5	7.3±0.6	<0.001
Self-control scale	11.8±0.4	8.2±0.3	<0.001
Autonomy-dependence scale	11.2±0.4	8.4±0.4	<0.001

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Enhancing flexibility through an adapted fitness programme within the framework of practical physical culture classes

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Abstract

Objective of the study is to develop and experimentally substantiate the effectiveness of an adapted fitness programme for improving flexibility in female university students.

Methods and structure of the study. The research employed analysis of literature sources, pedagogical observation, a respondent survey aimed at identifying the most popular fitness technologies among students, pedagogical testing designed to assess the level of active and passive flexibility, a pedagogical experiment, and mathematical-statistical data processing. The study involved third-year female students from the Faculty of International Relations and Political Studies, assigned to the primary and preparatory health groups (n=68).

Results and conclusions. An adapted fitness programme for flexibility development was designed, which contributed to increasing the range of motion in various joints. Assessment exercises for determining active and passive flexibility in female students were developed. The application of the adapted fitness programme in the educational process enables proportional development of physical abilities, formation of aesthetic qualities, health-improving effects and body composition improvement, as well as increasing sustained interest in practical physical education classes at university.

Keywords: *fitness, physical culture, female students, health.*

Introduction. A conscious attitude towards health and physical fitness through purposeful physical education and sports activities is currently particularly relevant for university students [1].

At the present stage of development, fitness tools for health improvement and promotion are gaining particular popularity. The introduction of adapted fitness programmes into the educational process will complement the standardised system of physical exercises with new movements and increase motivation for regular physical education classes at university. One type of fitness is stretching. Stretching is a form of health-enhancing gymnastics aimed at developing flexibility in specific muscle groups and improving mobility in various joints. Its primary purpose is to preserve and strengthen health, activate metabolic processes in the body, and improve blood and lymph circulation, thereby achieving a preventive and therapeutic effect.

The level of flexibility development depends on the anatomical structure of the body (muscle fibres, tendons, ligaments, joint capsules, joint shapes and articular cartilage thickness). The more pliable and elastic the muscles and ligaments, the higher the level of flexibility. Joint mobility is significantly affected by the ability to alternate muscle contractions with relaxation of the stretched muscles, which enables an increase in the range of the movement performed [2, 3].

Objective of the study is to develop and experimentally substantiate the effectiveness of an adapted fitness programme for improving flexibility in female university students.

Methods and structure of the study. At the first stage of the study, a survey of female students was conducted to identify the most preferred forms of class organisation at the university using fitness technologies. The survey results revealed that the greatest interest was in stretching classes (51%). This choice was motivated by the fact that regular classes focus primarily on flexibility development, making muscles more supple and elastic, improving joint mobility, re-

ducing salt deposits, normalising blood circulation, and making movements more fluid and graceful. The second preferred form of exercise identified by respondents was training on exercise machines (23%). Machine-based training is aimed at developing strength and endurance and building a defined physique. Exercises are performed in isolation targeting specific muscle groups. Ranked third in terms of interest, respondents identified classical and dance aerobics (19%). Aerobic exercises are aimed at en-

Table 1. Assessment exercises for evaluating active and passive flexibility of female students

No.	Test exercises	Guidelines	Indicators (standard)
1	**Range of motion in the shoulder joints**		
	Passive flexibility. Moving the gymnastic stick forwards and backwards. Starting position: feet together, gymnastic stick held horizontally downwards, overhand grip	When carrying the gymnastic stick, keep your arms straight and do not raise your shoulders. The distance between your hands when carrying the stick with straight arms is measured in centimetres	50-70 cm
	Active flexibility. Starting position: arms raised in a 'lock'. 1–4: bring arms back, hold the position; 5–8: return to starting position	Keep your shoulders down and your arms straight. The distance from your head to your hands is measured in centimetres	1-5 cm
2	**Mobility of the spinal column**		
	Passive flexibility. 'Bridge' from a supine position	Try to bring your hands as close to your feet as possible. Measure the distance from your fingertips to your heels in cm	40-50 cm
	Active flexibility. Starting position: standing facing the wall bars, hands on the bars. 1–4: lean backwards; 5–8: return to starting position	Stand with your feet together and your arms slightly bent, resting on a support. Initiate the bend from the head, slowly leaning your torso backwards. Measure the distance from your head to your buttocks in cm	20-25 cm
3	**Hip joint mobility**		
	Passive flexibility. Starting position: sitting, arms out to the sides. 1 – grasp the ankle with both hands; 2–4 – hold the position; 5–8 – return to starting position.	The distance is measured from the right and left legs, from the head to the shin, in centimetres. Keep your legs straight. Try to maximise the range of motion using your arms	5-20 cm
	Active flexibility. Starting position: standing with your back to the wall bars, hands gripping the bar from above. 1–4 – lift your leg forwards, hold the position; 5–8 – return to starting position.	Measurements are taken from the right and left legs. Keep your legs straight and your torso upright. Do not move away from the support	90 degrees and above
4	**Overall level of flexibility**		
	Passive flexibility. 'Fold', grasping the shin with the hands. Starting position: standing on a gymnastic bench, arms hanging down.	Feet together, legs straight. Do not bend your knees whilst performing the bend. The exercise should be performed without jerking or swaying. Try to maximise the range of motion using your arms. Measure the distance from your chest to your feet, in cm	0-10 cm
	Active flexibility. Starting position: standing on a gymnastic bench, arms down. 1–4: bend forwards; 5–8: return to starting position.	Feet together, legs straight. Do not bend your knees whilst performing the bend. The exercise should be performed without jerking or swaying. Using a ruler, measure the distance from the toes to the fingertips, in cm	13-16 cm

hancing the functional capacity of the cardiovascular and respiratory systems. Classes involve performing aerobic movements and steps to musical accompaniment, which are combined into routines of varying complexity. The routines are filled with rhythmic arm and leg movements, jumps and dance-style exercises stylised to various dance genres (jazz, hip-hop, Latin, etc.). According to the survey, the least significant fitness technology was step aerobics (7%). The essence of these classes involves performing aerobic routines using a step platform.

Thus, as a result of the survey, the question arose of developing and implementing a fitness programme aimed at flexibility development and health improvement to increase sustained interest in practical physical education classes at university. The fitness programme was designed for one academic semester and was applied during the main part of the practical class.

The programme employed exercises of static, dynamic and combined stretching incorporating adapted elements of rhythmic gymnastics, which contributed to increasing the range of motion in various joints.

To assess the effectiveness of the developed fitness programme, at the second stage of the study, pedagogical testing was conducted at the beginning and end of the pedagogical experiment, which included assessment exercises for determining active and passive flexibility levels among female students (Table 1). The assessment criteria were developed in accordance with age-related development trends, based on the principle of age-appropriate pedagogical interventions. Measurements were taken using a centimetre ruler, a gymnastics stick with centimetre markings, a goniometer and a protractor against a graduated chart.

At the third stage of the study, mathematical-statistical data processing was performed. The significance of differences was determined between the means of two samples using Student's t-test at a significance level of $p<0.05$.

Results of the study and discussion. The pedagogical experiment was conducted to test the developed fitness programme aimed at developing flexibility in female students. The tools and methodological approaches were based on the results of the theoretical analysis, including the respondent survey and pedagogical observation of practical classes at the university. Following the pedagogical experiment, repeat testing was conducted. A comparative superiority of the results obtained after the experiment was revealed at a significance level of $p<0.05$ (Tables 2, 3).

Table 2. Comparative passive flexibility indicators before and after the experimental fitness programme (n=68)

Assessment exercises		Value	P-value
Exercise 1 (cm)	Before	73.36±1.51	>0.05
	After	64.1±0.87	<0.05
Exercise 2 (cm)	Before	53.34±0.39	>0.05
	After	37.1±0.43	<0.05
Exercise 3 (cm)	Before	22.3±0.69	>0.05
	After	14.1±0.88	<0.05
Exercise 4 (cm)	Before	13.5±0.64	>0.05
	After	6.2±0.23	<0.05

Table 3. Comparative active flexibility indicators before and after the experimental fitness programme (n=68)

Assessment exercises		Value	P-value
Exercise 1 (cm)	Before	0.39±0.01	>0.05
	After	0.85±0.08	<0.05
Exercise 2 (cm)	Before	28.27±0.17	>0.05
	After	22.42±0.089	<0.05
Exercise 3 (degrees)	Before	67.24±0.48	>0.05
	After	74.13±0.17	<0.05
Exercise 4 (cm)	Before	13.74±0.110	>0.05
	After	16.31±0.49	<0.05

When planning classes involving flexibility development, it is necessary to observe a number of methodological recommendations. Such exercises can be incorporated into various parts of the class: warm-up, main, and cool-down. It is important to note that stretching exercises are most effective when performed daily. To maintain optimal joint mobility at the achieved level, practice 3–4 times per week. The number of repetitions depends on the mass of the muscle groups involved in a specific exercise, the age and fitness level of the participants. Before performing flexibility exercises, it is essential to warm up thoroughly to prevent muscle and joint injuries. Exercises should be performed with a gradual increase in range of motion, first at a slow pace and then at a faster one. The signal to stop performing exercises is the onset of sharp muscle or joint pain, as well as a decrease in the range of motion. When flexibility exercises are discontinued, the level will gradually decline and return to its initial state within two months.

Thus, classes aimed at developing flexibility of specific muscle groups and maintaining optimal joint mobility should be systematic in nature [4].

Conclusion. As a result of the study, the most preferred forms of organising fitness technology classes at university were identified. An assessment toolkit was developed, enabling prompt evaluation of the level of active and passive flexibility development in female students. An adapted stretching fitness programme incorporating elements of rhythmic gymnastics was developed and its effectiveness was experimentally demonstrated, contributing to the effective development of flexibility and the formation of sustained interest among female students in practical physical education classes at university.

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Training university students in obstacle course navigation during physical culture classes

UDC 371.134

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Abstract

Objective of the study is to develop, through modelling, an obstacle course and implement it into the educational process for students of military conscription age.

Methods and structure of the study. The article addresses issues related to preparing students for service in the Armed Forces of the Russian Federation. The following research methods were employed: literature review, data collection, and mathematical processing of research results.

Results and conclusions. The incorporation of obstacle course activities into the educational process within the discipline "Elective Courses in Physical Education" for senior students not only promotes the development of their comprehensive motor activity but also builds applied skills and enhances their level of physical fitness.

Keywords: *physical culture, training, motor activity, educational process, applied skills.*

Introduction. Overcoming obstacles is one of the key components of physical training for conscription-age individuals preparing for service in the Armed Forces of the Russian Federation, a category which includes final-year students. The techniques and movements performed on the obstacle course (running, jumping and crawling over various obstacles, jumping into and out of trenches, throwing grenades, etc.) contribute not only to the development of basic motor skills (speed, strength, endurance, coordination) but also help to improve the participants' mental fortitude.

The objectives of the study are:

- to improve the technique for overcoming elements of the obstacle course;
- to select methods for developing running, jumping and speed-strength fitness;
- to implement the developed methodology for overcoming elements of the obstacle course;
- to determine the effectiveness of incorporating obstacle course training into student preparation.

Objective of the study is to develop, through modelling, an obstacle course and implement it into the educational process for students of military conscription age.

Methods and structure of the study. In the first stage of the study, based on a review of the literature on the subject, we used a modelling approach to design an obstacle course within a 50×30 m sports hall (see fig.) with the aim of developing key motor skills (speed, strength, coordination, endurance) in a sports hall setting. This obstacle course allows for the performance and simulation of rapid movement, shooting from the knee, crossing a destroyed bridge and a trench, and moving in a crawling position under conditions of a gas attack [4]. At the end of the course, students performed a set of self-defence exercises against a simulated opponent [2].

Legend: 1. Start line; 2. Sprint section; 3. Tactical field, movement across the tactical field assuming kneeling firing position (30 m); 4. Ditch, 2 m wide (3 gymnastics mats); 5. Maze, 8 m long, 2 m wide; 6–8. Trenches, 1 m wide (gymnastics mat); 9. Destroyed bridge consisting of 4 segments (gymnastics benches with 1 m gaps) at a 135° angle; 10. Destroyed staircase

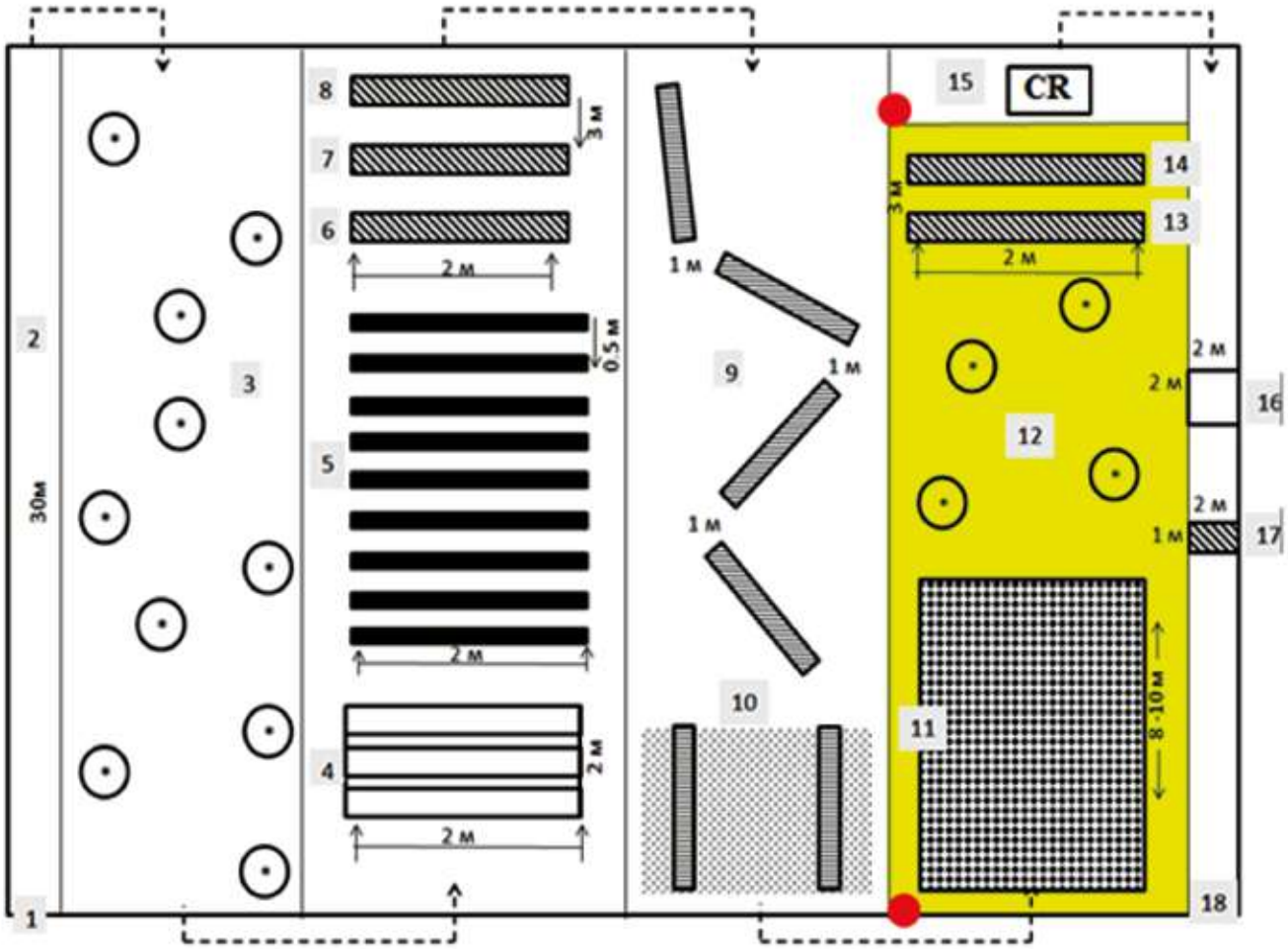

Figure. Standard obstacle course in the sports hall

(2 gymnastics benches, 3 m apart) with simulated contaminated section where all elements are performed wearing a medical mask (gas mask); 11. Soft surface section, 6–8 m; 12. Section for movement in kneeling firing position; 13–14. Trench; 15. Area for performing an 8-count unarmed combat routine; 16. Ditch (3 gymnastics mats), 2 m wide; 17. Trench (gymnastics mat), 1 m wide; 18. End of obstacle course.

During the first stage, methodological guidelines were also developed for performing the combined obstacle course exercise:

1. The start of the course is performed by trainees from a high start position [1]; 2. The sprint section is performed at a moderate pace; 3. Tactical field. Movement across the tactical field in the ready position for kneeling shooting is carried out at a fast pace; the knee must be lowered precisely at the marker, arms raised to simulate kneeling shooting, back straight; 4. The ditch is crossed from a running start, pushing off with one foot; lift the thigh as high as possible; land on the bent leg; 5. The maze is crossed using side steps with a forward stride; 6, 7, 8. The trench is crossed at a running pace; 9. When crossing the collapsed bridge, the legs are bent at the knees, and the torso is leaned forward to maintain balance on the gymnastic bench; 10. The collapsed staircase is crossed using a step-over movement, with both feet making contact with the floor outside the gymnastic bench, raising the hip as high as possible.

Crossing the 'contaminated' section of the obstacle course:

11. Crawling across the contaminated section of the obstacle course whilst wearing a medical mask (gas mask) over a soft surface 8–10 metres long; 12. Crossing the tactical field is performed whilst wearing a mask (gas mask) in the ready position for firing from

the knee; 13-14. Crossing the trench is performed whilst wearing a mask (gas mask); 15. A set of unarmed hand-to-hand combat techniques in 8 counts.

Starting position – parade rest.

'One' – step forward with the left foot and assume a fighting stance.

'Two' – parry upwards with the left hand and strike straight forward with the right hand.

'Three' – strike straight forward or from below with the right foot.

'Four' – step to the side with your right foot and deliver a backhand strike with the edge of your right palm.

'Five' – step back with your right foot and perform an inward parry with your left hand.

'Six' – step forward with your right foot and deliver a downward punch with your right fist.

'Seven' – strike forward with the left foot and remain in a left-side combat stance.

'Eight' — strike with the right knee whilst simultaneously grabbing the opponent with both hands and pulling them towards you, then assume a combat stance; step back with the left foot and assume the parade stance [3].

16. Crossing a ditch from a running start, using a running stride and landing on a half-bent leg; 17. Crossing a trench using a running stride, increasing speed towards the end of the distance; 18. Finish – the end of the obstacle course.

During the second stage of the study, the effectiveness of training sessions using a simulated obstacle course and a set of hand-to-hand combat techniques was determined.

Results of the study and discussion. Physical education classes were conducted throughout the first semester of the 2024–2025 academic year with third-year students in the "Journalism" and "Economic Security" specialisations, totalling over 150 participants. Performance indicators included heart rate data at the beginning (September 2024) and end (December 2024) of the experiment, as well as subjective assessment scores for the self-defence routine. Test results are presented in the Table.

Table. Heart rate indicators and routine assessment scores at the beginning and end of the experiment

Parameters	Before experiment	After experiment	Difference
HR (bpm)	153	140	13
Routine assessment (points)	3.2	4.1	0.9

Thus, heart rate improvement amounted to 13 bpm. The assessment score for the unarmed combat routine improved by 0.9 points, which confirms the effectiveness of incorporating modelled obstacle course sessions into the educational process for students within the "Elective Courses in Physical Education" discipline. These sessions also positively influenced the overall fitness level of participants, reflected in improved performance in other credit programme exercises such as the 100 m sprint, Cooper test, standing long jump, and flexibility exercises. Overall, improvements in the development of physical qualities including agility, speed and endurance can be noted.

Conclusions. The use of the proposed modelled obstacle course in physical education classes enables the successful resolution of both applied student preparation objectives and the enhancement of participants' physical fitness.

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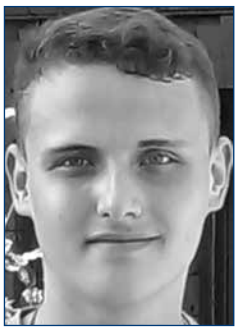
Legal requests and instructions in intelligent systems for the field of physical culture and sport

UDC 37.012



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Abstract

Objective of the study is to provide specific methods and examples for creating effective legally oriented prompts for the field of physical culture and sport.

Methods and structure of the study. The work employs a theoretical analysis of scientific publications based on the ideas of prompt engineering as an educational technology, representing the process of the targeted construction of textual query-prompts ('prompts').

Results and conclusions. Key methodological techniques are presented which allow the prompt-engineering processes of both sports legal specialists and current coaches to be optimised more rapidly. Among them are techniques whereby unnecessary context that distracts from the main goal must be avoided in the query. The prompt should be reformulated so that it sounds universal and meaningful. The key details necessary for an understanding of the question must be enumerated, and so on.

Keywords: *sports, physical culture, prompt engineering, law.*

Introduction. Prompting is a method of providing hints or initial data in order to obtain text or responses from artificial intelligence. Within the framework of working with language models and neural networks, it allows the user to formulate questions, give instructions or provide an initial fragment of text in order to obtain corresponding responses or continuations from the model [1].

Together with the new opportunities that generative artificial intelligence opens up for sports coaches and other workers in physical culture and sport, significant shortcomings have also been identified. Some studies have emphasised the difficulty of introducing these technologies into professional activity, the limited fields of application of artificial intelligence and the related ethical issues that arise from its use in the field of physical culture and sport [1-5, 7]. One of the 'technical' difficulties is the insufficient level of preparedness of staff in sports organisations for the use of intelligent system services in their work, and in particular for the ability to formulate prompts – queries for the generation of content.

Objective of the study is to provide specific methods and examples for creating effective legally oriented prompts for the field of physical culture and sport.

Methods and structure of the study. The work employs a theoretical analysis of scientific publications based on the ideas of prompt engineering as an educational technology, representing the process of the targeted construction of textual query-prompts ('prompts').

Results of the study and discussion. In order to organise productively the process of constructing legal queries and instructions in intelligent systems for the field of physical culture and sport, we present a number of methodological techniques that will enable both sports legal specialists and current coaches to optimise this prompt-engineering process more rapidly.

It is necessary to avoid the inclusion in the query of unnecessary context that distracts from the main goal. The prompt should be reformulated so that it sounds universal and substantive. It is essential to enumerate the key details necessary for an understanding of the question.

An example of a poorly formulated query:

We have received many contracts from clients, but we believe that most of them have been copied from a single sample. How can we identify exactly who has violated the rules?

A correctly formulated query:

I have a set of documents in PDF files. Some of them are very similar, probably made from a single template, while others are less alike. Is it possible to arrange them by level of similarity or to highlight those most closely matching in content?

Another example of an incorrect query:

Boxing is an Olympic sport, while kickboxing is a martial art. Could you give analogous pairs of similar sporting disciplines?

Here a confusion of concepts of different categories of classification occurs: 'Olympic sport' and 'striking martial art'. A correctly formulated task should sound as follows:

There are sporting disciplines that are often perceived as interconnected or interchangeable, for example, boxing and kickboxing (which use similar striking techniques), Thai boxing and cardio boxing (which use similar defensive and attacking techniques). Please share examples of analogous pairs of sports that are similar in technique or style.

It is advisable to use the method proposed by the well-known thinker Jacques Derrida, which involves the detailed division and study of the elements of a work, in our case the query. In order to construct a clear and comprehensible prompt, it is important to break down a complex task into separate stages, explaining the process of execution step by step. If one imagines a situation as if one were giving instructions to a novice trainee starting work for the first time, then one's explanations should be as simple and understandable as possible. For example, this is how to set such a task correctly for a novice:

Imagine yourself as a lawyer specialising in sports law. Your goal is to monitor the performance of tasks by your new trainee. The task consists of the following stages: – Read the text carefully. – Remove superfluous words and expressions that complicate the perception of the text. – Divide long and convoluted sentences into short and easily perceived parts. – Replace complex legal terms and constructions with simpler and more accessible formulations. You will then be provided with specific texts produced by the trainee. After checking each text, give it a mark on a five-point scale based on the quality of the task performed.

It is recommended to rewrite the instruction in one's own words in such a way as to preserve its essence whilst increasing readability and comprehension [3]. Superfluous information must be excluded, with the focus exclusively on the key elements and requirements of the task. It must be remembered that a correct query helps to convey the meaning clearly and to achieve the desired result.

It is important to monitor the correctness of sentence construction and the use of professional terminology, particularly in legal matters. Although the system is able to recognise even ungrammatical queries, the accuracy of the results will significantly increase if the user adheres to a correct legal style of presentation. Colloquialisms and conversational expressions complicate the system's processing of the query and reduce the quality of the response obtained.

Excessive information should be excluded, since most algorithms include explanations and detailed conclusions by default, which improves comprehension but increases the volume of data processing. Queries should preferably be formulated concisely and specifically. An example of such a simplified query:

It is necessary to analyse a sports project with investments in object A of US$2 million and in object B of US$3.5 million. The rates of return are set at 8% and 10%, respectively. Determine the initial cost of the project and the degree of investment attractiveness of each object. Provide numerical indicators without detailed reasoning.

It is also useful to request alternative solutions. This will allow one to determine quickly which of the proposed options is most suitable and to adjust the next steps accordingly.

Methods of managing interaction with artificial intelligence are very diverse, and non-standard methods are sometimes encountered, such as attempts at pressure or pleas for the correct answer. We will, however, focus only on those techniques that prove genuinely useful and have been successfully tested. Over time, every user will surely find their own effective methods.

One common technique of prompting is the assignment (setting) of the role of the subject. The context and stylistics of the generated text depend significantly on the role assumed by the virtual assistant. Thus, by setting an appropriate role for the subject in the query, one can control the form and content of the response of the intelligent system. Example:

Imagine yourself as a sports law expert. You have been given the task of preparing teaching material for the coaching staff – the compilation of a glossary containing the basic concepts used in sports law classes. Suppose the topic of the lesson concerns the foundations of legal liability for injuries in sport and the fight against the use of doping. Prepare at least 15 terms with accessible explanations.

Another important practice is the provision of examples of the expected result. It has been demonstrated

that showing a specific sample of the desired response noticeably increases the quality of the final product. In this way, artificial intelligence is able to determine more accurately the appropriate style, level of complexity and volume of the necessary material [6]. For example:

Imagine yourself as a practising lawyer in the field of physical education and sport. You have been instructed to write a brief guide to Russian legislation in the interests of active athletes. Suppose you have already drawn up a section on guarantees for athletes and employees of physical culture and sports organisations using the following formulation: 'According to Article 348.10 of the Labour Code of the Russian Federation, employers are obliged to pay independently the missing amount of sick leave up to the average monthly salary of the employee, if the appointed allowance is less than the specified amount and this difference is not reimbursed by insurance compensation.' Please propose three additional important aspects reflecting the rights of athletes.

Step-by-step reasoning makes it possible to gain a deeper understanding of the problem and to solve it more effectively. Intelligent systems often experience difficulty with the analysis of complex questions or with the selection of a starting point for analysis. To facilitate their task, it is useful to direct the line of thought by suggesting a clear sequence of actions or by directly asking the artificial intelligence to reason in a systematic manner, moving from one stage to the next. For example:

Imagine yourself as a specialist in Russian football law engaged in the qualification of violations. The task requires a step-by-step approach consisting of the formulation of consecutive questions and the provision of answers to them. A defender of Moscow CSKA in his own penalty area had a collision with a player of the Moscow Spartak. The referee initially decided to award a penalty, considering the contact that occurred to be a violation of the rules of the game. Subsequently, the intervention of the VAR video assistance system led to the cancellation of the previously awarded penalty. Commenting on the episode, former Premier League referee Igor Fedotov pointed out that the referee's verdict was in accordance with the established rules, despite the apparent ambiguity of the situation for fans. According to the expert, the defender was actively striving to engage with the play and was able to make contact with the ball. For this reason, the fact of an intentional foul is questionable, since the player's main aim was to make contact with the ball rather than with his opponent.

If artificial intelligence has a tendency to make mistakes, it is advisable to recheck each stage of its reasoning individually.

The submission of long messages in parts contributes to the absence of such shortcomings. Any model of artificial intelligence is limited by the size of its 'context window', that is, the number of characters stored in operational memory. Modern versions of intelligent systems are able to process large volumes of text – on the order of dozens of pages. At the same time, artificial intelligence service interfaces have limits on the length of the texts entered or output. For this reason, it is sometimes difficult to fit the full text within a dialogue window [4].

In such situations, it is sensible to divide a large text into fragments and to transmit them to the system gradually, with corresponding instructions. It is recommended to number the segments in order to minimise confusion. An example of a correct instruction:

I plan to send you a series of materials necessary for the performance of the following task [...]. Fragment number one is sent first... Fragment two will follow... Each fragment begins with the words 'Fragment 1 of 3'. Your response to each of my messages should consist of the single word 'Accepted'. After the last fragment ('Fragment 3 of 3') has been sent, process all the gathered information and present brief conclusions in a maximum of three paragraphs of simple and comprehensible language.

If the response received does not satisfy the user, then in order to improve the result one can use the method of explaining the errors made by the system and the technique of providing samples of the correct response. This approach is effective with multiple appeals involving similar tasks; however, it should be borne in mind that the system's memory is limited, and after some time it may lose knowledge of previous queries. The periodic repetition of training with artificial intelligence becomes a necessary condition for maintaining the effectiveness of conclusions. We will show a continuation of the previous example:

Imagine yourself as a specialist in Russian football law engaged in the qualification of violations. The task requires a step-by-step approach consisting of the formulation of consecutive questions and the provision of answers to them. It is required, in the described episode, to provide for supporters of cancelling the penalty detailed arguments based on a real sporting situation, and to include the full information necessary for writing a high-quality response.

Several case scenario hints are then sent. Each scenario is described in detail in 3–4 sentences, setting out a real sporting problem related to the application of an established rule of the game and providing sufficient content for the study:

Scenario 1. CSKA defender Igor Diveev was playing the ball, which unexpectedly changed trajectory. The subsequent physical contact with Spartak midfielder Roman Zobnin was deemed unintentional and not deserving of punishment. The artificial intelligence is to ascertain which legislative norms regulate the described episode from the standpoint of cancelling the penalty, with the cited arguments concerning the unintentional nature of the contact.

Below is a sample of the second hint from the position of supporters of cancelling the penalty, with cited arguments concerning the violation of rules in the attacking phase:

Scenario 2. Prior to the moment of the duel in the penalty area, Spartak midfielder Jhedson Fernandes violated the rules against CSKA player Rodrigo Villagra, which allowed the home team to continue the attack.

Both hints should be used to improve the subsequent output, taking into account different approaches and arguments.

It is also necessary to ask the system to formulate its own question. Sometimes there are difficulties in formulating an exact prompt. In such a case, it is worth entrusting the creation of the query to the intelligent system itself, providing it with illustrative samples [4].

Another method is to send texts 'before' and 'after' editing and to ask the system to explain the changes. The observations obtained will become the basis for the subsequent variant of constructing a new productive task [6]. For example:

I have prepared two variants of a text representing the original version and the revised version. Please analyse the differences and identify the main principles of textual improvement.

Thus, the main principles of text revision proceed through:

- the elimination of repetitions and ambiguities that reduce the expressiveness and accessibility of the text;
- the abridgement and simplification of sentences for ease of reading and comprehension;
- the exclusion of secondary details that carry no meaning [5].

Having received such feedback, one then uses the noted criteria when preparing a new task. In so doing, the text is altered in an analogous manner:

- correcting superfluous words and broken-off ideas that impair the cohesion and readability of the text;
- simplifying and shortening sentences to improve the clarity and conciseness of the presentation;
- removing repeated elements and clarifying insertions that contain no essential information.

Several other techniques are also sometimes employed, for example, using a different input language [5] or applying the method of overcoming censorship.

Conclusions. Prompting in the context of sports law is an important tool for forming legal queries and instructions in intelligent systems, which contributes to a more accurate and effective application of regulatory acts in the field of physical culture and sport. Mastering this process allows specialists to navigate legal norms better, ensuring their correct use and observance, and also contributes to the development of legal culture in the sports industry. On the whole, the development of prompting skills in the field of sports law is a key factor in improving the quality of legal regulation and the protection of the interests of participants in sporting activity.

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Effectiveness of chatbot application in supporting independent strength fitness training

UDC 796.011

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Abstract

Objective of the study is to assess the effectiveness of chatbot application as a form of pedagogical support for independently organised strength fitness training among young women.

Methods and structure of the study. A pedagogical experiment was conducted involving young women aged 18-20 with no prior sports experience, aimed at studying the potential of a chatbot as a form of pedagogical support for strength fitness training. The methods employed included anthropometry, functional testing, a pedagogical experiment, and pedagogical observation.

Results and conclusions. The experiment demonstrated that the intended result of reducing body circumference measurements in young women who trained according to a chatbot-generated programme, but without real-time specialist supervision, was achieved at the cost of deteriorated adaptive capacity of the body and loss of interest in using strength fitness for body composition correction. Interactive content enables the engagement and maintenance of an individual's interest in physical education and health-enhancing activities only with the active involvement of a specialist possessing the relevant competencies.

Keywords: *chatbot, cardiac autonomic regulation, pedagogical support, fitness training, young women.*

Introduction. The development of interactive content in the context of active digitalisation is regarded as a trend in the development of physical education and sport both in Russia and worldwide [5]. Currently, an active search is underway for ways to regulate the physical activity of the population through the use of interactive content, particularly chatbots. Developers see the advantages of their use in providing users with the ability to model motor regimes depending on physical fitness and functional capacity, as well as in monitoring physical activity with subsequent analysis of results [4]. Researchers note the need for more in-depth study of issues related to the creation of online communities, the organisation of training support using interactive content, and the prevention of risks associated with potential harm to health and reduced motivation [1].

The search for ways to improve public literacy in the independent application of physical education and sport methods during leisure time necessitates additional research on the effectiveness of using interactive content in the support of physical education and sporting activities.

Objective of the study is to assess the effectiveness of chatbot application as a form of pedagogical support for independently organised strength fitness training among young women.

Methods and structure of the study. The study was conducted at the sports and fitness complex of Nizhnevartovsk State University over a period of 15 weeks (September-December 2025) involving young women aged 18-20 with no prior sports experience. All participants gave voluntary written consent to participate in a pedagogical experiment involving the use of a chatbot for supporting strength fitness training aimed at body composition correction through reducing body circumference measurements. Depending on the content of pedagogical support, participants were divided into two groups: Group E-1 received, in addi-

tion to chatbot guidance, weekly individual consultations from a strength training instructor (n=7); Group E-2 communicated with a specialist only through the interactive format (n=8). The control group comprised young women who trained in the university gym during extracurricular hours following self-designed plans (n=15). The methods employed included anthropometry, functional testing, a pedagogical experiment, and pedagogical observation. Functional state assessment was based on heart rate variability analysis using the "Omega" hardware-software system. The following indicators were analysed: heart rate (HR), autonomic balance index (ABI), regulatory process adequacy index (RPAI), and stress index (SI). Statistical data processing was performed using MS Excel.

Results of the study and discussion. Pedagogical support for strength fitness training is designed to optimise the individual's independent application of physical education and sport in comfortable conditions and is aimed at enhancing the physical literacy of participants, enabling them to successfully solve motor tasks independently in the future [2]. The use of a chatbot provides the opportunity to receive rapid responses to queries related to a specific thematic area.

The chatbot "@HelptrenerBot" developed for the Telegram application is designed to individualise strength fitness programmes taking into account existing health conditions, functional capacities, interests and needs, as well as the conditions of the sports and fitness environment of the sports or educational institution. An important aspect in developing the interactive content was its orientation towards building participants' readiness for the independent use of strength fitness during leisure time.

The chatbot structure comprises the following sections: "Functional State Diagnostics", "Warm-up Routines", "Selection of Training Focus", "Recommended Routines Based on Experience and Fitness Level", as well as "General Information on Strength Fitness Guidelines" and "General Information on Rational Nutrition". The feedback feature enabled tracking of training progress, receiving answers to arising questions, and attaching exercise performance videos for technique assessment and correction. The selected exercises were structured, diverse, and did not require external spotting to prevent injuries.

The effectiveness of the chatbot as an interactive assistant for young women engaged in strength fitness was assessed through the dynamics of anthropometric indicators (Figure 1), functional body state (see Table), and gym attendance frequency (Figure 2).

Analysis of anthropometric changes revealed unidirectional changes in Groups E-1 and E-2: decreases in right thigh, right upper arm, waist and chest circumferences were observed, with a slight increase in hip circumference. In young women who received in-person specialist consultations, a slight increase in body mass was observed, unlike students who used recommendations in the interactive format only. The data obtained indicate effective resolution of the body composition correction task among young women who used the chatbot.

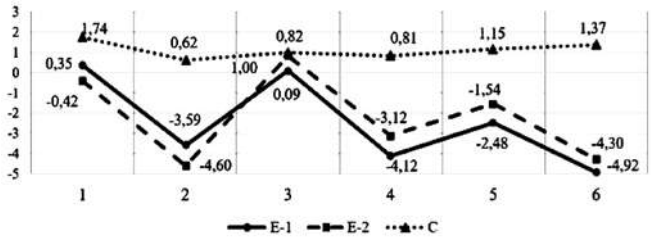

Figure 1. Differences in anthropometric indicators of young women during the experiment, % (1 – body mass, 2 – right thigh circumference, 3 – hip circumference, 4 – waist circumference, 5 – chest circumference, 6 – right upper arm circumference)

Table. Cardiac autonomic regulation in young women during the experiment (M±m)

Groups	Period	HR, bpm	ABI, a.u.	RPAI, a.u.	SI, a.u.
E-1 (n=7)	September	88.2±1.7	241.3±25.4	66.5±4.2	192.2±21.0
	December	82.8±2.0	158.5±26.4	49.8±4.7	102.7±8.5
	p	>0.05	<0.05	<0.05	<0.05
E-2 (n=8)	September	88.8±2.5	240.3±15.7	70.0±3.8	201.3±13.2
	December	90.0±2.11	253.0±29.3	72.2±8.4	209.7±18.4
	p	>0.05	>0.05	>0.05	>0.05
C (n=15)	September	86.6±2.0	199.0±17.7	57.3±3.1	173.8±15.6
	December	86.4±1.9	216.3±34.4	60.7±7.6	193.2±22.4
	p	>0.05	>0.05	>0.05	>0.05

Analysis of changes in cardiac autonomic regulation during independently organised fitness training enabled conclusions regarding the divergent effects of physical loading on objective indicators of the functional state of the young women's bodies (see Table).

Changes in the regulatory process adequacy index, autonomic balance index and regulatory system stress index in Group E-1 demonstrated a downward trend, indicating optimisation of body functioning at rest (changes were statistically significant by paired Student's t-test). Participants in Group E-2 exhibited sustained elevated sympathetic nervous system tone throughout the experiment, while control group participants showed a tendency towards increased sympathetic activity by the experiment's end (changes were not statistically significant by paired Student's t-test). This fact points to more strained cardiac autonomic regulatory mechanisms, which consequently indicates an uneconomical mode of body functioning at rest [3].

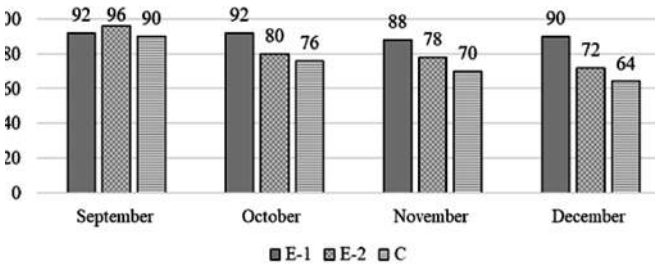

Figure 2. Training attendance activity of young women during the experiment, %

Developers' claims that the use of a virtual assistant would stimulate interest in using physical exercises for body composition correction were not confirmed. The analysis of training attendance showed that the use of a chatbot as a form of pedagogical support for training programmes without real-time consultation from a physical education specialist led to loss of interest in training and session absences among some participants (Figure 2). The highest number of missed sessions by the experiment's end was observed among control group participants who trained following self-designed plans.

Conclusions. The analysis demonstrated that, despite achieving the intended result of reducing body circumference measurements, young women who trained according to a chatbot-generated programme but without real-time specialist supervision exhibited more strained body functioning. Declining attendance by the experiment's end indicated loss of interest in using strength fitness for body composition correction. The use of a virtual assistant combined with physical education instructor consultations enabled students not only to achieve the body parameter correction objective but also to optimise their functional state and maintain motivation for continued training. The experiment showed that interactive content enables the engagement and maintenance of an individual's interest in physical education activities only with the active involvement of a specialist possessing the relevant competencies.

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Improving endurance performance among students through information technology

UDC 796.015

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Abstract

Objective of the study is to substantiate experimentally the influence of the use of smart watches and a mobile application on indicators of endurance and speed abilities of students in the process of physical education.

Methods and structure of the study. The scientific work involved 100 students of higher educational institutions aged 18 to 22, studying in their 1st to 3rd year and admitted to physical education classes in the special medical group. The students were divided into experimental and control groups of 50 people each. The formative stage included the implementation of a pedagogical experiment lasting 8 weeks (2 months), during which the experimental group used smart watches and a mobile application to monitor physical activity, while the control group followed a traditional physical education programme without the use of digital tools.

Results and conclusions. A comprehensive analysis of the results of the experimental study has made it possible to conclude that the use of smart watches and a mobile application has a multifactorial positive influence on students' physical fitness. The most pronounced effect was recorded in indicators of aerobic endurance, in functional indicators of the cardiovascular system, and in resistance to physical loads. Monitoring of load intensity, visualisation of progress and regular feedback contributed to the formation of a more rational motor regime in students of the experimental group.

Keywords: *students, physical education, information technology, endurance performance, smart watches.*

Introduction. Modern students are active users of digital devices, mobile applications and wearable technologies, which form a new environment of everyday activity, communication and self-monitoring. This phenomenon objectively requires scientific reflection from the standpoint of pedagogical and physiological potential. One of the key problems of students' physical education at the present time remains the decline in the level of motor activity and physical fitness, primarily in indicators of general and specific endurance. The increase in time spent in a sedentary position, a high study load, the wide spread of distance forms of learning and digital entertainment all form a steady tendency towards hypodynamia, which has a negative impact on the functional state of students' bodies [1, 2].

Paradoxically, it is precisely those digital technologies that are often regarded as a factor in the reduction of motor activity that simultaneously possess significant potential for stimulating it. Wearable devices (smart watches, fitness bracelets) and specialised mobile applications make it possible in real time to monitor the parameters of physical loads, to control heart rate, distance and speed of movement, and also to visualise the user's progress, forming sustained motivation for regular motor activity [3, 4].

Modern research shows that the use of digital tools in the field of physical culture is capable of exerting multilevel impact [5, 6]:

– physiological (optimisation of loads, increased endurance);

– psychological (growth of motivation, formation of self-discipline);

– pedagogical (personalisation of the educational process).

However, despite the growing number of publications, most works are descriptive or correlational in nature, being limited to the analysis of students' subjective evaluations or to questionnaire data. The number of controlled pedagogical experiments aimed at the objective evaluation of the influence of

the use of wearable devices on indicators of physical fitness remains insufficient, particularly in the conditions of higher education.

In this regard, particular relevance attaches to the conduct of a pedagogical experiment aimed at the comparative analysis of changes in endurance indicators in students who use smart watches in the educational and training process and students who follow a traditional physical education programme without the use of digital monitoring tools.

Objective of the study is to substantiate experimentally the influence of the use of smart watches and a mobile application on indicators of endurance and speed abilities of students in the process of physical education.

Methods and structure of the study. The scientific work involved 100 students of higher educational institutions aged 18 to 22, studying in their 1st to 3rd year and admitted to physical education classes in the special medical group. The students were divided into experimental and control groups of 50 people each.

The formative stage included the implementation of a pedagogical experiment lasting 8 weeks (2 months), during which the experimental group used smart watches and a mobile application to monitor physical activity, while the control group followed a traditional physical education programme without the use of digital tools.

Students of the experimental group used: smart watches (or fitness watches) with the function of monitoring HR, distance, pace and load duration; a mobile application synchronised with the device. In the course of classes and independent physical activity, students monitored zones of load intensity; tracked the number of steps, distance and time of activity; recorded the results of training sessions; and received visual feedback on their progress. The physical education teacher used the generalised data to adjust loads and to consult students on questions of intensity and recovery.

The control group followed a traditional physical education programme without the use of wearable devices and applications for the monitoring of physical condition. The assessment of the load was carried out by standard pedagogical methods (visual control, subjective assessment of fatigue, regulatory indicators).

The difference between the groups consisted exclusively in the use of digital technologies, which ensured the purity of the experiment.

The physical fitness of the students was assessed before the start and after the completion of the experiment using standardised tests. The choice of these tests was conditioned by their validity, ease of reproduction and wide use in the practice of physical education.

Of particular interest is the assessment of the influence of the use of smart watches on the results of:

– the Cooper test (12-minute run) – used to assess the level of general aerobic endurance;

– the dosed walking test – used to assess the functional state of the cardiovascular system and the general endurance of students with various levels of fitness;

– sprint running over 100 m – used to assess speed abilities and anaerobic power.

To improve the reliability of the results, the following conditions were observed: testing was carried out under identical weather and time conditions; participants did not perform intensive loads for 24 hours before the tests; uniform briefing was used; measurements were taken by the same teachers.

In the experimental group, the smart watches and the monitoring programme were used as means of objective monitoring of load intensity; of forming skills of self-monitoring; and of increasing awareness of the training process.

Particular attention was paid to ensuring that students were in the aerobic HR zones optimal for the development of endurance. Exceeding admissible values served as a signal to reduce load intensity, which lowered the risk of overexertion.

Results of the study and discussion. At the beginning of the experiment, no statistically significant differences between the groups were identified across all the parameters studied ($p>0.05$).

On the basis of the results of repeat testing after the completion of the experiment, significant differences in the dynamics of indicators of general aerobic endurance between the groups were identified (Table 1).

Table 1. Indicators of physical fitness of students before and after the experiment

Tests	Group	Before the experiment	After the experiment
Cooper test	EG / CG	2315 ± 185 / 2298 ± 192	2590 ± 170 / 2385 ± 180
Dosed walking	EG / CG	148.6 ± 9.4 / 149.2 ± 9.8	136.2 ± 8.1 / 145.7 ± 9.0
100 metres	EG / CG	14.62 ± 0.74 / 14.58 ± 0.71	13.88 ± 0.66 / 14.32 ± 0.69

Among students of the experimental group, a statistically significant improvement in Cooper test results was observed. The average distance covered in 12 minutes increased, indicating a growth of aerobic capabilities and general endurance.

The increase in indicators in the experimental group was steady in nature and was accompanied by: a reduction in the subjective sense of fatigue; a more stable running pace; and the optimisation of heart rate during the performance of the load.

Among students of the experimental group, after the completion of the experiment, a statistically significant increase in the distance covered in 12 minutes was recorded, which indicates an increase in the level of general aerobic endurance. In the control group, a tendency towards improvement of indicators is also observed; however, the increase in distance is less pronounced in nature and in a number of cases does not reach the level of statistical significance.

The data obtained confirm the higher effectiveness of the use of smart watches and a mobile application in the process of developing endurance compared with traditional forms of organising physical education classes (Table 2).

Table 2. Dynamics of indicators and statistical significance of differences

Tests	Group	Average distance covered	Average distance covered (%)	t	p
Cooper test	EG/CG	+275/+87	+11.9/+3.8	4.21 / 1.34	0.01 / 0.05
Dosed walking	EG/CG	-12.4/-3.5	-8.3%/2.3%	3.98 / 1.12	0.01 / 0.05
100 metres	EG/CG	-0.74/-0.26	5.1%/1.8%	2.89 / 1.01	0.05 / 0.05

A comprehensive analysis of the results of the experimental study makes it possible to conclude that the use of smart watches and a mobile application has a multifactorial positive influence on students' physical fitness.

The most pronounced effect was recorded in: (1) indicators of aerobic endurance; (2) functional indicators of the cardiovascular system; (3) resistance to physical loads.

Monitoring of load intensity, visualisation of progress and regular feedback contributed to the formation of a more rational motor regime in students of the experimental group.

Conclusions. Thus, the results of the pedagogical experiment carried out confirm the expediency of using smart watches and mobile applications in the system of students' physical education. The introduction of wearable devices into the system of students' physical education is a promising direction that contributes to the increase in the effectiveness of educational classes and to the formation of stable motivation for physical activity.

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Systematisation of university students' physical fitness using a software module

UDC 371.134

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Abstract

Objective of the study is to substantiate and implement a software module for the systematisation and monitoring of physical fitness levels among university students.

Methods and structure of the study. The following research methods were employed: literature review, data collection, questionnaire survey, and mathematical processing of research results. Based on the analysis of regulatory legal acts, the necessity of introducing innovative teaching technologies into the educational process was established. A questionnaire survey revealed that the use of a software module for the systematisation and monitoring of physical fitness levels is in demand among students and constitutes an important factor in increasing motivation for physical education classes.

Results and conclusions. The software module for the systematisation and monitoring of physical fitness levels among university students promotes the development of students' physical qualities and enhances the quality of education.

Keywords: *students, software module, systematization, monitoring, fitness.*

Introduction. In accordance with the curricula of most universities, the "Physical Education" discipline concludes with an interim assessment in the form of a credit. The credit grade is differentiated in nature and structurally comprises marks for criteria such as attendance points, theoretical knowledge assessment, and practical fitness assessment. The theoretical knowledge assessment is typically derived from the results of test assignments. Depending on the credit programme, the availability of teaching facilities and university requirements, test assignments may be completed in the classroom or at home via a distance learning system. Experience shows that solving physical education tests does not present major difficulties for students, and they earn fairly high scores on them. With classes planned once a week during the semester, the number of practical sessions in the discipline amounts to no more than twenty. Earning attendance points also does not pose a significant challenge for students, even considering their workload and absences for various reasons, including illness. The difficulty for 40% of students, particularly first-year students, lies in earning points for physical exercises included in the credit assessment. As a rule, the physical exercises included in the credit characterise the degree of development of physical qualities such as strength, speed and endurance. Given that most students have never participated in sport, or did so in primary school, that is, a long time ago, earning high scores in exercises targeting different physical qualities is quite challenging for them. While the development of physical qualities is one of the objectives of physical education departments, in practice, with an average class attendance rate of 35–40% (particularly in the third year of study), it is difficult to speak of developing physical qualities during practical classes. University students have different height and weight parameters, different body mass indices, yet the scores for credit exercises have the same averaged values for everyone. Discipline work programmes for physical education, regardless of specialisation or training programme, include several sections covering exercises from various sports. Regular training in exercises included in the credit assessment during teach-

ing sessions is not feasible, given the need to perform exercises from different programme sections. Federal state educational standards for virtually all specialisations and bachelor's degree programmes state that one of the competencies of a university graduate is the ability to organise independent physical training.

Objective of the study is to develop, on the basis of a literature review, questionnaire survey and study of best practices from leading universities, methodological recommendations for students on the development of physical qualities during independent physical training.

Research object: students at higher education institutions.

Research subject: e-learning systems at higher education institutions.

Methods and structure of the study. The research was conducted in two stages.

The first stage involved determining students' need for methodological recommendations on the development of physical qualities during independent physical training, and identifying the format of recommendations most convenient for student use.

The second stage involved developing methodological recommendations for students in the format determined during the first stage.

Before proceeding with the development of methodological recommendations, it was necessary to establish whether students would actually use them. To answer this question, a questionnaire survey was conducted with the participation of more than 100 second- and third-year students. The survey results are presented in Figure 1.

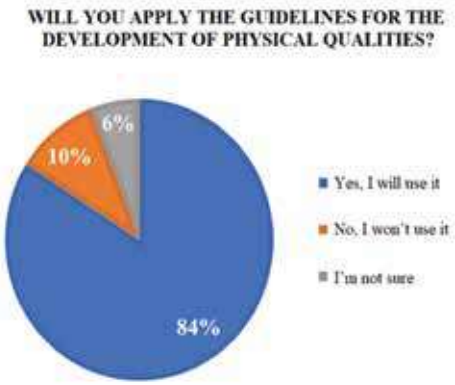

Figure 1. Student assessment of the need for methodological recommendations on developing physical qualities

The survey results show that the overwhelming majority of students (84%) feel the need for methodological recommendations on the development of physical qualities during independent physical education classes.

To determine the format of methodological recommendations, students were asked: "Which format of recommendations is most convenient for use in the educational process: electronic or printed?" The survey results, presented in Figure 2, clearly demonstrate that the most preferred option for students regarding methodological recommendations for the development of physical qualities would be an electronic software product.

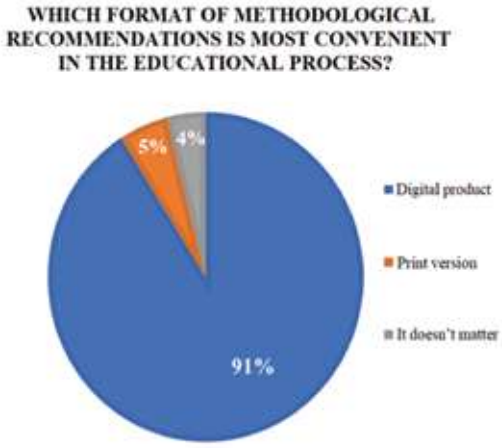

Figure 2. Students' preferred format for methodological recommendations on developing physical qualities

Analysis of the survey results reveals: the most challenging credit assessment criterion for the majority of students is the evaluation of their practical fitness level through exercises characterising the development of physical qualities; students are interested in obtaining credit on time to avoid academic debts and spending time clearing them in subsequent semesters; in the absence of necessary knowledge about methods for developing physical qualities, students feel the need for methodological recommendations on their development during independent training; students, as representatives of modern youth, prefer electronic educational systems [1]; the application of innovative technologies stimulates interest in the learning process and encourages students to engage in creative and cognitive activity [2].

Currently, educational practice is placing increased emphasis on the use of innovative information technologies, alongside traditional teaching tools, to en-

Figure 3. Entry of personal data

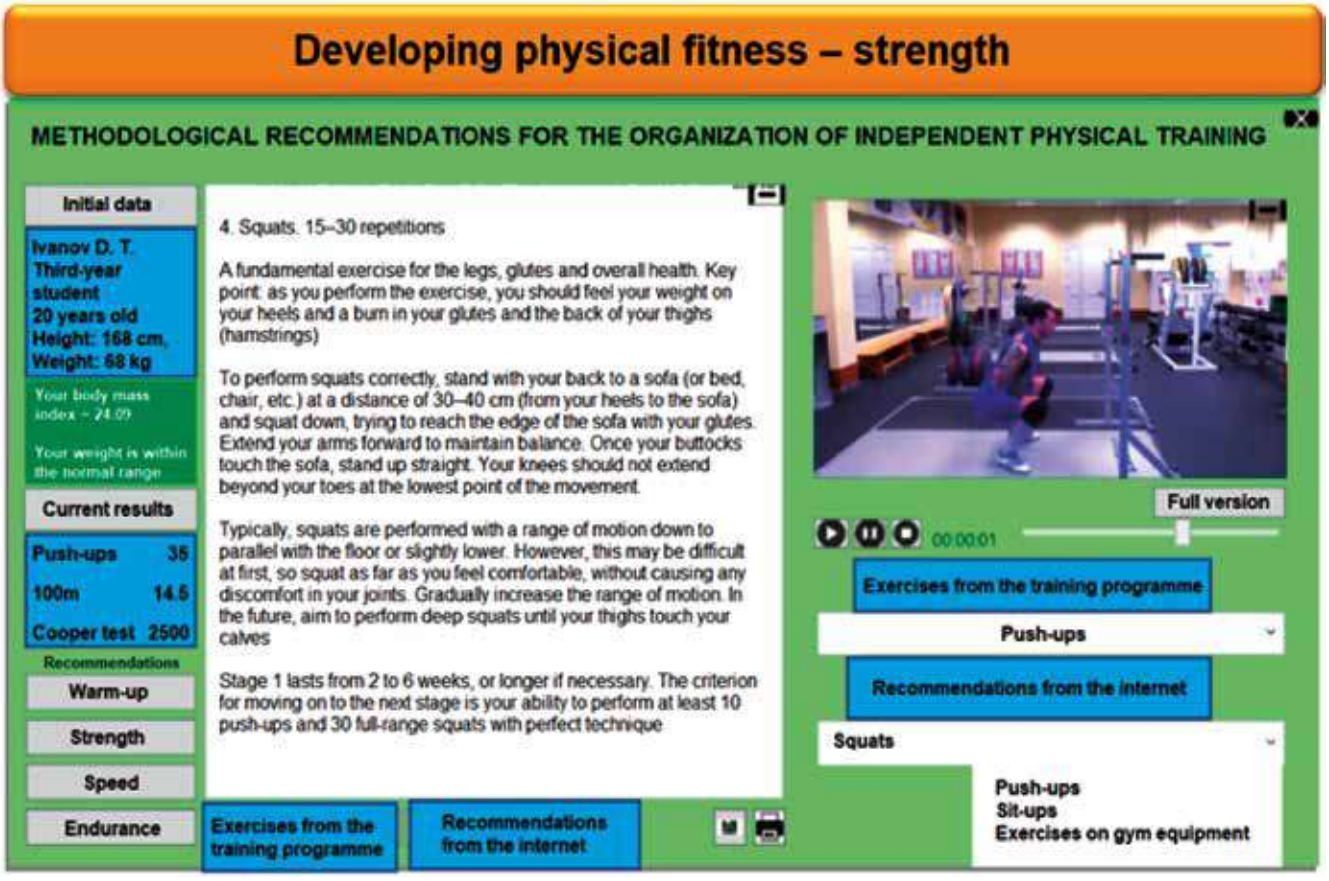

Figure 4. Programme recommendations for developing the physical quality of "strength"

gage and motivate students [3]. Information retrieval systems provide participants in the educational process with accessible learning materials and enable effective self-study. Training programmes and systems are becoming a means of managing the educational-cognitive process, adapted to the needs and capabilities of learners and ensuring the development of their personal qualities.

Results of the study and discussion. The research results contributed to the decision to develop an electronic software product – a module for the systematisation and monitoring of the physical fitness level of students. Structurally, this module contains methodological recommendations for developing physical qualities based on the user's current assessment. The module's operating principle consists of executing pre-set sequences of arithmetic, logical and other operations that determine the user's initial level of physical quality development and provide recommendations for improving their indicators.

1. Entry of personal data: surname, first name, patronymic, age (Figure 3).

2. Entry of height and weight parameters (Figure 3). The programme automatically calculates the body mass index, after which the start page displays the numerical BMI value and weight category: overweight, underweight, normal. For example: BMI – 21.34, weight normal.

3. Entry of initial results for strength, speed, endurance and flexibility exercises that the student demonstrates at the time of use.

The programme analyses the exercise results and provides an assessment based on the requirements of the assessment criteria. The programme indicates which qualities are more or less developed and which require particular attention during independent physical training. For example: the physical quality of "strength" is underdeveloped; the recommendation is to focus on developing this quality during independent physical training. The programme offers text files with exercise technique descriptions for "strength"; videos of these exercises from the curriculum; and videos of various strength exercises from the internet (Figure 4). The programme provides similar information for each physical quality scored below four points.

6. Regardless of the exercise results entered, after determining the body mass index, the programme provides recommendations for physical exercises that promote weight gain or loss (depending on the user's index).

7. The programme provides recommendations for performing general developmental exercises on the spot (warm-up).

The software module should be hosted on the physical education department's website, within the university's distance learning system, and accessible to 100% of students enrolled at the university. The module enables monitoring of students' personal physical fitness levels and systematisation of their results data.

Conclusion. Electronic educational systems promote the advancement of proactive learning, focused on the "tomorrow" of scientific development and professional practice of university graduates. The educational process at university under modern conditions should not be of a passive, contemplative nature, but rather should take into account the prospects of scientific and technological progress and trends in the informatisation of society and education. The software module for the systematisation and monitoring of physical fitness levels among university students should contribute to the development of students' physical qualities, the formation of skills for organising independent physical training, and the improvement of interim and final assessment results.

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A pedagogical framework for engaging middle-aged university faculty in systematic physical culture and health-enhancing activities

UDC 796.01

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Abstract

Objective of the study is to theoretically substantiate and develop an experimental pedagogical framework for engaging middle-aged university faculty (50–59 years) in systematic physical culture and health-enhancing activities and to recommend it for practical implementation.

Methods and structure of the study. At the preliminary stage, a theoretical analysis of scientific-methodological literature was conducted, along with a sociological survey of university faculty regarding their physical culture and health-enhancing activities. The material and technical provision for physical culture among faculty members was assessed, together with the organisational forms and directions of physical culture activities in higher education. The factual material obtained enabled the systematisation and identification of the overall picture of physical culture organisation among university faculty, and the development of the content and structure of an experimental pedagogical framework for motivating educators, including those aged 50–59, to engage in systematic physical culture and sport.

Results and conclusions. The comprehensive scientific-theoretical analysis revealed the percentage of the population systematically engaged in physical culture and sport; popular types of physical activity among the population; primary preferences regarding exercise venues; the age distribution of participants in mass physical culture and sporting events; and other relevant factors. Additionally, the structure and content of the experimental pedagogical framework for engaging middle-aged university faculty in systematic physical culture and health-enhancing activities were developed.

Keywords: *pedagogical framework, organisation, middle-aged university faculty, physical culture and health-enhancing activities.*

Introduction. An analysis of the state of physical culture and sport development in the Russian Federation, presented in the Strategy for the Development of Physical Culture and Sport until 2030, indicates that the proportion of citizens systematically engaged in physical culture and sport currently amounts to less than 43% of the total population. At the same time, the state has set the objective of attracting up to 80% of the population to systematic physical culture and sport by 2030.

Of particular significance in this context is the engagement of middle-aged university faculty (50–59 years) in systematic physical culture and sport. This group constitutes the core scientific and creative potential for the progressive development of educational activities in higher education at the required professional level. However, this age category of faculty is insufficiently active in university physical culture and sporting activities, with their participation amounting to only 3–5%. To attract university faculty aged 50–59 to physical culture and sport, it is necessary to develop a pedagogical system of motivational measures aimed at activating educators towards a physically active and health-oriented lifestyle, which constituted the objective of this work.

Objective of the study is to theoretically substantiate and develop an experimental pedagogical framework for engaging middle-aged university faculty (50–59 years) in systematic physical culture and

health-enhancing activities and to recommend it for practical implementation.

Methods and structure of the study. At the preliminary stage, a theoretical analysis of scientific-methodological literature was conducted, along with a sociological survey of university faculty regarding their physical culture and health-enhancing activities. The material and technical provision for physical culture among faculty members was assessed, together with the organisational forms and directions of physical culture activities in higher education. The factual material obtained enabled the systematisation and identification of the overall picture of physical culture organisation among university faculty, and the development of the content and structure of an experimental pedagogical framework for motivating educators, including those aged 50–59, to engage in systematic physical culture and sport.

Results of the study and discussion. The pedagogical framework for engaging middle-aged university faculty in systematic physical culture and sport is a comprehensive physical culture and health-enhancing process, incorporating a set of organisational forms, tools, and methods that stimulate middle-aged faculty to actively engage in physical culture and sport.

An analysis of the state and content of physical activity among the country's population, based on systematic reports, revealed: 19% of respondents en-

Table 1. Content of the pedagogical framework for engaging university faculty in systematic physical culture and health-enhancing activities

No.	Organisational forms	Objective	Methods	Resources	Results
1.	The university's trade union	Organisation of mass sports and physical fitness and health-promoting activities for teaching staff	Verbal, visual, competitive, comparative, etc.	Logistical and technical, physical exercises, etc.	Encouraging university lecturers to take an active part in various mass physical culture and sporting events
2.	The university's sports club	Systematic organisation within the university of sports clubs, general physical training groups and various sporting events for staff and teaching staff	General pedagogical methods: verbal, visual; practical teaching methods: circular, interval, holistic, competitive, etc.	Logistical and technical, physical exercises, etc.	Increasing the number of lecturers teaching physical culture and sport, and creating a supportive physical culture and sporting environment at the university for staff
3.	Ranking competition: 'Lecturer – Healthy Lifestyle'	Supporting and promoting teaching staff who champion healthy lifestyles	Verbal, visual, comparative, demonstrative, etc.	Logistical and technical, electronic, etc.	Increasing the number of lecturers promoting a healthy lifestyle
4.	Interest groups: 'Healthy Lifestyle', 'General Physical Training', 'Nordic Walking and Running', 'Hiking', 'Weekend Activities', etc.	Introducing staff and lecturers to a variety of physical fitness and health activities	General pedagogical, practical, etc.	Logistical and technical, physical exercises, etc.	Encouraging lecturers to take part in active and varied physical culture and sporting activities
5.	Healthy Lifestyle Sports Day for university staff and lecturers	Identifying the best academic departments in organising physical fitness and sporting activities amongst staff	General pedagogical, practical, etc.	Logistical and technical, physical exercises, etc.	Promoting physical culture and sporting activities within the university
6.	'Ready, Set, Go – GTO'	Encouraging lecturers to systematically undertake the 'GTO' fitness tests	General pedagogical, practical, etc.	Logistical and technical, applied physical exercises, etc.	Increasing the number of lecturers holding 'GTO' badges
7.	'Hall of Fame' for the university's best Healthy Lifestyle lecturers	Highlighting the importance and significance of a healthy lifestyle amongst university lecturers	General pedagogical, practical, visual, etc.	Material and technical, etc.	Increasing the number of lecturers promoting healthy lifestyles

gage in physical culture 4–5 hours per week; 6% engage 5–8 hours per week; and 4% more than 8 hours per week.

Popular types of physical activity among the population include: walking (38%), swimming (30%), fitness (24%), yoga (17%), cycling (16%), running (12%), and team sports (10%).

Primary venue preferences: fitness clubs and sports complexes (50%), outdoor activities (40%), and home-based exercise (10%).

Age distribution of mass sporting event participants: children and youth aged 10–35 (70%), adult population aged 36–54 (20%), and older generation aged 55–79 (10%).

The experimental pedagogical framework includes the following core organisational forms: the trade union organisation, sports club, 'Faculty Member – Healthy Lifestyle' competition, physical culture and health clubs (covering general fitness, cross-country skiing and running, tourism, "Weekend" activities, etc.), a university sports festival among faculty, the "Everyone to the Start – GTO" initiative, and the "Honour Board" of the most active healthy lifestyle proponents.

Conclusion. The analytical work demonstrated that less than 43% of the country's population actively participates in physical culture and sporting events (with a target of 80% by 2030); only 19% of respondents engage in physical culture 4–5 hours per week; the most popular types of physical activity include walking (38%), swimming (30%), and fitness (24%); in the overall composition of sporting event participants, 70% are children and youth, 20% are middle-aged adults, and 10% are the older generation. A low participation rate in physical culture activities is also observed among middle-aged university faculty (50–59 years), at only 3–5%.

The developed pedagogical framework for engaging university faculty, including middle-aged faculty, in systematic physical culture and sport will contribute to increasing the motor activity of educators within the university environment.

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Pedagogical potential of mini-handball in optimising the psychophysiological state of primary school pupils during physical culture lessons

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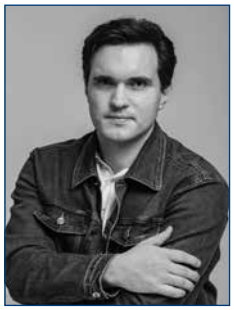

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Abstract

Objective of the study is to assess the pedagogical effectiveness of incorporating mini-handball elements into physical culture lessons for optimising the psychophysiological state of primary school pupils.

Methods and structure of the study. The study involved pupils aged 8–11, divided into two groups: an experimental group (following a programme enriched with mini-handball elements) and a control group (following the standard curriculum). Diagnostic tools included pedagogical testing of physical qualities (speed, coordination, strength, endurance, flexibility). Data processing was performed using the non-parametric Rosenbaum Q-test and the parametric Student's t-test for independent samples.

Results and conclusions. Statistical analysis revealed significant positive changes in the experimental group compared with the control group across several key indicators: speed, coordination, and strength abilities. By the end of the pedagogical experiment, the experimental group demonstrated statistically significant improvement in six of eight assessed parameters ($p<0.05$). The results indicate a high pedagogical effectiveness of mini-handball as a game-based technology in physical culture lessons. Its inclusion in the educational process promotes not only the development of physical qualities but also the optimisation of the functional state of primary school pupils' bodies, which is an important condition for enhancing their cognitive activity and academic performance.

Keywords: *pedagogical technologies, physical culture, psychophysiological state, mini-handball, academic performance, Student's t-test, Rosenbaum's Q-test.*

Introduction. Modern educational standards, in particular the Federal State Educational Standards (FSES), emphasise the need to foster not only subject-specific but also cross-curricular outcomes, the key one being the promotion of pupils' health. In this regard, educational science is seeking effective educational technologies capable of harmoniously developing a child's personality, optimising their psychophysiological state as the foundation for cognitive activity and academic performance. Within the framework of health-promoting pedagogy, physical culture ceases to be a secondary subject, becoming a powerful tool for achieving personal and meta-subject educational outcomes.

An analysis of contemporary pedagogical research [1-2] allows us to identify key factors that negatively affect pupils' well-being and require pedagogical intervention: physical inactivity, academic overload, and a stressful educational environment.

Another significant issue is the optimisation of schoolchildren's psychophysiological state. In this regard, the book by Smirnov N.K. (2006) is noteworthy; it is devoted to health-preserving technologies which, according to the author, must be applied in schools, as they imply 'the priority of psychological and pedagogical approaches and methods for protecting and strengthening pupils' health over medical ones' [3], as well as the work by O.B. Vedernikova, A.S. Usha-

kov, E.Yu. Prokopchik [et al.], aimed at developing and justifying a methodology to enhance the role of physical culture in the formation of a healthy lifestyle within educational institutions [4]. Of particular interest in this regard is the article by A.N. Gerasevich, Parkhots E.G., Nozhka I.A. [et al.], which analyses the dynamics of improvements in physical development indicators among schoolchildren aged 7–17 [5], as well as the work of Kiryanova L.A., Korobov I.A., Ivanova A.A., and Savchenko Yu.A., aimed at studying the influence of physical culture and sports on the process of forming a well-rounded personality and a healthy lifestyle, in which the authors emphasise that 'physical activity contributes to the development of psychological qualities, including conscientiousness, discipline, self-confidence and the ability to manage one's emotions' [6].

Objective of the study is to assess the pedagogical effectiveness of incorporating mini-handball elements into physical culture lessons for optimising the psychophysiological state of primary school pupils.

Methods and structure of the study. Team sports, including handball and mini-handball (a child-adapted version of handball), possess significant educational and developmental potential. They promote the development not only of physical qualities (agility, speed, coordination) but also of universal learning actions: communicative (team interaction), regulatory (rule-following, self-control), and personal (willpower, perseverance).

To test the hypothesis regarding the positive influence of mini-handball on pupils' psychophysiological state, a pedagogical experiment was conducted at a youth sports school. The study involved 50 pupils aged 8–11, divided into control (CG, n=25) and experimental (EG, n=25) groups. The CG followed the standard physical culture curriculum. In the EG, 30% of lesson time was replaced with a specially designed set of game exercises and educational mini-handball games.

The diagnostic toolkit was aimed at comprehensively assessing the effectiveness of pedagogical intervention and included testing of basic physical qualities: 30 m sprint (speed), 3 10 m shuttle run (agility/coordination), standing long jump (speed-strength qualities), forward bend (flexibility), small ball throwing at a target (coordination), sit-ups and push-ups (strength endurance).

The testing was carried out on three occasions: before the start of the experiment, halfway through, and after its completion. Data analysis was carried out using methods of mathematical statistics: Rosenbaum's Q-test (to identify trends in differences) and Student's t-test for independent samples (to establish the significance of differences at a significance level of $p < 0.05$).

Results of the study and discussion. The Rosenbaum Q-test showed that before and midway through the study period, there was no statistically significant difference between the groups. After the study period, five of eight exercises showed statistically significant differences, with the experimental group demonstrating significantly higher results (Table 1).

Table 1. Rosenbaum Q-test values

Parameter	Q before training	Q midway	Q after training
30 m sprint	1	5	8*
1000 m run	-	2	4
3x10 m shuttle run	-	4	10*
Sit-ups	-	2	4
Forward bend	4	3	9*
Push-ups	2	4	8*
Small ball throwing	2	4	9*
Standing long jump	2	3	5

*Note: * – significant differences at p<0.05 between control and experimental groups.*

Given that the critical value for the Rosenbaum criterion, for sample sizes of 25 and 25 and a significance level of 0.05 (a probability of error of 5% or less), is 7, it is possible to conclude whether or not the experimental group's indicators exceed those of the control group for the variables under investigation.

The Rosenbaum criterion shows that, prior to and in the middle of the study period, there was not yet a statistically significant difference between the indicators in the study groups. After the study period, a statistically significant difference in the indicators was observed in the study groups for five out of eight exercises (in the experimental group, the indicators were statistically significantly higher than in the control group).

Student's t-test for independent samples [8] As Student's t-test is applied to samples with a normal distribution, a Harkey-Beer test was conducted to assess the normality of the distribution in the populations under study. The results of the test indicate that all populations follow a normal distribution.

Given that the critical value according to the Student's t-test for samples of 25 and 25 individuals and a significance level of 0.05 (probability of error less than or equal to 5%) is 2.011, it is possible to con-

clude whether or not the indicators in the experimental group exceed those in the control group for the indicators under investigation (Table 2).

Table 2. Student's t-test values

Parameter	t before training	t midway	t after training
30 m sprint	0.512	1.495	2.261*
1000 m run	0.212	0.879	1.481
3x10 m shuttle run	0.287	2.267*	3.308*
Sit-ups	0.146	1.773	3.183*
Forward bend	1.329	2.707*	3.071*
Push-ups	1.280	1.853	2.269*
Small ball throwing	1.380	2.118*	2.927*
Standing long jump	1.082	1.695	1.950

Note: * – significant differences at $p<0.05$ between control and experimental groups.

The Student's t-test indicates that, prior to the study period, there was no statistically significant difference between the indicators in the study groups. By the middle of the study, a statistically significant difference was already observed in the study groups for three out of eight indicators. After the study period, a statistically significant difference in indicators was observed in the study groups for six out of eight exercises (in the experimental group, the indicators were statistically significantly higher than in the control group).

The experiment demonstrated an improvement in the psychophysiological condition of the group of pupils playing handball (mini-handball) compared to the group of pupils following the standard school curriculum; consequently, it not only contributes to their academic success but also influences their psychological development. This result makes it possible to recommend handball (mini-handball) to pupils aged 8–11 during physical culture lessons and as a voluntary hobby.

Conclusions. The study conducted allows us to draw the following conclusions, which are significant for the theory and practice of modern education:

1. The incorporation of mini-handball elements into physical culture lessons for primary school pupils is an effective teaching method that embodies the principles of health promotion, a person-centred approach and an activity-based approach.

2. This game-based approach provides a comprehensive effect: it contributes to a significant improvement in physical fitness indicators (speed, coordination, strength) and optimises the body's functional state, thereby creating a favourable psychophysiological basis for learning activities.

3. The empirical data obtained confirm the research hypothesis and allow us to recommend mini-handball as an effective means of physical culture for widespread use in primary schools. This is in line with the objectives of the Federal State Educational Standards (FSES) regarding the development of a culture of health and the creation of conditions for pupils to achieve an optimal level of development, taking into account age-specific characteristics.

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Constraining factors in the development of veterans' track and field athletics movement in Russia and pathways to their elimination

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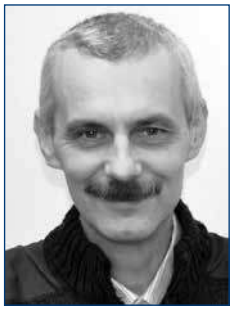

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Abstract

Objective of the study is to identify and systematise the main constraining factors in the development of the veterans' track and field athletics movement in Russia and to outline pathways for their elimination.

Methods and structure of the study. The work employed a range of methods: analysis and synthesis of scientific-methodological literature and official sources (records of international and national competitions, regulatory legal acts), analysis of statistical materials, and secondary analysis of sociological surveys of veteran athletes (n>100) conducted in 2020–2022.

Results and conclusions. Despite record figures for Russia in certain events (over 700 participants in Saint Petersburg in 2025), the overall scale of the movement remains at the level of stagnation. The necessity of removing the identified barriers is substantiated in order to realise the achievement-oriented and socio-communicative potential of veteran athletes as an important factor in active longevity and social stability.

Keywords: *veterans, sport, athletes, factors, barriers, motivation, development.*

Introduction. In accordance with the national development goals of the Russian Federation for the period up to 2030, set out by Presidential Decree, one of the key objectives is the preservation of the population, health and well-being of citizens. Achieving this objective is directly linked to engaging citizens in systematic physical education and sport, particularly in the middle and older age categories, for whom regular physical activity is a critically important factor in extending active life [2, 5]. Organised competitive activity within veterans' sport (masters categories) is recognised as one of the most powerful stimuli for such engagement [1, 6].

The global veterans' movement, which has existed for over 45 years, demonstrates a steadily positive trend. World Masters Athletics Championships consistently attract between 5,000 and 8,000 participants (Gothenburg 2024 – 8,028 participants from 110 countries). In Russia, however, despite sustained interest and record national figures for individual events (over 700 participants at national competitions in Saint Petersburg in 2025), the overall number of regular competition participants remains stagnant. This indicates the presence of systemic problems constraining the movement's development and requiring detailed analysis [1, 2].

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Methods and structure of the study. The work employed a range of methods: analysis and synthesis of scientific-methodological literature and official sources (records of international and national competitions, regulatory legal acts), analysis of statistical materials, and secondary analysis of sociological surveys of veteran athletes (n>100) conducted in 2020–2022 [1, 2, 5].

Results of the study and discussion. Analysis of quantitative indicators and comparative analysis of international statistics and Russian competitions revealed a sustained and enormous gap. World championships consistently increase their participant numbers. In Russia, by contrast, long-term stagnation is observed: national track and field athletics events have not exceeded 400–500 participants for many years [1, 2]. Even the record figure in recent history of 700 participants at one of the national competitions in Saint Petersburg (2025) merely underscores the existence of enormous unrealised potential and is incommensurable with the scale of world forums [5].

Constraining factors of development. Based on the analysis of previously conducted research, several key groups of problems can be identified that act as constraining factors:

1. Regulatory vacuum. Current sports legislation lacks clear definitions of the concepts of "veterans' sport" and "veteran athlete". This creates insurmountable difficulties in including competitions in the official calendar, allocating budgetary funding for the preparation and participation of athletes, and addressing issues of their medical and social provision [1, 5]. Veteran athletes who achieve results at the level of elite sport in their age groups are effectively excluded from the state support system, which contradicts the declared principles of equality and accessibility of sport for all ages.

2. Infrastructure and methodological limitations. Most modern sports facilities are oriented towards training sports reserves and elite athletes. Veterans are often forced to train at inconvenient times, at unsuitable venues, or to rent expensive facilities at their own expense. There is a lack of scientifically grounded and adapted training methodologies that account for age-related involutionary processes and individual characteristics [1, 5]. As a consequence, a high level of injury is observed (reported by 73.7% of respondents) [2], which leads to disillusionment and cessation of training.

3. External restrictions (sanctions). The exclusion of Russian athletes from international competitions, even in the absence of any anti-doping violations by veterans, deprives them of their main "achievement-oriented" stimulus. According to surveys, the desire to demonstrate a high result for one's age is a priority for 58.8% of athletes [2]. The lack of opportunity to compare one's level with the world standard and to participate in prestigious international forums, where sport is organically combined with social and cultural interaction [6], significantly reduces the attractiveness of training and inhibits the growth of athletic performance.

Previously conducted research [2, 3] enables a socio-psychological portrait of the Russian veteran track and field athlete to be compiled. These are individuals who in their youth held high sporting qualifications (70% held rankings up to Master of Sport and above), took a lengthy break from their careers (for 50%, more than 15 years), and return to training due to dissatisfaction with the outcomes of past performances and a desire to extend active life. Their key motives are achieving results, socialising with like-minded individuals and maintaining health.

Of particular note is the dominance of the achievement-oriented component: for 58.8% of those surveyed, the opportunity to demonstrate a high sporting result for their age is the main stimulus for resuming and continuing training [2]. It is precisely the competitive goal that transforms physical activity from a routine obligation into an emotionally rich, purposeful process requiring discipline, self-organisation and long-term planning. The presence of a specific sporting objective (participation in championships, achievement of a standard, attainment of a record result) forms a sustainable habit of regular training, making it an integral part of one's lifestyle. The aspiration for self-improvement and testing one's abilities in competitive struggle serves as the internal driving force that sustains motivation over many years, even in the absence of external rewards [4, 6].

This portrait indicates that the target audience already possesses high intrinsic motivation. The removal of external constraining factors (legal, infrastructural) is capable of releasing this enormous potential. Creating conditions analogous to international ones, where, as Hodge and co-authors note [6], masters sport is simultaneously both a competitive and a social environment, would enable Russian veterans not only to realise their achievement-oriented ambitions but also to adapt successfully in the post-career period of life [4, 7], finding in sport a new source of meaning and purpose.

Conclusions. The analysis conducted has enabled the systematisation of the main constraining factors in the development of the veterans' track and field athletics movement in Russia: regulatory vacuum, in-

frastructure-methodological limitations, and foreign-policy barriers. To address these, a comprehensive approach is required, including:

1. Amending the fundamental sports law to enshrine the status of “veterans’ sport” and “veteran athlete”, which will enable the integration of this category into the unified system of financing, preparation and medical-biological support.

2. Establishing accessible groups and sections for individuals over 35 on the basis of existing sports facilities, as well as developing and implementing scientifically grounded training methodologies that take into account age-related characteristics.

3. Intensifying internal competitive formats capable of compensating for the temporary absence of international competitions, with maximum utilisation of the social component (team competitions, cultural programmes) to satisfy the need for communication and belonging.

Implementing these measures will not only neutralise constraining factors and increase quantitative engagement indicators, but also qualitatively change attitudes towards ageing, transforming it into a period of active, purposeful and socially rich life, which fully aligns with the national development goals of the country.

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A model of physical readaptation of combat veterans and members of their families

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Abstract

Objective of the study is the theoretical substantiation of a model of physical readaptation of combat veterans (CV) and members of their families.

Methods and structure of the study. In the scientific work carried out at the Plekhanov Russian University of Economics, an analysis, synthesis and generalisation of the literature were conducted; modelling and a scientific and methodological substantiation of the physical readaptation of CV and members of their families were carried out; and conclusions were formulated.

Results and conclusions. The physical readaptation of CV and members of their families is a biopsychosocial process using the means of adaptive physical culture (APC), comprising restorative, socio-psychological and family-centred components. The model of physical readaptation has been developed on the basis of biopsychosocial, systemic, activity-based and family-centred approaches. Strategies of readaptation for the target groups of veterans and members of their families have been identified. The structure of the model includes the following levels: individual physical readaptation, family physical readaptation and the institutional organisation of physical readaptation. The effectiveness of the model is evaluated by the following criteria: physical, psychological and social. The model of physical readaptation of CV and members of their families makes it possible to develop 'biopsychosocial' programmes using the means of APC and sport in order to form a family sporting lifestyle and to ensure the successful resocialisation of the target groups into peaceful society.

Keywords: *combat veterans and members of their families, physical readaptation, model, adaptive physical culture, adaptive sport.*

Introduction. The restoration of the social status of combat veterans (CV) in peacetime conditions is a state priority, the relevance of which is increasing as the number of participants in military conflicts grows [3]. The need for the comprehensive readaptation of this target group is dictated by the consequences of military operations (a crisis of psychophysical health, the disruption of CV's social ties, including those with members of their families).

In the presence of an effective system of in-patient rehabilitation, there is a lack of methodologically substantiated models of long-term physical readaptation, integrating the methods of APC into the rehabilitative socio-psychological and professional programmes for the recovery of combat veterans and members of their families [4].

Objective of the study is the development and theoretical substantiation of a model of physical readaptation of combat veterans and members of their families.

Methods and structure of the study. In the scientific work carried out at the Plekhanov Russian University of Economics, the following were undertaken: an analysis and generalisation of the literature; modelling and a scientific and methodological substantiation of a model of physical rehabilitation of CV and members of their families; and the formulation of conclusions.

Results of the study and discussion. From the standpoint of V.A. Gordashnikov, the transformation of

Table 1. Differentiation of CV target groups

CV group	Leading strategy	Physical readaptation
With post-traumatic growth (PTG) 15-20%	Development of constructive psychological constructs	Consolidation of changes through sporting self-realisation
CV with readaptation crisis 67%	Relief of tension, activation of resources	Catalyst for transition to PTG (APC and sports activities)
CV with PTSD 15-20%	Comprehensive clinical assistance with inclusion in readaptation programmes	Therapeutic exercise, soft fitness, body-oriented practices (yoga, wushu, stretching, qigong)

Table 2. Strategies of physical readaptation of CV family members

Group	Leading strategy	Recommendations for physical readaptation
In a state of resourcefulness	May act as agents of readaptation	Consultation with a specialist to determine the means of APC and sport with the help of which the family member can themselves initiate family physical activity (individual classes for learning APC complexes and elements of sport, family APC classes, family sports celebrations and competitions)
Secondary traumatisation	Psychological support is needed	Individual and group APC classes (kinesiotherapy, 'soft' fitness, health-improving systems of physical exercise); gradual inclusion in physical-culture and sports competitions (draughts, billiards, board games) with a transition to team sports under simplified rules
Emotional alienation	Need restoration of communication	Individual APC classes using kinesiological practices, with a gradual transition to group and family APC classes, participation in family sporting events in various roles (spectator, judge, participant)

the personality of CV is defined through readaptation (the restructuring of psychological constructs upon a change from peaceful to military conditions) and re-readaptation (the return from military to peaceful conditions of life) [1].

Among the main directions of comprehensive rehabilitation of persons with disabilities, including CV, are physical rehabilitation through the use of the means of APC and adaptive sport [5].

The physical readaptation of CV and their families

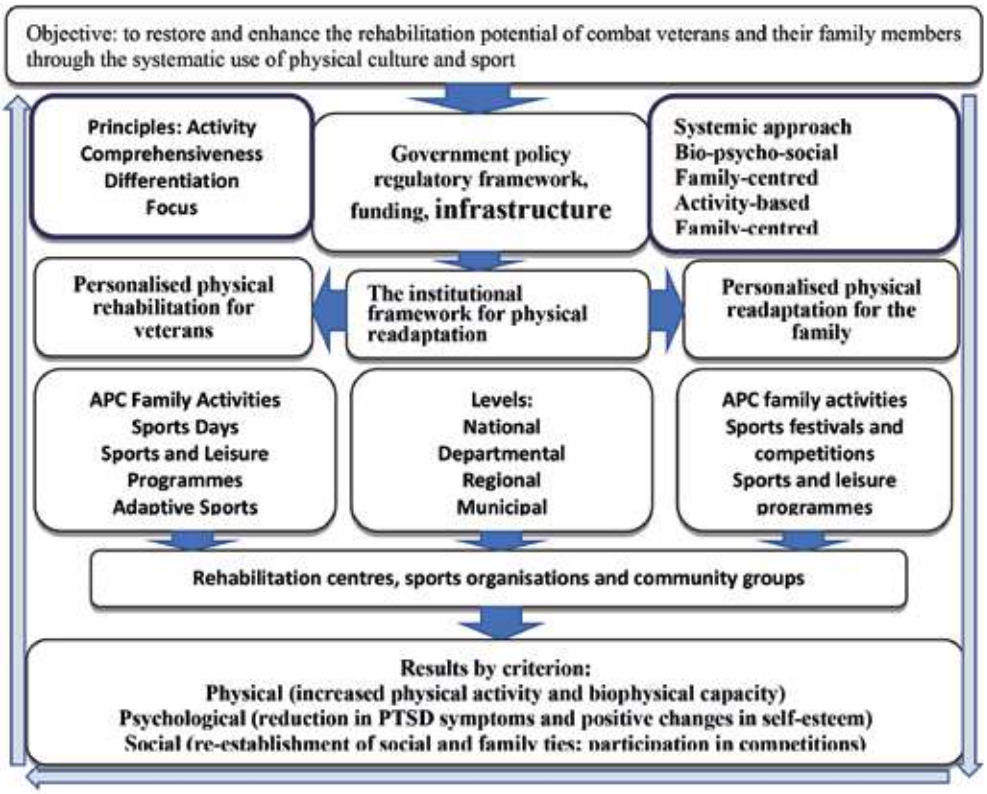

Figure. Model of physical readaptation of CV and members of their families

is a biopsychosocial process making use of the means and methods of APC and sport, including restorative (the restoration of somatic and mental health), socio-psychological (socialisation in peaceful society) and family-centred (the improvement of family relationships) components.

The successful resocialisation of the target group in civilian life is possible through the implementation of an integrated system of socio-psychological and professional readaptation, in which the physical component (physical readaptation) acts as a system-forming component of resocialisation.

On the basis of an analysis of the literature, a conceptual model of the physical readaptation of CV and members of their families has been developed, reflecting the logic of the transformation of the readaptation process at various levels of interaction, both for the veteran and their family and for the structures and departments operating within the system of rehabilitation of the target groups (see Figure 1).

The methodological basis of the model rests on the following approaches:

- the biopsychosocial approach allows physical readaptation to be considered from the standpoint of an alliance of psychophysiological and social processes occurring in the target groups, including in each measure of the other directions of comprehensive rehabilitation;

- the systemic approach systematises the conception of the veteran and members of their family as interconnected elements of an open system, in which all readaptation actions must be considered in the unity of this system, taking into account the state of health of the participants of the system;

- the activity-based approach determines the active creative and transformative role of the subject in the process of readaptation, including the distribution of the determining role among members of the family system;

- the family-centred approach ensures that the family is regarded as a fully fledged subject and resource of intra-family readaptation and of the acquisition of a fully-fledged (new) family social status.

On the basis of the model of vector influence of combat experience (M. Matthews, A.G. Karayani) [2], target groups of veterans with corresponding strategies of readaptation by means of APC and sport have been identified (Table 1).

The fourth group in the system of readaptation comprises members of veterans' families (children, wives, husbands and parents), who, like CV, may also be in a variety of states of biopsychosocial health and require corresponding strategies of adaptation (Table 2).

The structure of the model includes three interrelated levels in accordance with the implementation of the readaptation process for CV and members of their families.

Table 3. Recommended means and methods of APC

Areas	Means and methods of APC and sport	Expected outcome
Physical recovery	Kinesiotherapy, therapeutic exercise, swimming, exercise machines	Increase in functional capacities, activation of reserve resources
Psychological discharge	Relaxation and breathing practices, cyclic sports	Reduction of anxiety, normalisation of psycho-emotional state
Transformation of combat experience	Martial arts, military-applied sports	Conversion of 'combat aggression' into sporting drive and the will to win
Social integration	Team sports, participation in competitions	Restoration of communicative skills, acquisition of social status

Table 4. Forms of family physical-culture and sporting activity

Forms of family activity	Content	Expected effect
Physical-culture classes	APC and sports classes, hiking trips	Emotional synchronisation, bodily interaction
Sporting celebrations	Competitions 'Dad, Mum, Me – a Sporting Family', relay races	Strengthening of family ties, common positive emotions
Leisure programmes	Attendance at sporting events, interest clubs	Formation of new family traditions
Psychological and pedagogical consultations	Consultations on interaction, instruction in support methods	Prevention of re-traumatisation

Level I: individual physical readaptation of CV and members of their families, which can be successfully replaced by group APC and sports classes in accordance with the biopsychosocial health of the participants of the process. The aim is to increase the adaptive potential of CV and members of their families through the regular application of the means of APC and sport (Table 3).

The tasks of this stage are: the restoration of the functional capacities of the body; the reduction of psycho-emotional tension; the transformation of 'combat reflexes' into constructive behavioural patterns; and the formation of a cognitive-behavioural basis for social integration.

Level II: family physical readaptation with the aim of harmonising family relationships and stabilising the microsocial environment through joint physical-culture and sporting activity (Table 4).

The tasks are: reducing manifestations of secondary traumatisation; overcoming communicative barriers; and the conduct of a family healthy lifestyle.

Level III: institutional organisation of physical readaptation of CV and members of their families, with a view to creating a sustainable readaptive environment on the basis of interdepartmental cooperation and state support. The tasks are: creating a network of centres of physical readaptation, including a system of all-Russia level competitions; training specialists in APC and sport to work with CV and their families; and providing information support.

The effectiveness of physical readaptation is evaluated by physical criteria (an increase in physical activity; an improvement in functional capacities and physical fitness); psychological criteria (a reduction in the level of anxiety, an increase in stress resilience, positive dynamics of self-esteem); and social criteria (the restoration of social and family ties; participation in competitive, public and labour activity).

Conclusions. The modelling of physical readaptation determines the development of family-centred programmes of comprehensive rehabilitation, in which physical readaptation by means of APC and sport acts as the basis for the psychophysiological recovery, socio-psychological resocialisation and family harmonisation of CV and members of their families.

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Leveraging the historical experience of the GTO fitness standards to promote contemporary physical education movement in an agricultural university

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Abstract

Objective of the study is to reconstruct the historical stages of the GTO fitness standards development at the Timiryazev Academy and, drawing on an analysis of contemporary students' motivation, to identify ways of utilizing historical experience for promoting the physical education movement in an agricultural university.

Methods and structure of the study. The methodological basis comprised a comparative-historical method, analysis of the university's programme documents, and analysis of sociological survey data. The study reconstructed three key stages in the development of the programme at the Timiryazev Academy: the military-mobilisation stage; the stage of labour mobilisation and mass physical education movement; and the contemporary recreation-incentive stage, characterised by voluntariness, health preservation, and a system of material incentives. The empirical component draws on an analysis of large-scale GTO fitness testing competitions held at the academy in September 2025, involving over 800 students and 120 faculty members, enabling a comparison between historical traditions and modern practices.

Results and conclusions. A sociological survey revealed a dominance of pragmatic participation motives: earning additional points and benefits (52.88% of respondents), aspiration to obtain the GTO badge as a status symbol (50.52%), and improving physical appearance (42.93%), whereas the influence of the older generation's example (12.3%) and that of instructors (18.32%) proved the least significant. A small but important group of students – bearers of 'historical memory' – was identified, who may serve as ambassadors of tradition within the student community. Practical recommendations provide a rationale for a model of GTO promotion in an agricultural university based not on a direct appeal to the past, but on an organic integration of the historical foundation into a contemporary system of pragmatic incentives and rewards, including the strengthening of bonus mechanisms. The findings may be applied in developing strategies for the advancement of physical education and sport in agricultural and specialised universities, as well as in the practical work of GTO testing centres.

Keywords: *GTO fitness standards, university, students, analysis, motivation.*

Introduction. The revival of the GTO ("Ready for Labour and Defence") fitness standards in 2014 presented universities with the challenge of finding effective mechanisms for motivating students. Drawing on the historical experience of the Timiryazev Academy – a flagship of agricultural education – enables the identification of enduring traditions and work methods relevant to the contemporary system of physical education.

Since 2015, the GTO programme has been the subject of numerous studies. The historical dimension of GTO has been examined by S. Ulyanova and colleagues [8] and in a publication by E.A. Istyagina-Yeliseyeva [2]. Regarding the current situation, a team of authors from Buryat State University argues that the deterioration of young people's physical fitness prompted the return to the GTO system. They surveyed students to determine their motivation, forms of engagement in sport and preparation methods for the fitness tests [1, p. 133]. A similar study was conducted at South Ural State Humanitarian-Pedagogical University [4, pp. 134–144].

D.D. Prokofyeva raised the question of socio-political determinants, proposing the hypothesis that the mere restoration of GTO standards is not a sufficient condition for developing a sustainable need for sport among young

people [7, p. 17]. The gender aspect has also attracted researchers' interest. A team representing Ryazan universities highlighted the readiness of female humanities students to meet GTO standards [3, pp. 193–197].

The present authors have also contributed to the study of this topic by conducting a comparative analysis of the role of physical education in the agricultural education system of the USSR and modern Russia [5, pp. 112–114]. However, no comprehensive study linking the historical experience of a specific agricultural university (the Timiryazev Academy) with an analysis of contemporary student motivation through the lens of that experience has been conducted to date, which defines the scientific novelty of this work.

Objective of the study is to reconstruct the historical stages of the GTO fitness standards development at the Timiryazev Academy and, drawing on an analysis of contemporary students' motivation, to identify ways of utilizing historical experience for promoting the physical education movement in an agricultural university.

Methods and structure of the study comprised a comparative-historical method, analysis of the university's programme documents, including the Programme for the Development of Physical Education and Sport for 2021–2030, and a sociological survey of 380 students, which enabled an assessment of the range of motives for participating in GTO fitness tests, taking into account the historical-patriotic component.

Results of the study and discussion. As is well known, the GTO fitness standards were established in the USSR in 1931, as a realisation of one of the Komsomol initiatives. Passing GTO tests gradually became an indispensable attribute of Soviet youth life. In the 1930s, Timiryazev Academy students even undertook "socialist commitments", including pledges to become GTO badge holders of levels I and II [6, p. 591]. Holding the level III badge was considered a matter of course. To earn these, one had to successfully pass a series of tests, such as running, long jump and high jump, grenade throwing, swimming, and so on. During the war years, the programme was supplemented with tree climbing, carrying ammunition boxes, and other applied disciplines. Consequently, this period in the history of GTO may be termed the "military-mobilisation" stage.

In the post-war period up to the dissolution of the USSR, the GTO system underwent evolution. It continued to prioritise raising the general and specialised physical fitness of military-age youth, but also devoted considerable attention to increasing labour productivity at enterprises, which could only be achieved with a healthy population. According to contemporary publications in the newspaper Timiryazevets, student badge holders performed better during harvest work. All of this allows this period to be characterised as the "stage of labour mobilisation and mass physical education movement".

The modern stage of GTO has added a third dimension – health preservation, with an emphasis on voluntariness, recreation and material/rating-based motivation of participants, which allows it to be classified as the "recreation-incentive" stage.

How GTO functions within the modern agricultural university system, where it is a priori assumed that a qualified agricultural worker is, above all, a healthy, physically developed individual, can be traced using the example of the Timiryazev Academy – the flagship of agricultural education in Russia.

In September 2025, the Timiryazev Academy organised large-scale GTO fitness testing competitions for the first time in many years, with over 800 students participating. The tests included: 100-metre sprint; 2,000 metres (women) or 3,000 metres (men); pull-ups on a horizontal bar (men) or inclined pull-ups from a hanging position (women); standing forward bends on a gymnastics bench; standing long jump; sit-ups from a supine position (for one minute); and shooting a pneumatic rifle at a 10-metre range using an electronic simulator. These tests were conducted on the university's sports grounds, with an emphasis on the mass participation of students from all institutes of the academy.

Notably, 120 faculty members also participated in the competition. It is worth mentioning that in the annual assessment of faculty performance, there is a corresponding criterion (clause 5.2 of the performance contract – prize placements by faculty in various cultural and mass events, including sporting ones). Obtaining the GTO badge for 2025 allowed them to fulfil this performance criterion, which served as an additional incentive.

In the course of this study, a sociological survey was conducted, resulting in a motivational profile of students participating in the GTO system. For the first time, the typical study of motives was combined with a historical-patriotic component (knowledge of university history as a motivational factor).

A total of more than 380 students took part in the sociological survey. Respondents were asked to anonymously select several answers to the question "Why do you take the GTO tests? What motivated you to participate?", which made it possible to assess not a single reason but a range of motives.

The leading motive for taking GTO tests was "Additional points or benefits" (52.88%). This indicates a high degree of pragmatism among contemporary stu-

dents. Participation in GTO is perceived not so much as a physical education initiative, but as a tool for achieving utilitarian goals (postgraduate admission, increased scholarship, employment benefits). For an agricultural university, this is an important signal: material and bonus incentives work more effectively than abstract appeals to a healthy lifestyle. The second most significant factor was "Desire to obtain the GTO badge" (50.52%). Despite their pragmatism, students have retained the perception of the GTO badge as a status symbol and personal achievement. "Improving figure and physical appearance" (42.93%) occupies a respectable third place. For an agricultural university, where much time is devoted to field practice and physical labour, this may seem unexpected, but it reflects the general youth culture trend towards meeting certain aesthetic standards. The least significant factors in the hierarchy of motives were "Influence of instructors" (18.32%) and "Desire to emulate the older generation" (12.3%).

These results demonstrate a utilitarian-status model of engagement in the physical education movement at an agricultural university. Historical experience is important as a foundation; however, to promote GTO today, it is necessary to leverage students' pragmatic motives (grades, appearance), only indirectly appealing to traditions, or repackaging the traditions themselves within the modern system of incentives and rewards. At the same time, in promoting GTO, one should rely on the small (12.3%) but active group of students motivated by the example of the older generation. This group is not only a bearer of historical memory but can also be regarded as ambassadors of tradition.

Conclusions. The study conducted enables a reconstruction of the main stages in the development of GTO fitness standards at the Timiryazev Academy and reveals that historical experience serves not as a direct motivator but as a foundation upon which the contemporary system of promotion through pragmatic incentives is built. The dominance of motives for earning points and benefits (52.88%) and improving physical appearance (42.93%) among students, coupled with the continuing significance of the GTO badge as a status symbol (50.52%), requires not a juxtaposition of tradition and pragmatism, but their organic integration, realised through concrete steps – branding bonuses (for example, "Timiryazev Scholarship for GTO Badge"), enhancing the ceremonial nature of badge presentations using historical narrative, and relying on the identified group of "bearers of historical memory" (12.3%) as ambassadors capable of transmitting traditions to the student community in an accessible way. Thus, effective promotion of GTO in an agricultural university should follow the principle of "historical meaning in a pragmatic wrapper", where material and rating-based incentives are infused with the symbolic capital of university history, which may contribute to transforming GTO testing into an element of student identity.

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Assessing the impact of foundational ballet training on dance technique acquisition among primary school children in China

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Abstract

Objective of the study is to assess the effectiveness of basic ballet training for primary school children of the People's Republic of China in the process of teaching them dance technique.

Methods and structure of the study. The study was conducted during the 2024/2025 academic year in primary classes of general education schools in China. As a result of the experiment, experts (n=2), holding the highest coaching qualification in ballroom dancing, assessed the quality of movements during the performance of technical dance elements within the framework of basic training, using a 5-point grading system.

Results and conclusions. In the control group, the quality of movement of the pupils before the experiment was rated at 6.67 points, with a standard deviation of 0.41. During the experiment, this indicator increased by 0.80 points and amounted to 6.75 points, with a standard deviation of 0.37 points. Despite the fact that the spread of indicators decreased slightly, it was nevertheless not possible to achieve a significant improvement ($p>0.05$). The results obtained indicate that the small increase could have been associated with the natural maturation of the children, habituation to repeated exercises, but not with the training programme itself. The conducted study proves that ballet dynamic technique effectively develops muscular abilities, range of motion, strength and agility as the main components of successful mastery of dance elements.

Keywords: *children, primary school, ballet preparation, fundamental skills, movement quality, dance technique.*

Introduction. In the modern system of primary education in China, increasing attention is being paid to the aesthetic and physical development of schoolchildren; however, the methods of teaching dance technique, in particular ballroom dance, are often of an empirical nature and lack scientific substantiation. The absence of specialised basic training leads to insufficient dynamic technique, low quality of movements and, as a consequence, a decrease in children's motivation. Existing practice does not fully utilise the potential of the ballet school, which traditionally lays the foundation of correct body placement, turnout, strength and coordination.

Thus, the relevance of the topic is determined by:

– the educational demand for scientifically substantiated methods of improving the quality of dance training for younger schoolchildren in China;

– the insufficient development of the issue of systematic application of basic ballet training in the conditions of a general education school, and not only in choreographic schools;

– the proven effectiveness of the proposed approach, which can be recommended for implementation in primary classes with the aim of improving the level of dynamic technique and the general physical fitness of children.

Objective of the study is to assess the effectiveness of basic ballet training for primary school children of the People's Republic of China in the process of teaching them dance technique.

Methods and structure of the study. The study was conducted during the 2024/2025 academic year in primary classes of general education schools in China. As a result of the experiment, experts (n=2), holding the highest coaching qualification in ballroom dancing, assessed the quality of movements during the performance of technical dance elements within the framework of basic training, using a 5-point grading system.

Results of the study and discussion. In the control group, the quality of movement of the pupils before the experiment was rated at 6.67 points, with a standard deviation of 0.41. During the experiment, this indicator increased by 0.80 points and amounted to 6.75 points, with a standard deviation of 0.37 points. Despite the fact that the spread of indicators decreased slightly, it was nevertheless not possible to achieve a significant improvement ($p>0.05$). The results obtained indicate that the small increase could have been associated with the natural maturation of the children, habituation to repeated exercises, but not with the training programme itself.

In the experimental group, the quality of movement of the pupils before the experiment was 6.70±0.35 points and did not show significant differences from the control group. During the experiment, this indicator significantly ($p<0.05$) increased to 7.33±0.43 points. The increase in the level of results indicates that the inclusion of basic ballet dynamic technique in the programme (especially training of the lower extremities, increasing the range of motion, strength and agility) led to an improvement in the quality of movements.

Conclusion. The conducted study proves that ballet dynamic technique effectively develops muscular abilities, range of motion, strength and agility as the main components of successful mastery of dance elements.

The study confirms the expediency of using elements of ballet training and also opens up prospects for improving educational dance programmes in the general education system of the People's Republic of China.

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The health a biopsychosocial approach to discussing student health issues: current trends in foreign research

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Abstract

Objective of the study is to determine the problem field of research into student health from the standpoint of a biopsychosocial approach.

Methods and structure of the study. The methodological basis of the study consisted of theoretical analysis and the systematisation of data from contemporary foreign publications (a total of 16 scholarly articles).

Results and conclusions. Studies have shown a high prevalence of psychological problems among students. The COVID-19 pandemic has aggravated the situation: up to 63.4% of students reported a deterioration in mental health during distance learning. The reasons for the deterioration in students' health have been generalised: low motivation – 65.4%, insufficient family involvement – 22.7%, ineffectiveness of the educational process – 11.9%. It is possible to improve students' health on the basis of physical activity, mediated by psychosocial mechanisms: self-efficacy, enjoyment of activities and social support. The analysis of foreign publications confirms the universality of the health problems of students from different countries and the necessity of integrating digital technologies and pedagogical strategies for effective health-formation in higher education institutions on the basis of a biopsychosocial approach.

Keywords: *students, youth, health, biopsychosocial approach, foreign studies, psychological problems.*

Introduction. Preserving and strengthening the health of student youth is a priority task for educational systems throughout the world. Numerous studies in recent years have recorded a steady tendency towards the deterioration of both the physical and the psychological and social components of students' health. At the same time, the vector of state policy in many countries is directed towards population preservation and the search for effective ways of improving the health indicators of the rising generation. However, despite the extensive empirical material, existing studies are fragmentary in nature, are limited to national samples and do not provide a holistic view of global tendencies in the health-formation of student youth. Systematisation of data on the comparative effectiveness of various approaches in different countries is lacking.

Methods and structure of the study. The material for the review consisted of 16 foreign scholarly articles published in peer-reviewed journals over the period 2021–2025. The search for sources was carried out in the PubMed, Scopus, Web of Science and Sage Journals databases, as well as on the Academia.edu and Google Scholar platforms. The following methods of analysis were applied: the comparative method (to identify similarities and differences in approaches across countries); the method of systematisation (for the grouping of data by thematic blocks); and the method of generalisation (to formulate integrative conclusions). The choice of these methods is determined by the aim of the study – to obtain a holistic picture of current trends.

The methods were implemented in three stages. At the first stage, an initial selection of articles was made on the basis of keywords (students, physical activity, mental health, higher education, university). At the second stage, a content analysis of each publication was carried out, identifying methodological characteristics (sample, instrumentation, main results, statistical indicators). At the third stage, the data were compared and interpreted in the context of the biopsychosocial approach. The aim of the present study is to determine the problem field of research into student health from the standpoint of a biopsychosocial approach.

Results of the study and discussion. The analysis of publications makes it possible to identify a number of universal tendencies that are characteristic of students irrespective of country and educational system.

First, researchers Sheldon E. and colleagues (2021) record a high prevalence of psychological health problems [13]. An important factor is the quality of sleep and its connection with stress [4].

Second, virtually all authors agree on the existence of a direct relationship between the level of physical activity and indicators of physical, psychological and social health. The Spanish researchers Rodriguez-Romo G. and colleagues (2022), with a sample of 847 undergraduate students, identified a stable interrelationship: the higher the overall physical activity, the better the indicators of psychological health [10].

Third, researchers note the influence of the digital environment on students' well-being. The Finnish authors Ruvinen H. and colleagues (2023) established that one fifth of students experience problems with their studies and daily routines caused by excessive time spent on the internet. These problems are linked with anxiety ($p<0.001$) and physical health symptoms, including problems with physical health ($p<0.001$) [11]. Pop L.M. and colleagues [8] (2022) confirm the relationship between the use of social networks and feelings of loneliness, self-esteem and body image, while noting the existence of gender differences [6].

Impact of the COVID-19 pandemic and distance learning. The study by Pokhorilyak R.Yu. [9] and colleagues (2023), involving 333 students (22.3% from Russia, 77.7% foreign students), identified serious consequences of distance learning. The vast majority of respondents (86.5% of Russian and 85.1% of foreign students) reported anxiety and concern for their health. 59.4% of Russian and 63.4% of foreign students indicated a deterioration in mental health and increased anxiety during distance learning. Depressive states were experienced by 49.3% of foreign and 52% of Russian respondents. Complaints of back pain, headaches, deterioration of vision and decline in academic performance were also recorded [9].

Chinese studies stand out for the scale of their samples and the active introduction of digital technologies. Wu J. (2022) studied the influence of physical exercise on the physical fitness and the psychological and social health of students. The results showed that the average scores in the national standards of physical fitness for young men and women were 58.50 and 60.49 respectively, and the percentage of unsatisfactory results was 48.24% and 43.55%. Among students, various mild mental disorders occur in 44.56% of cases, and moderate disorders in 9.69% of cases [14].

Deng T. and colleagues (2022) propose an innovative approach to the management of students' physical health on the basis of big-data technologies. The authors identify four reasons for the decline in the health level of Chinese students: a lack of positive attitudes towards physical activity and a healthy lifestyle (85.43%), weak family involvement (62.76%), insufficient implementation of school sports policy (55.35%) and a distorted system of sports values (42.27%) [2]. The intelligent management system developed makes it possible to gather data on physical development, health and sporting behaviour by means of wearable devices and to provide personalised recommendations [3].

The authors Xu B. and Amini H. (2025) conclude that increasing emotional and social engagement in physical education classes can reduce the level of physical inactivity and health-related anxiety [15]. Studies of students with special needs. Leirgul E. and colleagues (2022) conducted a national study in Norway (n=50,054), examining the physical and mental health of young people with cardiovascular diseases [1, 5]. The study by Mokmin N.A.M. and colleagues (2025) in Malaysia is devoted to the possibilities of using augmented reality in the physical education of students with dyslexia. The authors identified problems with the traditional approach and studied the possibilities of introducing AR technologies, noting their potential for increasing the effectiveness of classes [7].

The Spanish researchers Sánchez García C. and colleagues (2025) studied the influence of teachers' leadership style on pupils' aspiration to lead a healthy lifestyle. Support and an individual approach on the part of the teacher contribute to the formation in students of a desire to continue with their classes [12]. Liu L. and colleagues (2025), with a sample of 2,340 Chinese students, studied the influence of moral education in the course of PE classes on positive change in deviant behaviour [6]. The study by Zhang S. and Yoon J. (2025), involving 280 students from 11 US universities, showed that the quality of physical education teaching in senior school years has a direct connection with leisure-time physical activity. The authors emphasise the importance of high-quality teaching for increasing engagement in physical activity [16].

Conclusions. The analysis and systematisation of contemporary foreign publications (2021–2025) revealed common tendencies, problem fields and proposed solutions in the field of the health-formation of student youth. It has been established that studies from

the USA, Norway, China, Spain, Finland and other countries demonstrate a single tendency: the health of students is a complex biopsychosocial phenomenon. Common problems have been identified: a high prevalence of anxiety and depressive states, sleep disorders and a decrease in physical activity. The articles have demonstrated that physical activity has a positive influence on improving health, since it is mediated by psychosocial mechanisms: self-efficacy, enjoyment of activities and social support. The active introduction of digital technologies (big data, wearable devices) also has a positive influence on health indicators, helping to adjust loads in accordance with capabilities and limitations.

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Competition system of elite cross-country sprint skiers during the preparation for and participation in the XXIV Olympic Winter Games 2022 in Beijing (PRC)

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Abstract

Objective of the study is to analyse the competition system of elite cross-country skiers at the stage of direct preparation for the Olympic Winter Games (OWG) 2022 in Beijing.

Methods and structure of the study. The factual material of the study was obtained through the analysis of the competition systems of the winners and medallists of the OWG 2022 at the World Cup (WC) stages in 2021/22. The characteristic features of the construction of such systems include the following: the total number of starts in the WC before the beginning of the OWG; the distribution of starts across WC periods; the ratio of starts in various competitive disciplines in the classical and free styles and their performance outcomes; participation in the multi-day WC tournament – Tour de Ski (8 starts over 10 days). The primary informational and documentary source was the materials of the official FIS website.

Results and conclusions. Sprint competitions at the 2022 Olympic Winter Games in Beijing were held in the free style on a ski course of 1,461 m for both men and women. Based on the results of the performances of cross-country skiers at the OWG 2022, it was noted that out of 6 possible medals awarded in the individual sprint, five medals were won by representatives of different countries: Sweden, Russia, the USA, Norway and Italy – which indicates a high level of competition in this discipline. The individualisation of the entire preparation, and especially the start calendar of elite cross-country skiers, during the competitive period and at the stage of direct preparation for the Olympic Winter Games contributes to a more effective realisation of their potential capabilities in achieving the highest sporting results.

Keywords: *cross-country skiing, competition system, individual sprint, Olympic Winter Games.*

Introduction. In the modern conditions of professionalisation of elite sport, including cross-country skiing, a steady trend has emerged towards a significant increase in international competitions, which are one of the most important factors in improving the mastery of leading athletes [2]. The continuous increase in the number of stages, individual and team competitions, including the increase in sprint disciplines in the World Cup programme, has led to a reduction in the time for direct preparation for the main start – the World Championship or the Olympic Games. The increase in the number of advertisers, television broadcasts of competitions and the resulting profits for the International Ski Federation and the organisers of individual WC stages, as well as the fees of racers, are increasingly transforming the World Cup into a highly successful commercial project. Under these conditions, athletes have less and less time for training with the aim of maintaining and further developing their level of preparedness – sporting form. A significant number of such starts and their localisation in the structure of the annual macrocycle often comes into conflict with purposeful preparation and successful performance in the main competitions – the Olympic Games and World Championships [3]. The most important problem of the preparation system of the strongest cross-country skiers of Russia and other countries is the optimisation of quantitative and qualitative indicators of individual competitive practice during the period of preparation for the main international competitions [1].

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Methods and structure of the study. The factual material of the study was obtained through the analysis of the competition systems of the winners and medallists of the OWG 2022 at the World Cup stages in 2021/22. The characteristic features of the construction of such systems include the following: the total number of starts in the WC before the beginning of the OWG; the distribution of starts across WC periods; the ratio of starts in various competitive disciplines in the classical and free styles and their performance outcomes; participation in the multi-day WC tournament – Tour de Ski (8 starts over 10 days). The primary informational and documentary source was the materials of the official FIS website.

Results of the study and discussion. Sprint competitions at the 2022 Olympic Winter Games in Beijing were held in the free style on a ski course of 1,461 m for both men and women. Based on the results of the performances of cross-country skiers at the OWG 2022, it was noted that out of 6 possible medals awarded in the individual sprint, five medals were won by representatives of different countries: Sweden, Russia, the USA, Norway and Italy – which indicates a high level of competition in this discipline (Table 1).

Table 1. Winners and medallists of the individual sprint at the 2022 Olympic Winter Games

Category	1st place	2nd place	3rd place
Women	Sundling J. (SWE)	Dalqvist M. (SWE)	Diggins J. (USA)
Men	Klebo J. (NOR)	Pellegrino F. (ITA)	Terentyev A. (RUS)

The performances of athletes in other disciplines of the Olympic programme (Table 2) show a focus on in-depth sports specialisation – Sundling participated in two sprint disciplines, as well as in the relay and marathon; however, it was in the latter that she remained without a medal. The other Swedish skier, Dalqvist, won medals in all three disciplines in which she participated, including two team races and one individual sprint. The Swedish women have a high ranking specifically in the sprint World Cup standings (11th and 1st place, respectively). The American Diggins competed in the entire Olympic programme; the best achievements were recorded in sprint and marathon, and the high ranking in the sprint and distance World Cup standings confirms the versatility of this skier. Among men, a similar tendency towards the selection of shorter distances in the entire competitive programme of the OWG 2022 is observed. The best performances of the skiers were recorded specifically in sprint disciplines, which is confirmed by their current ranking before the Olympics – Klebo J. (1st place), Pellegrino (8th place) and Terentyev A. (3rd place).

The analysis of the obtained qualitative and quantitative characteristics of the competition systems of the world's leading sprinters showed that the Swedish female skiers only episodically participated in the World Cup stages, choosing sprint races – out of 16 WC stages held before the OWG, Sundling J. participated in one sprint stage, which consisted of individual and team sprints, where she finished 2nd and 1st, respectively. Dalqvist M. participated in 6 starts (37.5%), 5 of which she won were sprints. The competition system of Diggins J. was built on the principle of maximum participation in WC races, while among all 5 free-style sprint races, the American had a mean finishing position of 6.4±7.56. The 2022 Olympic champion in the sprint, J.

Table 2. Performance results of the world's leading sprinters at the 2022 Olympic Winter Games

		Sundling J.	Dalqvist M.	Diggins J.	Klebo J.	Pellegrino F.	Terentyev A.
CURRENT RANKING BEFORE OWG 2022							
Sprint		11	1	3	1	8	3
Distance		-	62	7	2	24	42
Overall		32	8	3	1	11	13
PERFORMANCE AT THE OLYMPIC GAMES							
Sprint events	Ind. sprint 1.5/1.5 km F	1	2	3	1	2	3
	Team sprint 1.5/1.5 km C	2	2	5	1	6	3
Distance events	Ind. race 10/15 km C	-	-	8	3	-	-
	Relay 4x5 km/4x10 km C/F	3	3	6	2	8	-
	Skiathlon 15/30 km C/F	-	-	6	40	-	-
	Mass start 30/28.4 km F	4	-	2	DNF	-	-

Table 3. Competitive practice of winners and medallists of the individual sprint at the OWG 2022 in Beijing

Date	Discipline	Sundling J.	Dalqvist M.	Diggins J.	Klebo J.	Pellegrino F.	Terentyev A.
26.11.21	SP 1.4/1.4 km C	-	1	16	2	29	1
27.11.21	15/10 km C	-	-	18	9	20	-
28.11.21	Pur 15/10 km C	-	-	11	-	9	-
03.12.21	SP 1.6/1.6 km F	-	1	2	1	16	13
04.12.21	15/10 km F	-	-	18	12	-	-
05.12.21	Relay C/F	-	-	4	1	5	2
11.12.21	SP 1.5/1.5 km F	-	1	19	1	13	7
12.12.21	15/10 km F	-	24	2	2	-	-
18.12.21	SP 1.3/1.3 km F	2	1	8	-	2	8
19.12.21	TSP 1.3/1.3 km F	1	1	2	-	4	
Tour de Ski							
28.12.21	SP 1.3/1.5 km F	-	-	1	1	5	7
29.12.21	15/10 km C	-	-	16	4	13	19
31.12.21	15/10 km F Mst	-	-	1	1	71	44
01.01.22	SP 1.5/1.2 km C	-	-	21	1	13	11
03.01.22	15/10 km C Mst	-	-	13	1	27	32
04.01.22	Final Climb 10/10 km Mst	-	-	15	5	20	-
Direct preparation stage (days)		51	51	33	33	35	36

Klebo, participated in 13 WC starts (81.3%), showing the best results in sprint disciplines – mean position 1.2±0.44. F. Pellegrino, similarly to the American Diggins J., participated in 14 out of 16 starts, which constituted 87.5%. The best performance of the Italian cross-country skier was observed in free-style sprint races – mean position 8±6.12. Having investigated the duration of the stage of direct preparation for the main start, the average number of days between the last start at the World Cup stage and the first start at the OWG 2022 was determined: for women, this indicator was 45 days; for men – 34 days (Table 3).

Conclusions. Of paramount importance in optimising the individual calendar of sprint skiers and the success of performance at the main competitions are the indicators of the number of starts in the competitive period before the beginning of the Olympic Games; for women, participation in 2–5 starts is characteristic (no more than 40% of WC stages), predominantly in sprint disciplines. Men participate in 13–14 WC stage starts (approximately 85%), showing the best results in short-distance races. Such indicators may be considered optimal in the years of the Olympic Games for cross-country skiers specialising in sprint.

The individualisation of the entire preparation, and especially the start calendar of elite cross-country skiers, during the competitive period and at the stage of direct preparation for the Olympic Winter Games contributes to a more effective realisation of their potential capabilities in achieving the highest sporting results.

The stage of direct preparation for the Olympic Winter Games averaged 45 days for women and 34 days for men in duration. Therefore, the 5-week duration of this stage should be considered optimal, and it proceeds without participation in competitive activity. This is related to the fact that the primary focus of athletes during this period of time is directed towards the training process.

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Retrospective analysis of group tactical actions in defense when receiving a serve in volleyball

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Keywords: *volleyball, retrospective analysis, serve reception, group tactical actions, libero.*

Introduction. Due to changes in the rules, coaches of high-level teams are developing new tactical options. However, these options have no scientific basis and are not used in the long-term training system of volleyball players. A contradiction arises. On one hand, there is a practical need to improve the training system. On the other hand, there is no understanding of how volleyball tactics will develop. The aim of the study is to determine the trends in the development of group tactical actions in defense when receiving a serve based on a retrospective analysis.

Methods and Organization of the Study. We used a retrospective analysis of 27 sources on the theory and methodology of volleyball (for example, [1, 2]). This included historical essays and an analysis of changes in the FIVB rules. When there was no direct data on group actions in defense, we used logical modeling based on the rules and attacking tactics.

Results and Discussion. The retrospective analysis allowed us to identify 6 key periods in the development of group tactical actions in defense when receiving a serve. First period (1921–1936): the origins of tactics. An even positioning of players appeared to counter the serve [2]. Second period (1937–1945): the introduction of the "attack line" and the first tactical formations [1]. Third period (1946–1964): the appearance of the "5-1" formation and the ban on the "screen" of the serving team. Fourth period (1965–1997): the appearance of the jump serve. Fifth period (1998–2024): the introduction of the libero position [3, 4, 5]. Sixth period (from 2025): a new rule — the receiving team may take any position on the court after the server tosses the ball.

Conclusions. The identified periods show a stable global trend. Attacking and defensive actions become more balanced, but the game does not lose its entertainment value. The main trend in the development of tactical actions in defense when receiving a serve throughout the history of volleyball is a shift from the task of "keeping the ball in play" to the task of "creating the most favorable conditions for starting an attack." Modern serve reception should be considered as the first key element of an attacking combination.

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