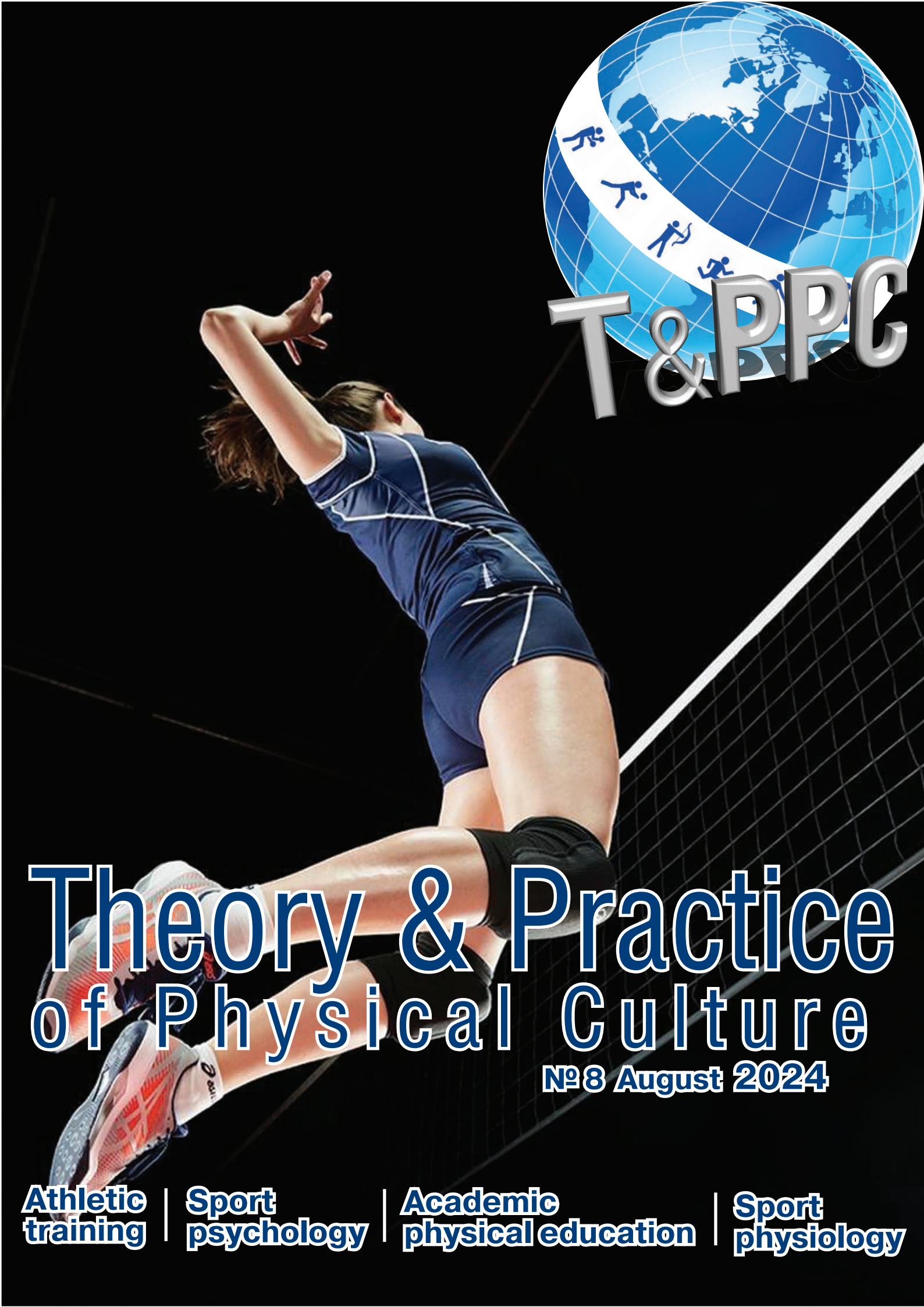

Theory & Practice of Physical Culture

№ 8 August 2024

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

The socio-cultural environment of Russian universities as a tool for the integration of national means of physical culture

Attracting students from other countries is of great importance in establishing links between Russian and foreign universities at the level of interethnic, intercultural, and interfaith interaction.

In the conditions of the university, a multinational youth community is formed, which is characterized by great differences in national culture, lifestyle, and social communication. In this regard, there is a need to form such a socio–cultural environment of the university, which would, on the one hand, preserve cultural traditions, and, on the other, expand the possibilities of socialization and adaptation of the student to new social conditions of life.

One of the ways to increase the effectiveness of educational and educational processes is to design the socio-cultural environment of the university as a system of education that ensures the free creative development of students and the acquisition of positive social and cultural experience in the process of studying at the university. The infrastructure of the socio-cultural environment unites all departments of the university, as well as public associations and communities that implement social and educational activities within the framework of an educational organization.

Currently, Russian universities carry out close international cooperation with the People's Republic of China on student exchange, which leads to the actualization of innovative approaches in the formation of a socio-cultural environment based on the translation of the values of national physical culture.

The use of Chinese wellness practices in the process of physical education classes helps to strengthen physical health, develop psychological stability and improve overall physical fitness, as well as helps to improve concentration, relieve stress and increase the level of physical and mental performance.

Among the popular types of Chinese wellness practices, Qigong should be highlighted, which is a traditional Chinese method of preserving and strengthening health, which includes "qi" (breathing) training and will training, i.e. continuous conscious improvement of breathing exercises and forms. A modern interpretation of traditional Chinese practices is fitness qigong, which combines elements of traditional Qigong, breathing practices, creating a unique training system to improve physical fitness, strength and flexibility, as well as the development of internal energy and psychological well-being.

Another popular type of physical activity among young people is the wellness practice of Tai chi or Taijiquan, which combines deep conscious breathing and performing smooth movements reminiscent of animal images. Tai chi and other wellness practices help to improve coordination of movements, flexibility, balance function and strength abilities.

An important part of physical education at the university is the development of students' coordination abilities, as well as personal qualities such as emotionality and communication. In this aspect, Chinese national outdoor games – Chinese shuttlecock and diabolo, give sports educators new ideas and tools for developing physical skills due to their unique features and broadcast values. The shuttlecock game, which has a centuries-old history, allows you to develop physical abilities, increase dexterity and reaction of those involved. Shuttlecock kicks have a great stimulating effect on the physical coordination and balance of the players. Along with the shuttlecock game, the diabolo game has become widespread in China, turning into a unique sports event combining fitness, entertainment and competitions.

Thus, the inclusion of the successful Chinese experience of physical education, the translation of the values of national culture into Russian educational practice makes it possible to expand and systematize knowledge in the field of sports pedagogy. A variety of means and methods of physical activity contributes not only to improving physical performance, but also to the development of artistry, emotionality and expressiveness of students during classes.

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

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Theory and Practice of Physical Culture

Contents

Development of the starting reaction of track and field sprinters using sensory-motor means

UDC 796.015.58

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Abstract

Objective of the study was to substantiate the development of the starting reaction using sensory-motor means of special training for female sprinters.

Methods and structure of the study. The pedagogical experiment involved female sprinters of the I sports category, CMS (n=10) at the age of 17,5±0,5 years. Temporary indicators of the starting reaction of female sprinters competing in running at a distance of 60 m were considered. A set of special exercises was developed aimed at improving the starting reaction (RT) indicator, and corrections were made to the educational and training process at the special preparatory stage of training female athletes.

Results and conclusions. The starting reaction index decreased from 0,207±0,01 s to 0,164±0,01 s. Positive dynamics were achieved through targeted improvement of the neuromuscular response of female athletes. Mobilization stimuli of sensory-motor exercises ensure intensive functional changes in the neuro-functional sphere and improve the coordination structure of the starting actions of female sprinters.

Keywords: *special training, track and field sprinters, motor reaction time, mobility of nervous processes.*

Introduction. One of the indicators that influences the success of competitive activity of track and field sprinters is the reaction time at the start. The speed of the motor reaction to the starting signal, which generates the initial impulse of movement, largely determines the outcome of the sports fight, determining the timeliness and rationality of the sprinter's response to changes in competitive conditions. The mechanism for the development of speed-reactive qualities is based on the high mobility of the sprinter's nervous processes [1, 6].

It has been established that the physical training of female sprinters is aimed at developing complex manifestations of speed: reaction time, speed of individual movements and pace of steps [2]. Practice shows that speed qualities in a single complex coordination motor action only indirectly determine the speed of an athlete [4].

The time of the starting reaction from the start signal to the moment the hands are lifted off includes latent and motor periods. The latent period is characterized by the length of time from the start signal to the onset of electrical muscle activity; the motor period is the time from the beginning of pressure on the starting blocks to the lifting of the foot from the support. The integral development of sensory and motor components of a motor reaction is a complex pedagogical task in sprinter training [3, 5].

Objective of the study was to development and substantiation of means for improving the sensory-motor starting reaction of track and field sprinters.

Methods and structure of the study. The pedagogical experiment involved female sprinters of the I sports category, CMS (n=10) aged 17,5±0,5 years. The training process was carried out using developed means for developing a sensory-motor response to the start signal.

At the first stage, the time indicators of the starting reaction of female sprinters competing in running at a distance of 60 m were studied. Based on the data obtained, a set of special exercises was developed aimed at improving the starting reaction (RT) of female sprinters, and corrections were made to the educational and training process for special preparatory stage of training of female athletes.

The use of means for developing a sensory-motor reaction was based on the use of the surprise factor, in which female athletes, in response to a stimulus, performed predetermined movements or motor actions that corresponded to given conditions.

The exercises used included a variety of auditory and visual stimuli that contributed to the development of reaction speed. The adjustable parameters for performing means of improving the sensory-motor starting reaction were: order, mode and number of repetitions of exercises, number of series, rest intervals.

The content of the means for developing a sensory-motor reaction to the starting signal consisted of exercises:

- performing a start from various starting positions by an audible signal in light conditions;
- exercises for reaction speed with changing the time between the preliminary and executive commands (from 1 to 6 s);
- exit from the start on a visual signal with maximum speed of response;
- performing starting actions in variable situations using additional equipment.

During the study, control and pedagogical testing was carried out to monitor physical fitness indicators: running 10, 30 and 60 m. During testing, the starting reaction time was determined using contact sensors built into the starting blocks.

Results of the study and discussion. The initial time of the starting reaction with an average result in the 60 m run of 8,01 ± 0,17 s varied from 0,20-0,215 ms to 0,178-0,191 ms.

After the experiment, the results of all control tests improved.

The starting reaction rate decreased from 0,207±0,01 s to 0,164±0,01 s, which is 20,8% and is in the zone of optimal values for athletes of this qualification. The positive dynamics of the starting reaction indicators was achieved through the targeted improvement of the neuromuscular reaction. Despite the improvement in the starting reaction of female athletes, the differences before and after the experiment were not statistically significant (p>0,05).

After the experiment, the 10 m running time decreased by 9,9%, which indicates an improvement in the integral manifestation of strength, speed and reactive abilities of track and field athletes. Results in the 30m race improved by 4,7%; in the 60 m run – by 4,3%. The results of control tests before and after the experiment are statistically significant at p<0,05, which indicates the effectiveness of using means to improve the sensory-motor starting reaction of female sprinters.

The feasibility of introducing into the process means of improving the sensory-motor starting reaction, helping to reduce the response time to an audio signal, is justified by analyzing the results of the study. The mechanism of action of means of developing a sensory-motor reaction, based on the use of the surprise factor, in which female athletes, in response to a stimulus, perform predetermined movements or motor actions that correspond to given conditions, has shown its effectiveness. Variation of the conditions for performing starting movements is a powerful irritant of the central nervous system, promoting the mobilization of sensory-motor components of the starting response, which leads to improvement of the time

Dynamics of physical fitness indicators of track and field athletes, $\bar{X} \pm m$

Indicator	Results		t	p
	Before	After		
10m run, s	1,82±0,06	1,64±0,09	9	<0,05
30 m run, s	4,65±0,04	4,43±0,05	10,6	<0,05
60 m run, s	8,01±0,08	7,66±0,08	7,4	<0,05
RT, s	0,207±0,01	0,164±0,01	0,43	>0,05

indicators of the start of female sprinters and an improvement in sports results.

Conclusions. The results of the conducted criterion study experimentally prove the effectiveness of means of developing a sensory-motor reaction in controlling adaptation mechanisms to the need for an instant response to the start signal when performing sprint exercises. Mobilization stimuli of sensory-motor exercises, maximally oriented towards minimizing the start time, ensure intensive functional changes in the neuro-functional sphere and improve the coordination structure of the starting actions of track and field sprinters.

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Optimization of recovery processes for athletes using bioenergy means

UDC 796.6

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Abstract

Objective of the study was to assessment of the influence of bioenergetic exercises on the recovery process of track and field athletes specializing in 400 m running.

Methods and structure of the study. The experimental group consisted of 16 male athletes specializing in 400 m running at the age of 20,3 ± 1,5 years. The anaerobic glycolytic load corresponded to performing the main competitive exercise three times. During recovery periods between training tasks, bioenergetic recovery agents were used. Bioenergetic indicators characterizing the intensity of adaptation processes to the training load were recorded.

Results and conclusions. It has been established that the use of bioenergetic exercises during the recovery process accelerates the decrease in heart rate and oxygen consumption without causing accelerated removal of lactate from the blood plasma. The results of changes in heart rate and oxygen consumption indicate that bioenergetic exercise has a positive effect on the recovery processes of athletes.

Keywords: *track and field athletes, bioenergetic exercises, bioenergetic parameters.*

Introduction. Due to competition in elite sports, the level of volume and intensity of the training load has come very close to prohibitive indicators [4, 6]. Despite the fact that three training sessions a day are becoming the norm in some sports, there is an obvious tendency towards an additional increase in the extensiveness and intensity of training loads [2]. This is possible with regular planning of training work and activation of recovery processes [1].

One of the methods that helps accelerate the processes of adaptation to the training load is the use of bioenergetic exercises, the effect of which on recovery processes in sports has not been thoroughly studied [3, 5].

The means of bioenergetic recovery include bioenergetic breathing exercises, the development of elasticity of ligaments and the ability of muscles to stretch, movements to balance the energy fields of various bodily locations, massage products that improve the conductivity of nerve pathways, correction of energy meridians and emotional states associated with them, etc.

Objective of the study was to assessment of the influence of bioenergetic exercises on the recovery process of track and field athletes specializing in 400 m running.

Methods and structure of the study. The experimental group consisted of 16 male athletes specializing in 400 m running at the age of 20,3 ± 1,5 years. Each of the athletes participated in four tests, the content of which included a preliminary measurement of bioenergetic indicators at rest, warm-up, completion of the main training task, and measurement of bioenergetic indicators during the recovery period.

Basal metabolism was measured using a Quark metabolograph (Cosmed, Italy). Oxygen consumption (VO_2) in ml/min/kg was recorded. The anaerobic glycolytic load corresponded to three repetitions of the main competitive exercise in the 400 m race, which caused a high heart rate and lactic acid content in the blood. During rest periods between sets for five minutes, the pulse value and blood lactate concentration were recorded.

Bioenergetic recovery tools, including stretching, breathing exercises, and manipulative proce-

dures with the athletes muscles (massage, kneading), were used during recovery periods between training tasks.

The study analyzed 11 variables. Eight variables related to rates of heart rate decline during recovery. Declining indices are obtained by subtracting the heart rate value at a specific minute of recovery from the heart rate max value and dividing by the product of the number sixty per minute of recovery: HRi = (HR max – HR n) / 60×n.

Variables associated with blood lactate concentration (LT_2, LT_2, LT_2) characterize the decrease in values, which were calculated based on the difference between lactate concentrations in the first minute of rest and subsequent minutes of recovery. At the end of the training load, as well as in the second and third minutes of recovery, oxygen consumption was measured (VO_2 1, VO_2 2, VO_2 3).

Statistical analysis of the results was carried out using Statistica algorithms for Windows 8.0. Univariate analysis of variance (ANOVA) was used to analyze differences between group means.

Results of the study and discussion. In the standard recovery mode, indicators related to oxygen consumption have lower average values. Higher average values of VO_2 1 were found when using bioenergetic exercises (Table 1).

For all eight indicators of heart rate index reduction, the highest average values were observed when using bioenergetic exercises. Significant statistics of differences in means were obtained for 7 out of 15 variables, or in 46,7% of cases.

The reduction in blood lactate concentrations was minimal for all variables, both with the use of bioenergetic exercises and with the standard recovery regimen. No statistically significant differences were found for any pair of variables.

When interpreting the data obtained, it should be taken into account that the athletes body strives to maintain internal constancy both during training and during subsequent recovery, aimed at returning all body functions to their original state.

At the same time, an excessive amount, as well as a deficiency of bioenergy, disrupts the energy balance of the body, which makes it difficult to maintain homeostasis.

Taking into account that bioenergetics has a strong potential to influence the bodily and motor well-being of the body, the attributive connections of bioenergetic exercises contribute to the stabilization of the energy field and the intensive restoration of homeostasis. The additional energy generated by bioenergetic exercises stimulates the functioning of the sympathetic and parasympathetic systems, which determines their balanced state. Increased activity of one of the systems - sympathetic or parasympathetic - causes a neurophysiological imbalance, causing the resonant nature of autonomic reactions. High-intensity sympathetic stimulation of bioenergetics subsequently, predominantly through vagus nerve impulses, excites the parasympathetic part of the autonomic nervous system, which leads to vasodilation of blood vessels. According to recovery theory, this should result in a reduction in blood

Table 1. Indicators of bioenergy variables

Bioenergy parameters	Bioenergetic regulation	Standard holiday	F	p
HRmax	177,4±,5	178,7±7,2	4,53	< 0,05
VO_2 1, ml/min/kg	55,8 ± 5,8	51,2±5,4	3,48	< 0,05
VO_2 2, ml/min/kg	54,7±4,9	43,2±3,7	3,13	< 0,05
VO_2 3, ml/min/kg	39,2±37,6	36,5±28,6	3,65	< 0,05
HRi1	0,627±0,22	0,563±0,21	1,76	> 0,05
HRi2	0,538±0,17	0,498±0,58	3,64	< 0,05
HRi3	0,436±0,23	0,401±0,25	3,35	< 0,05
HRi4	0,344±0,35	0,327±0,34	1,63	> 0,05
HRi5	0,263±0,73	0,284±0,42	2,25	> 0,05
HRi6	0,637±0,54	0,533±0,56	4,78	< 0,05
HRi7	0,452±0,47	0,466±0,26	1,22	> 0,05
HRi8	0,368±0,55	0,357±0,44	1,69	> 0,05
LTi_2	0,99±0,02	1,32±0,08	1,87	> 0,05
LTi_2	0,75±0,09	0,86±0,04	0,89	> 0,05
LTi_2	0,73±0,06	0,84±0,06	1,57	> 0,05

pressure, oxygen consumption, heart rate, and blood lactate levels.

When considering the results obtained, some contradictions arise. When using bioenergetic recovery means, heart rate and oxygen consumption indicators show a dynamic trend toward an intense decrease in values, while the change in lactate concentration is diametrically opposite. Perhaps the described phenomenon is a consequence of the relative conservation of the physiological mechanism of lactate removal from muscles into the bloodstream.

Presumably, additionally obtained bioenergy quanta help to accelerate the process of restoration of all body systems, including muscle, to their original stable state. This ensures accelerated removal of lactate from muscle tissue into the bloodstream, which allows muscle cells to get rid of acidosis products as quickly as possible.

Thus, the concentration of lactic acid in the muscles quickly decreases, as a result of which its short-term accumulation in the blood plasma is observed. In this regard, a short-term increase in the concentration of lactate in the blood is only a transitional stage, helping to accelerate the process of excretion of ATP hydrolysis products in general, and is not a symptom of dysfunction in the athletes body.

Conclusions. Bioenergetic exercises have a positive effect on the recovery processes of track and field athletes specializing in 400 m running. The utilization of blood lactate after anaerobic exercise, in the case of bioenergetic exercises, goes beyond the scope of one session, but is also intensive in nature compared to the standard recovery regime for athletes.

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Planning loads of different intensity in the annual cycle of training highly qualified cyclists in the aspect of foreign research

UDC 796.61

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Abstract

Objective of the study was to identification of modern approaches to planning loads of different intensity in the annual training cycle of highly qualified cyclists.

Methods and structure of the study. Analysis of literary sources. More than 50 sources of foreign literature published in recent years were analyzed.

Results and conclusions. In the four load distribution options described in foreign publications (polarization, pyramidal, threshold and high-intensity models), the effectiveness of both the polarized and pyramidal options is noted. At the same time, the most important area of training activity is the use of large volumes of low-intensity training. In addition, it is also recommended to use short, moderate-intensity and high-intensity training sessions consistent with competition intensity. Optimizing training load prior to a major event using a compressed version of high-intensity overload training followed by a taper period provides improved performance levels in elite cyclists compared to traditional taper training.

Keywords: *cycling, highly qualified athletes, training loads, intensity zones, annual cycle, foreign research.*

Introduction. The volume and intensity of training loads are the main parameters taken into account when planning and managing athletes' training. Despite a large number of studies conducted in Russia and abroad, the discussion regarding the gradations of load intensity, their distribution in training cycles, and compliance with pedagogical tasks continues to this day. Moreover, the terms «periodization» and «programming»/«planning» are often used by foreign authors as interchangeable, although periodization (long-term general organization of training) should be distinguished from programming (short-term planning of individual training sessions and exercise complexes) [6]. The article was prepared based on the R & D materials of the thematic plan for conducting applied scientific research in the field of physical education and sports within the framework of the state assignment for scientific organizations and educational institutions of higher education subordinate to the Ministry of Sports of the Russian Federation for 2022-2024.

Objective of the study was to identification of modern approaches to planning loads of different intensity in the annual training cycle of highly qualified cyclists.

Methods and structure of the study. Analysis of literary sources. More than 50 sources of foreign literature published in recent years were analyzed.

Results of the study and discussion. Traditionally, the literature identifies 3 main physiologically determined zones of intensity of physical activity in cyclic sports [9]. These zones (zone 1, 2 and 3) are determined depending on individual indicators of aerobic and anaerobic thresholds or threshold values of lactate levels in the blood and are taken into account when choosing a load distribution option [11].

In foreign literature, 4 options for distributing the intensity of training (IT) loads are currently identified: polarization, pyramidal, threshold and high-intensity models [11]. These and other works describe the features of their use. However, this raises many questions

about the possible distribution of loads at different stages of the annual cycle in cycling, in which there is currently a lack of knowledge on issues that determine the structure of traditional (ST) and block (BP) periodization. Long competitive seasons in cycling and tight competition schedules requiring frequent peaks in performance have led to a shift from traditional periodization (TP) (initially involving a period of high volumes of low-intensity training (LIT) followed by a period of volume reduction and an increase in the proportion of high-intensity training (HIT) in the immediate preparation for competitions) to block periodization (BP) of training [8].

Gal n-Rioja M. . et al. [3] point out that the use of a higher or lower volume of training depends on a number of factors, such as the stage of preparation during the season, age, and skill level of the athletes. For this reason, both volume and IT should be assessed and planned in combination with each other [4].

In both the pyramidal and polarized models of training intensity distribution, approximately 80% of the total training volume is spent in Zone 1. However, in the pyramidal RIT model, the remaining 20% of training is spent in Zones 2 and 3, while in the polarized RIT model, these 20% are performed mainly in Zone 3, with a smaller volume of training in Zone 2. In contrast, the threshold RIT model provides for a high proportion of training volume in Zone 2 (more than 35%), and the remainder in Zone 1. In addition, cycling also uses IT models that include loads in Zones 4 and 5 [7]. Recently, the issue of which IT variants provide the highest efficiency has been actively discussed [1, 2]. Both polarized and pyramidal IT are very effective variants of load intensity distribution. At the same time, the most important direction of training activity is the use of large volumes of LIT (Zone 1). However, it should also be noted that the distribution of loads in intensity zones 2 and 3 using both IT options depends on the training phase or preparation cycle and the specialization of the athlete at the competition distance. Most studies involving elite athletes report the use of pyramidal IT with a high proportion of high-volume LIT. For example, according to various data, cyclists participating in World Tour races are distinguished by a high annual training volume, conducted mainly in zone 1 (from 67% to 69%) and to a lesser extent in zone 2 (from 4% to 5%), zone 3 (from 3% to 4%), zone 4 (from 1% to 2%), zone 5 (from 0.3% to 1%). At the same time, competitions occupy from 9 to 12%, and other training – 10%. On the other hand, polarized IT is also an effective option for some elite athletes during certain periods of the annual cycle [3].

The distribution of training intensity in road cyclists, according to different authors, with block periodization is approximately: LIT - from 54% to 73.7%; moderate-intensity training (MIT) - from 0% to 33%; HIIT - from 9.4% to 35%; other training - from 5% to 12%; with traditional periodization: LIT - from 64% to 83.5%; MIT - from 2.5% to 27%; HIIT - from 2.3% to 9%; other training - 6.2%; with the daily planning model: LIT - from 49% to 66%; MIT - from 0% to 39%; HIIT - from 10% to 41% [3]. Thus, at the moment, there is no reason to believe that the use of any of the special periodization models (BP or TP) or the daily training planning model in qualified road cyclists is more effective than other options for improving performance and competitive efficiency. In addition, it is recommended to use various combinations of the pyramidal and polarized distribution methods of RIT, taking into account the results of daily monitoring of the state of preparedness [3]. To further improve the level of performance, cyclists, in addition to increasing the volume of LIT, are also recommended to use short MIT and HIT corresponding to the levels of competitive intensity.

Sprint is an important element in cycling, used at starts, breakaways from the group, pedaling uphill, finishes. Therefore, many sub-elite cyclists additionally use sprint training to increase the power and efficiency of pedaling [5]. In addition, sprint training is a softer strategy for maintaining physical performance while reducing the training volume during the transition period. Including sprint training (30-second sprints) in a low-intensity workout allows elite cyclists to maintain the necessary level of fitness during the first six weeks of the preparation period [12].

The current approach to achieving peak performance, called the taper period, is to use overload (forced load) training for 2-4 weeks followed by a gradual reduction in load over 1-3 weeks. However, the implementation of this approach, which requires a 3-7 week preparation period for the main competition, is practically impossible for many elite athletes due to the tight competition schedule. Therefore, rather than using a specific overload period before the taper period, an alternative approach is to use a taper period alone (simply reducing the training volume in cycling during the taper period by 21-60% over 8-14 days) [10]. However, implementing a pe-

riod of overload before tapering provides a higher increase in performance compared to using only a period of tapering.

Ronnestad B.R. et al. [10] proved that the implementation of a short period of bringing physical performance to a peak level during a 6-day period of using HIIT with an overload and a subsequent 5-day tapering period with a gradual decrease in the load by 55% allows to increase the indicators of peak oxygen consumption, maximum output power, and pedaling economy in highly qualified cyclists compared to traditional tapering (tapering). The traditional tapering period with a decrease in the training load by 40% takes 11 days. The stage of training cyclists preceding the overload and tapering (4 weeks) includes low-intensity training (LIT) 60-82% of the peak HR; moderate-intensity training (MIT) 83-87% of the peak HR; high-intensity training (HIT) 88-100% of the peak HR. In general, traditional tapering results in a greater reduction in total training load over an 11-day period compared to overload with tapering (by 35±8% and 17±21%, respectively). Interestingly, an 11-day period of high-intensity overload training followed by a reduction in training load during tapering in cyclists produces a similar performance-enhancing effect compared to a longer 5-week period of overload and tapering training used in other cyclic sports, such as triathlon. This is due to the fact that a longer overload period causes functional overstrain in athletes (a 2% decrease in maximum power), which does not allow supercompensation processes to develop during the subsequent tapering period. A significant reduction in performance during the overload period cannot be sufficiently compensated for during the tapering period. The risk of excessive performance decline after an overload period can be minimized by using a shorter overload phase that does not cause a deterioration in physiological performance parameters [10].

Conclusions. The four load distribution options described in foreign publications note the effectiveness of both the polarized and pyramidal RIT options. In this case, the most important direction of training activities is considered to be the use of high-volume LIT. In addition, it is also recommended to use short MIT and VIT corresponding to the competitive intensity. Optimization of the training load before major competitions using a compressed version of training with overload in the VIT format and a subsequent period of taper ensures an increase in the level of performance in highly qualified cyclists compared to traditional taper.

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Scientific and philosophical theory of sports: real state and development prospects

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Abstract

Objective of the study was to based on critical analysis, substantiate the development of a philosophical theory of physical culture and sports.

Methods and structure of the study. The arguments through which the evidentiary basis for the development of a philosophical theory of physical culture and sports are based are considered. The source base consists of scientific works devoted to the conceptual foundations of the development of philosophy and sports science.

Results and conclusions. In the need to develop a scientific and philosophical theory of physical culture and sport, the authors present arguments that consist in resolving such problems as the different understanding in Russian and foreign science of the subject of the philosophy of sport itself, the interpretation of the phenomenon of sport, the historical and philosophical presentation of modern science of sport, three theoretical dimensions sports, historical and philosophical falsification, consideration of the philosophy of sport as the philosophy of Olympism and its historical and philosophical falsification, logical and linguistic inconsistency of the profile thesaurus.

The authors conclude that, as a theoretical perspective, the design of a scientific and philosophical theory of sport is possible provided that all problematic issues considered in the study are systematically resolved. The structure of the model of scientific and philosophical theory presented in the article involves the development of a number of sections of philosophical applied knowledge in the fields of history, science, religion, politics, culture, and logical-linguistic analysis.

Keywords: *scientific and philosophical theory of physical culture and sports, problem analysis, prospects, conditions for creation, structural components.*

Introduction. One of the most important problems of Russian philosophy is the construction of a modern scientific and philosophical theory of physical culture and sport, capable of becoming a reliable ideological and methodological basis for applied science and state goals of developing public institutions [1, 7, 8].

Objective of the study was to based on a critical analysis, provide a well-reasoned justification for the development of a philosophical theory of physical culture and sport.

Methods and structure of the study. The arguments by which the evidentiary basis for the development of a philosophical theory of physical culture and sport are based are considered. The source base consists of scientific works devoted to the conceptual foundations of the development of philosophy and sports science.

Results of the study and discussion. There are several arguments to support the need to develop a scientific and philosophical theory of physical culture and sport.

1. The problem of different understanding of the subject of philosophy of sport proper in Russian and foreign science. The problem of different interpretations of the subject and features of philosophy is superimposed on the features of applied knowledge positioned as philosophy of sport [1, 2, 7, 10, 13].

At the same time, philosophical developments in the USA and Western Europe differ from their Eastern European and Soviet-Russian analogues in the following main aspects:

- the lag of philosophical Eastern European and Soviet-Russian research behind Western European research initially by 45-50, and subsequently by 25-30 years, gradually reducing this gap;

- unlike Western European science, based on the results of empirical research interpreted in ontological and epistemological contexts, Eastern European and Soviet-Russian works often belonged to areas of axiology that do not have scientific and philosophical status in the West. It should be noted that in the last two decades, this difference has gradually been leveled with the dominance of the Western approach;

- the main directions and foundations of Western philosophy of sport until now have been tacitly positivism, neopositivism, postpositivism, structuralism, and explicit and actively positioned - pragmatism, existentialism, hermeneutics, modernism, symbolism. Neo-Marxism and orientalism were rejected as weak directions that did not deserve the right to be included in the World Anthology of Philosophy of Sport. Modern sports mythology is increasingly claiming the role of modern philosophical anthropology of sport in Western specialized literature. Until the end of the 20th century, Soviet-Russian materials on the philosophy of sport formally declared their commitment to dialectical materialism. In reality, they were increasingly inclined to pro-Western examples of specialized and applied philosophizing.

In general, all existing materials on the philosophy of sport can be conditionally divided into three levels:

1) the level of philosophical self-reflection;

2) the level of philosophical foundations of sports science;

3) the level of philosophical understanding of the real sports process.

It should be recognized that the majority of applied philosophical research, especially in the Eastern European and Soviet-Russian cluster of scientific research, belongs to the first level, which is not familiar with either sports science or the sports process, that is, it is very far from the real phenomenon of sports.

The second and third levels of Western philosophy of sports, on the contrary, are often very far from the classical understanding of the subject of philosophy, but correspond to the European interpretation of philosophy as a theoretical or theoretical-empirical study. Therefore, such topics as a comparative analysis of doping tests of athletes are considered quite philosophical in the West and deserve the right to be placed on the pages of the World Anthology of Sports.

A characteristic feature of the entire philosophy of sports is the uncritical mixture of philosophy, sociology, political science, cultural studies, psychology and pedagogy.

2. The problem of different interpretations of the phenomenon of sport. The concept of «sport», which has English, French, Spanish and other etymological versions that arose in the New Age, and perhaps earlier, in the 18th-19th centuries is already quite clearly associated with the verb "to have fun" and the noun «entertainment». The specifics of sports entertainment depended on the national and social class affiliation of those having fun, which certainly served as the basis for the formation of future sports. Most scientists are confident that any, even passive-contemplative, participation in physical (body-motor) recreational and entertaining activities, including outdoor recreation and a healthy lifestyle in general, which involves morning exercises with jogging or periodic visits to the gym, introduces to sport.

3. Problems of modern science about sport in the light of history and philosophy of science. The cluster of natural scientific knowledge was the first to develop in Europe in the following order: mathematics, physics, chemistry, biology. The first classical and non-classical hypothetico-deductive theories were created in it. With a lag of about 1.5 centuries in Europe, on the basis of natural scientific borrowings in the direction of creating hypothetico-deductive theories, social sciences also began to develop: political, political economy, economic, other social and, finally, sociological. In the second half of the 20th century, UNESCO positions the concept of so-called «breakthrough theories», which are understood as a synthesis of hypothetico-deductive theories and specific sociological research. It is recognized that only such a synthesis can provide reliable or, at least, highly probable knowledge [1]. Sports science, as an applied science, taking into account its tendency towards natural-scientific empiricism and/or social and humanitarian scholas-

ticism, still remains in the positions of descriptive theories and abstract theorizing, and is also still distinguished by a very weak connection with the main science, and in all directions [1].

The apotheosis of the development of sports science (mainly Soviet) are considered to be general and integrative theories: physical education, physical education, history of physical culture, physical culture and sports, history and theory of sports, sports training, sports training, sports competition.

4. The problem of three theoretical dimensions of sports. The real history of sports knows three main dimensions: socio-cultural, political, religious. Until recently, in the history and philosophy of sports, the decisive emphasis was placed on its socio-cultural dimension [2, 4, 9, 10]. Moreover, this dimension was considered almost exclusively in the context of the cultural and civilizational values of democracy, humanism, and tolerance accepted in Western society and formed in the second half of the 20th century.

The political dimension of sport was initially presented as a debatable issue requiring specific historical research, usually reduced to a tendentious selection of relevant facts [8, 10]. But bare, and even selective, facts, from the point of view of general subject-object knowledge of the most general laws, as is known, are of no significant importance.

At the same time, the religious dimension of sport in applied philosophy was not subjected to either historical or philosophical analysis [2-12, 14, 15].

5. Philosophy of sport and the problem of historical and philosophical falsification. Modern philosophy of sport, as well as social and humanitarian profile science, is full of historical and historical and philosophical falsifications, which include, in particular, the ideas about the general cultural nature of sport and Olympism; about their non-religious and non-political nature; about the social similarity or likeness of ancient sport and Olympism with their modern versions; about the unity and consistency of the cultural and civilizational role of sport and Olympism, even in the context of the philosophical problem of alienation.

Obviously, it is impossible to build a scientific and philosophical theory of sport on such an illusory philosophical and historical basis.

6. The problem of considering the philosophy of sport as the philosophy of Olympism. In foreign and domestic philosophy, there is a position, which has its supporters, considering the philosophy of sport as the philosophy of Olympism. As such, this recognition is wishful thinking and, in particular, is based on the philosophical and pedagogical maxims of Pierre de Coubertin, which largely assumed the restoration or creation of a new Olympic religion [7, 12, 14, 15]; on the attempts of Hans Lenk to develop a "new philosophical anthropology of sport", which objectively serves as a prospect for the creation of a modern sports-Olympic mythology [2, 7].

7. The problem of the historical and philosophical falsification of Olympism. Philosophical speculations around Olympism have their own falsified historical and factual basis, traditionally passed off as the real history of Olympism. In this regard, practically all key points of the theory and history of Olympism are subject to certain correction, the inaccurate or incorrect interpretation of which purposefully turns Olympism into an illusory-mythological champion of Western market ideology [2-12].

8. The problem of logical-linguistic inconsistency of the specialized thesaurus. All the above-mentioned distortions, errors and shortcomings are reflected in the specialized-applied thesaurus of the philosophy of sport, which should also be substantially revised in order to form a basis for a consistent logical-linguistic analysis, immanent in any hypothetical-deductive theoretical model and program of specific sociological research [1].

Conclusions. As a theoretical perspective, the design of a scientific and philosophical theory of sport is possible under the condition of a systematic resolution of all problematic issues considered in the study. The structure of the model of scientific and philosophical theory presented in the article assumes the development of a number of sections of philosophical applied knowledge in the fields of history, science, religion, politics, culture, logical and linguistic analysis.

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Assessment of cyclists' pedaling techniques by patterns of muscle bioelectrical activity

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Abstract

Objective of the study was to identify the features of the parameters of bioelectric activity of muscles that characterize the pedaling technique using the electromyography method.

Methods and structure of the study. A pilot study was organized with the participation of 2 athletes who had experience competing in major international cycling competitions. Each athlete performed a task during a standardized 30-second anaerobic test (Wingatetest) on a Cyclus 2 bicycle ergometer, recording the bioelectrical activity of the leading muscle groups of the legs.

Results and conclusions. Analysis of electromyograms made it possible to identify the individual characteristics of the implementation of the motor potential of each athlete according to parameters characterizing the contribution to the work of the leading muscle groups, the asymmetry of the manifestation of muscle activity on the left and right, as well as the ratio of muscle activity in the bench press and pull-up phases. The presented approach made it possible to clearly reflect the features of the pedaling technique of two athletes with a comparable level of preparedness and to form an objective idea of the mechanisms of involvement of the leading muscle groups in the work of the pedaling phases. A promising direction for further research is the use of electromyography as a means of biofeedback to optimize pedaling technique.

Keywords: *electromyography, bioelectrical muscle activity, cycling, pedaling.*

Introduction. The basis of a cyclist's pedaling, from a mechanical point of view, is the creation of a torque on the carriage axis to move the cranks along a circle. This process is cyclical and consists of movements repeated in a certain sequence. In the cycle of one revolution of the crank, two main parts are distinguished: pressing and pulling. During the cycle of the crank revolution, the thigh and shin produce a pendulum-like movement, transmitted through the foot into a rotational movement. During pedaling, movement occurs in three joints - the hip, knee and ankle, but the muscles involved in this can perform different work depending on the skill of the athlete. A cyclist comprehends the art of pedaling faster and better if he specially trains the extensor muscles that ensure the active transfer of the pedal through the upper position, and the flexors involved in pulling the pedal during the completion of this movement [4]. However, it is visually impossible to understand to what extent the muscles key to this motor action are involved in the work, and what is the amplitude of their work. Meanwhile, the study of this process is of great importance for assessing pedaling technique and improving the athlete's performance by optimizing it [4].

Methods and structure of the study. In order to develop an approach to assessing pedaling technique in terms of the involvement of the leading muscle groups of the legs, a pilot study was organized with the participation of two cyclists with ex-

perience of performing in major international competitions. The testing program included performing a standardized anaerobic test (Wingatetest) on a Cyclus 2 bicycle ergometer, lasting 30 s, with recording the bioelectrical activity of the leg muscles. This test task is specific to cycling and is regularly used to assess the level of athletes' fitness. To record muscle bioelectrical activity signals, a mobile hardware and software complex Delsystrignoavanti (Delsys, Inc., Massachusetts, U.S.A) with wireless skin electrodes with a built-in inertial unit was used.

Results of the study and discussion. The total EMG analysis was performed based on amplitude characteristics. A 6th-order Butterworth bandpass filter with a pass frequency in the range from 30 to 600 Hz was used to filter out various motor artifacts that distort the quality of the original signal. For the purpose of comparative analysis, two pedaling phases were distinguished in each data set characterizing the athlete's work during the test task: pressing and pulling up. This is due to the need to perform active muscle work not only in the pressing phase, but also in the pulling up phase, in order to achieve maximum movement performance by distributing the load in each cycle between the two limbs. The phase boundaries were determined by regular changes in the synchronously recorded gyroscope signal from the rectus femoris muscle (Biceps femoris). The gyroscope signals were preliminarily filtered using a median filter with a window width of 0.05 seconds.

The resulting files were exported for further analysis to Microsoft Excel, where the developed automated analysis template was used to automate the computational processes. Automation of a number of operations was implemented using macros. Using a template, the boundaries of the pressing and pulling phases were identified, the identification criterion of which is the intersection of the gyroscope signal with the isoline (in this case, the zero line). Depending on the polarity of the gyroscope signal, each pedaling phase was identified (the

Table 1. Results of the analysis of electromyography data of the leg muscles of athlete 1 during pedaling (front view)

Muscles	R Rectusfemoris	L Rectusfemoris	R Vastuslateralis	L Vastuslateralis	R Vastusmedialis	L Vastusmedialis	R Tibialisanterior	L Tibialisanterior
Parameters characterizing muscle work in the bench press phase								
A±σ, mkV	151,3±41,4	165,1±27,4	497,3±119,3	466,0±97,5	326,6±82,1	280,8±54,8	178,0±84,9	83,5±43,4
CW, %	5,2	5,6	17,0	15,9	11,2	9,6	6,1	2,9
ASI, %	8,7		6,5		15,1		72,2	
R/L, %	47,8	52,2	51,6	48,4	53,8	46,2	68,1	31,9
Parameters characterizing muscle work in the pull-up phase								
A±σ, mkV	50,0±15,4	59,3±19,1	138,4±52,5	139,7±60,6	97,7±29,8	76,8±22,0	82,1±38,0	83,7±21,5
CW, %	3,8	4,5	10,6	10,7	7,5	5,9	6,3	6,4
ASI, %	16,9		0,9		24,0		1,9	
R/L, %	45,8	54,2	49,8	50,2	56,0	44,0	49,5	50,5

Table 2. Results of the analysis of electromyography data of the leg muscles of athlete 1 during pedaling (rear view)

Muscles	R Bicepsfemoris	L Bicepsfemoris	R Gastrocnemiuslateral	L Gastrocnemiuslateral	R Gastrocnemiusmedial	L Gastrocnemiusmedial
Parameters characterizing muscle work in the bench press phase						
A± , mkV	100,9±43,7	76,8±22,2	127,3±80,3	140,0±61,0	165,9±73,5	164,0±57,8
CW, %	3,5	2,6	4,4	4,8	5,7	5,6
ASI, %	27,2		9,5		1,2	
R/L, %	56,8	43,2	47,6	52,4	50,3	49,7
Parameters characterizing muscle work in the pull-up phase						
A± , mkV	72,1±35,2	74,3±25,6	142,9±86,1	85,2±44,3	107,7±43,9	92,9±44,2
CW, %	5,5	5,7	11,0	6,5	8,3	7,1
ASI, %	3,0		50,5		14,7	
R/L, %	49,2	50,8	62,6	37,4	53,7	46,3

area of positive values corresponds to the pressing phase, and negative values - to the pulling phase).

Based on the functional purpose of the muscle groups that were studied, the peak activity of almost all of them falls on the press phase, with the exception of the anterior tibial muscle (Tibialis anterior).

Based on the initial data of the bioelectrical activity of the muscles, the parameter - contribution to work (CW, %) was calculated, characterizing the contribution of each muscle to the overall performance of movements, expressed as a percentage of the total activity of all muscles [1]. To assess the asymmetry of muscle work on the left and right, a parameter widely used in sports research - ASI [2, 3] was used. The indicators of this parameter characterize the percentage difference between the right and left parts of the athlete's body when performing motor actions.

The parameters analyzed based on the results of electromyogram patterns are of high practical value for a deep understanding of the mechanisms of realizing the motor potential of cyclists when pedaling, characterizing the internal form of this process.

For a visual representation of the dominant side in the analysis of the asymmetry of muscle work, the ratio between them was calculated (hereinafter in the tables it is designated - R/L, %). The results of the electromyography data analysis for the athletes who took part in the study are presented in Tables 1-4.

Based on the results of the data analysis, the following conclusions can be drawn:

With varying degrees of severity, both athletes are characterized by a predominance of muscle activity in the pressing phase during the pedaling process compared to the pulling phase. The most significant predominance of pressing efforts is observed on the part of the leading limb.

Both athletes have a high level of asymmetry in the work of individual muscle groups (ASI index over 15%). This feature is a reflection of unbalanced work and has a negative impact on the efficiency of pedaling. This logically correlates with the results of the test, where athlete 2 has a lower indicator: 1298 W versus 1345 W for athlete 1. The

Table 3. Results of the analysis of the electromyography data of the leg muscles of athlete 2 during pedaling (front view)

Muscles	R Rectusfemoris	L Rectusfemoris	R Vastuslateralis	L Vastuslateralis	R Vastusmedialis	L Vastusmedialis	R Tibialisanterior	L Tibialisanterior
Parameters characterizing muscle work in the bench press phase								
A±σ, mkV	136,0±29,3	80,5±13,9	151,9±28,6	128,9±20,6	114,2±21,6	109,8±21,1	116,2±31,1	58,7±14,3
CW, %	10,1	5,9	11,2	9,5	8,4	8,1	8,6	4,3
ASI, %	51,3		16,4		3,9		65,6	
R/L, %	62,8	37,2	54,1	45,9	51,0	49,0	66,4	33,6
Parameters characterizing muscle work in the pull-up phase								
A±σ, mkV	45,0±9,1	32,0±12,0	44,4±13,5	63,1±29,2	37,1±12,7	46,5±17,4	98,5±15,2	60,0±8,2
CW, %	5,7	4,0	5,6	8,0	4,7	5,9	12,4	7,6
ASI, %	34,0		34,8		22,7		48,5	
R/L, %	58,5	41,5	41,3	58,7	44,3	55,7	62,1	37,9

Table 4. Results of the analysis of electromyography data of the muscles of the back legs of athlete 2 during pedaling (rear view)

Muscles	R Bicepsfemoris	L Bicepsfemoris	R Gastrocnemiuslateral	L Gastrocnemiuslateral	R Gastrocnemiusmedial	L Gastrocnemiusmedial
Parameters characterizing muscle work in the bench press phase						
A±σ, mkV	53,9±9,1	66,6±9,7	98,0±21,8	69,1±11,6	78,5±16,9	90,8±14,8
CW, %	4,0	4,9	7,2	5,1	5,8	6,7
ASI, %	20,9		34,6		14,5	
R/L, %	44,8	55,2	58,7	41,3	46,4	53,6
Parameters characterizing muscle work in the pull-up phase						
A±σ, mkV	35,1±6,2	54,4±10,7	68,8±15,8	57,7±16,3	76,5±17,5	72,5±14,9
CW, %	4,4	6,9	8,7	7,3	9,7	9,2
ASI, %	43,2		17,7		5,3	
R/L, %	39,2	60,8	54,4	45,6	51,3	48,7

same trend is in the ratio of muscle activity in the press and pull-up phases (unequally for the left and right legs), as well as in the average ASI index for all muscles studied: 29,5 versus 18,0. Based on the initial results of the study, it is impossible to assess to what extent these features affect the technique of athletes' movements, however, it is known from earlier publications that the presence of equal efforts when pedaling on both sides is an important condition for highly efficient work [2, 3].

Conclusions. The presented approach allows to visually reflect the total bioelectrical activity of the left and right leg muscles during pedaling, compare the results of different athletes with each other and form an objective idea of the mechanisms of involvement of the leading muscle groups in the work by the phases of movements. With a proportionate total ratio of muscle activity in the phases of the press and pull-up, different athletes may have significant differences in the composition of the activity distribution between the leading muscle groups, the degree of asymmetry of the left and right legs, and, as a consequence, in the nature of pedaling with visually identical work. A promising direction for further research is the use of the electromyography method as a means of biological feedback to optimize the pedaling technique of cyclists.

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Control of technical and tactical readiness of athletes in all-style karate

UDC 796.799

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Abstract

Objective of the study was to improvement of athletes control over the technical and tactical readiness of athletes in all-style karate.

Methods and structure of the study. 14 representatives of the Russian national all-style karate team took part in the pedagogical experiment, which took place during the All-Russian training camp, in preparation for the World Championship, analysis of information sources, control tests, expert assessment, mathematical and statistical methods.

Results and conclusions. The experiment made it possible to determine the current state of the theory and practice of monitoring the technical and tactical readiness of athletes in all-style karate. A promising direction of this work is the use of artificial intelligence, implemented in relevant digital resources.

Keywords: *control in sports, technical and tactical training, all-style karate.*

Introduction. Analysis of information sources, our own scientific research and personal coaching experience allows us to conclude that the theoretical and practical aspects of monitoring the technical and tactical readiness of athletes in all-style karate have not been sufficiently developed to date. Based on the research of E.M. Chumakov in sambo, we have previously developed indicators of technical and tactical readiness of karatekas, and also partially determined the corresponding model characteristics of qualified athletes [1, 2, 6]. The proposed approaches can be used in training qualified athletes, while when training beginner karatekas, it should be remembered that their technical resources are limited.

Objective of the study was to improvement of athletes control over the technical and tactical readiness of athletes in all-style karate.

Methods and structure of the study. 14 representatives of the Russian national all-style karate team took part in the pedagogical experiment, which took place during the All-Russian training camp, in preparation for the World Championship, analysis of information sources, control tests, expert assessment, mathematical and statistical methods.

Results of the study and discussion. According to R.A. Piloyan, at the initial stage of training, martial artists master some motor skills and technical arsenals of their sport [5]. Previously, we formulated a classification of technical actions in all-style karate in the full contact discipline, which can be relied upon in the process of control (visual, instrumental, complex) [2].

When visually assessing movement, you can use the technology used in the All-Russian Physical Culture and Sports Complex «Ready for Labor and Defense» for the «Self-Defense Without Weapons» test. Thus, points are awarded for performing a technical action: 1 point - if there are 2 errors in demonstrating the technical action; 2 points – if there is 1 error; 3 points – when performing a technique without errors [3]. For a more detailed analysis, you can use a 5- and 10-point rating system.

Let us give an example of the implementation of comprehensive monitoring of the technical readiness of 14 representatives of the Russian national team in

Results of assessing the technical preparedness of members of the Russian national team in all-style karate

Technology section	Features of the technique	Weight categories, kg				
		Men				Women
		90/90+	80	70	60	60
Punches	Number of beats in 8 s	35,3±4,2	60±4,2	37±10,1	50±7,1	31±9,6
	Total tonnage of impacts in 8 s, (cu)	3463±1081	4036,5±805,4	3526±496,6	5629,5±474	2517±445
	Average severity of punches (cu)	97,5±28	67±8,5	101,6±34,8	114,4±25,7	84,7±23,5
Kicks	Impacts on the electronic paw (point)	7,6±0,6	8,0±0,2	8,4±0,4	7,0±0,2	7,2±0,4
Fighting technique	Throws (point)	5,94±0,5	7,5±1,6	5,8±0,3	5,5±0,5	5,3±0,6

all-style karate, which took place during the All-Russian training camp, in preparation for the World Championship. Three referees were involved to assess preparedness (two of the All-Russian category and one of the first).

To assess the quality of punches, a control test was used - punches for 8 s on a dynamometer dummy KIKTEST-209-2M with a «BOXBOX» target. As a result, the number of strikes and their total tonnage were determined (table). According to the manufacturer, the device is not a measuring device (it has significant errors with the reference value of kg), but it is capable of ranking impacts according to the peak value of the pulse. In this regard, the physical parameters of the estimated impacts in the table are reflected in conventional units.

To evaluate the technique of kicks, a control test was used - kicks on an electronic paw with a KIKTEST-L5 impact force sensor. In accordance with four options for the color indication of the sensor, the blows inflicted were classified as weak, average, above average, strong (see table). The paw indicator served as a guide for the judges to understand the accuracy and force of the blow.

The throwing technique was assessed on a non-resisting partner under standard conditions (see table). Throws and kicks were assessed on a 10-point scale.

Analysis of the table allows us to note the following trends. The speed of punches in men varies in waves depending on the weight category; it reaches its maximum value in representatives of the 80 kg weight category, and the minimum in heavy categories. In terms of the «Total tonnage of blows» indicator, the largest values were shown by representatives of the 60 kg weight category, this figure was 28% less for representatives of the 80 kg weight category and 38% less for athletes in the 70 kg weight category and heavy categories. In terms of the «Average severity of impacts» indicator, the highest values were also shown by representatives of the 60 kg category, and the lowest by 80 kg. Comparing the performance of men and women of the same weight category (60 kg), we can state that the speed of technique execution and the severity of blows for men are significantly higher (by 38% and 26%, respectively) than for women. The quality of kicking technique is almost the same among representatives of different weight categories and gender. A relatively low quality of throws is observed in all subjects, which indicates the need to increase the effectiveness of teaching methods in this section of technique (see table).

A promising direction in monitoring technical readiness is the use of artificial intelligence, implemented in relevant digital resources [3]. In China, a mobile application «LeDynamics» has been developed, which is used to conduct online competitions in performing basic exercises (squats, push-ups, jumping rope, etc.). This application is not currently available on the Russian market. Artificial intelligence makes it possible to increase the accuracy of measuring certain characteristics of equipment (temporal and spatial characteristics), the speed of processing the information received, and reduce human labor. However, it can be stated that today artificial intelligence cannot be fully self-sufficient in the process of monitoring technical readiness.

Control of tactical knowledge is carried out by surveying or conducting written testing of those involved in the traditional or online way.

Control of tactical thinking in martial arts is the most difficult to implement. It can be carried out using digital and instrumental technologies that simulate the course of a fight, where the speed and correctness of decision-making is the measurement scale.

Conclusions. The conducted research made it possible to determine the current state of the theory and practice of monitoring the technical and tactical readiness of athletes in all-style karate. A promising direction of this work is the use of artificial intelligence, implemented in relevant digital resources.

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Indicators that determine the physical readiness of young judokas aged 13-14 years for fights

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Abstract

Objective of the study was to identify indicators of physical readiness that influence the effectiveness of technical actions and attacking combinations of young judokas aged 13-14 years.

Methods and structure of the study. The experiment was carried out in 2023 on the basis of a sports school, in which young judokas from the training group took part. The intensification of training tasks in the process of special motor training made it possible during the formative experiment to identify significant indicators of the development of speed, speed-strength, coordination abilities and speed endurance.

Results and conclusions. To perform a series of throws with a two-handed grip, throws over the shoulder from a lapel grip and other complex technical combinations, agility, coordination of movements, speed and strength are required, since in a short period of time a judoka must assess the situation, instantly make the only correct decision and execute accurately technical action. Indicators of the degree of physical readiness of young judokas aged 13-14 years for competitive activities have been identified, contributing to the growth of technical and tactical skills.

Keywords: *judo, throws; physical training; competitive activity; fights, athletes.*

Introduction. Modern judo fights are a complex of dynamic actions, where the physical, technical and tactical capabilities of athletes are most clearly demonstrated [1]. The most spectacular judo fights are associated with technically correct attacking combinations, supported by high physical readiness of athletes. By implementing attacking combinations, judokas achieve victories. [1, 2].

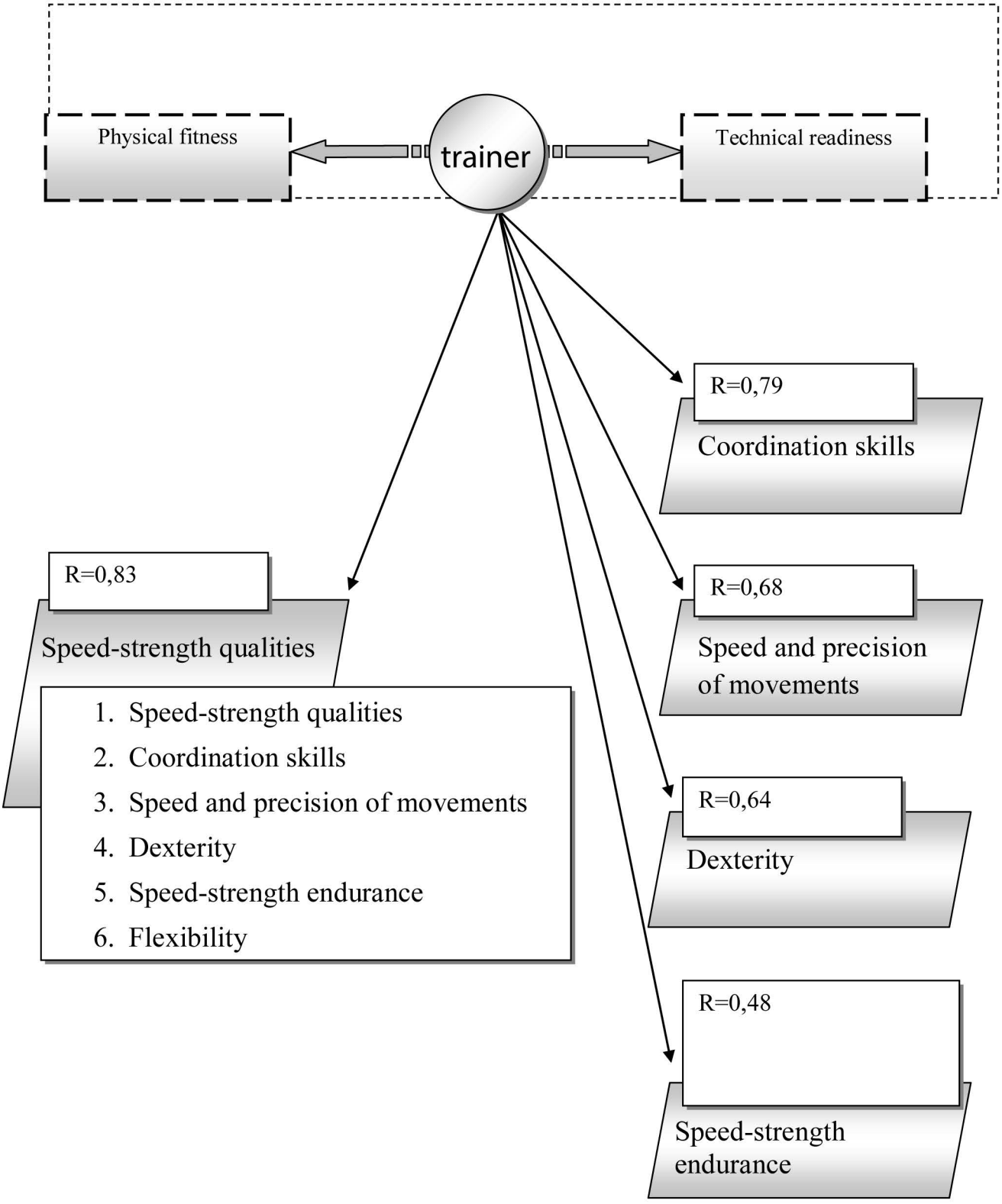
Young judokas aged 13-14 are at the stage of learning complex technical combinations. At the same time, in order to effectively carry out attacking combinations, they must be physically prepared. To perform a throw with a sweep from the inside, to perform a number of throws with a two-handed hold, throws over the shoulder from a lapel hold and other complex technical combinations, dexterity, coordination of movements, speed and strength are required. In a short period of time, a judoka must assess the situation, instantly make the only correct decision and perform an accurate technical action. [1, 2]. Physical fitness is of great importance for performing complex technical combinations, but to date, the indicators that determine the physical fitness of young judokas aged 13-14 years for fights have not been scientifically substantiated.

Objective of the study was to identify indicators of physical fitness that influence the effectiveness of technical actions and attacking combinations of young judokas aged 13-14 years.

Methods and structure of the study. A formative pedagogical experiment was conducted at a sports school in 2023, involving 13-14 year old judokas training in a training group. The study identified the main technical actions of judokas and their relationship with indicators that determine the physical and technical readiness of athletes for fights.

Results of the study and discussion. It has been established that in order to perform various technical actions, exercises must be performed on individual muscle groups of the arms, legs and torso (see figure).

The figure shows the high degree of influence of the level of physical fitness on the effectiveness of



The degree of influence of physical fitness on the effectiveness of attacking combinations of young judokas aged 13-14 years (according to the correlation coefficient)

the main technical actions. Let us consider these technical actions and their dependence on the manifestation of certain physical qualities during judokas' training.

It is shown that none of the grips is performed without the manifestation of strength, dexterity and speed. Therefore, during grip training, special attention is paid to the use of exercises that require the manifestation of these physical qualities. [1-3].

All grips are divided into attacking and blocking. Blocking grips aim to limit the mobility of the opponent's actions, and attacking grips are aimed not only at limiting the effectiveness of his actions, but also at tiring the opponent in various ways during the fight in order to prepare for the implementation of a particular technical action or technique. [1-3]. Such actions require judokas to demonstrate speed-strength qualities.

Several phases can be distinguished during the struggle for a grip in judo. During the non-contact phase of the struggle for a grip, active footwork is required in order to choose the most active position in relation to the opponent. This requires coordinated footwork from athletes. During the first contact phase, deceptive actions can be performed to disorient the opponent. In the third phase, the capture itself is performed, from which it is convenient to perform an active scoring technical and tactical action. And in the final phase, the fight itself is carried out in a convenient capture. This is especially well seen when performing throws with a sweep.

Throws with a sweep can be performed with minimal resistance from the opponent and throws with significant resistance from the opponent. This depends on the preparatory actions of the judoka. In the practice of performing throws with a sweep from the inside, there are deceptive preparatory actions, which lead to different types of execution of such throws. Performing throws with a sweep from the inside with significant resistance from the opponent requires a different technique. In this case, it is necessary to impart rotation when performing the throw. This requires the manifestation of dexterity and precision of movements. The degree of influence of these qualities is very high, or high. Judokas in the course of competitive activity mainly perform throws with a sweep from the inside, performing complex deceptive preparatory actions. Throws with a sweep should be performed after preliminary deceptive actions that mask the true intentions of the judoka. In the practice of performing throws with a sweep from the inside, there are deceptive preparatory actions, which lead to different energy costs when performing such throws. Performing throws with a sweep from the inside with significant resistance from the opponent requires great effort and a different throwing technique. This indicates insufficient preparation for the throw, during the execution of preliminary deceptive actions in the fight for capture. In this case, it is necessary to impart a powerful rotation when performing a throw, which requires additional effort. In this case, the manifestation of strength, dexterity and precision of movements in a judoka comes to the fore. Judokas, during competitive activities performing throws with a sweep from the inside, must carry out complex deceptive preparatory actions. Performing a number of throws with a capture of two hands requires not only the development of speed-strength qualities, but also the development of endurance. Performing a number of throws with a capture of two hands is carried out simultaneously with blocking the opponent's arms. Often, in order to increase the force of impact on the opponent, judokas bend in the lumbar part of the back before the throw. This requires additional effort from the back muscles. Before training such throws, it is necessary to first use exercises that develop individual muscle groups of the back, as well as flexibility training. For young judokas aged 13-14, this is often a difficult task to accomplish. Since the main task of a judoka is to complicate the opponent's defensive actions when performing a series of throws with a two-handed hold.

Since a series of throws with a two-handed hold are performed simultaneously with blocking the opponent's hands, it is necessary to mask your actions well. This requires young judokas to demonstrate speed-strength endurance.

According to many experts, performing shoulder throws from a lapel hold is one of the simplest technical actions that does not require lengthy training to practice the technique of movements. Therefore, before you begin training to perform shoulder throws from a lapel hold, you should significantly improve your level of physical fitness, and also pay close attention to the development of agility and speed. Despite the fact that performing shoulder throws from a lapel hold is a relatively simple technical action, its implementation requires significant

physical effort. Meanwhile, learning this technical action requires special physical readiness from young judokas aged 13-14, associated with the manifestation of agility, strength and speed. When training this technical action, speed-strength readiness comes first in its importance.

Conclusions. Thus, to improve technical actions, complex combinations and perform signature throws, it is necessary to demonstrate and develop a high level of a number of physical qualities. Among them, in terms of their importance and influence on the technical capabilities of young judokas, the following can be distinguished: speed-strength qualities, coordination of movements, speed and accuracy of actions, agility, speed-strength endurance and flexibility. The identified indicators of physical readiness of young judokas aged 13-14 for competitive activities will more effectively contribute to the growth of their technical and tactical skills.

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Capabilities of «motion capture» systems in identifying features of cyclists pedaling techniques

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Abstract

Objective of the study was to determination of kinematic parameters characterizing pedaling technique using «motion capture» systems.

Methods and structure of the study. To solve this problem, a pilot study was organized with the participation of 2 athletes who had experience competing at major international cycling competitions. Each athlete performed a test with a progressive increase in power to failure on a bicycle ergometer using a Cyclus 2 bicycle station and a Simi Aktisys motion capture system.

Results and conclusions. Analysis of the obtained video sequences after their computer processing made it possible to identify the most variable biokinematic links in the dynamics of performing a test on a bicycle ergometer with a linearly increasing load (15 W/min). The most pronounced changes were observed for the ankle joint and the position of the torso relative to the horizontal. The results obtained allow us to draw logical conclusions about the possibility of using «motion capture» systems to obtain accurate data characterizing the features of the kinematic parameters of pedaling, without affecting the biomechanical structure of the athlete's movements. The use of new approaches in the study of kinematic characteristics of pedaling will improve the efficiency of monitoring the technical readiness of highly qualified cyclists.

Keywords: *kinematic parameters, motion capture, cycling, pedaling.*

Introduction. Peculiarities of pedaling technique on the road and track at different distances are associated with the need to develop both the maximum and optimal pedaling frequency for each type of race when rotating the pedals, using cranks of different lengths and different gear ratios. But in any type of race, when pedaling, the knee joints must move in strictly vertical and parallel planes [5]. If this requirement is met, a dynamic stereotype is developed, and movements become lighter and freer. A common condition for all cyclists is the expediency and economy of movements and the associated correct alternation of tension and relaxation of individual muscle groups involved in pedaling [1, 2].

Objective of the study was to determination of kinematic parameters characterizing pedaling technique using motion capture systems.

Methods and structure of the study. In assessing pedaling technique, the primary task is to determine the features of the kinematic parameters that characterize it [1]. A pilot study was conducted with the participation of two athletes with experience of performing in major international cycling competitions. Each athlete performed a test with a linearly increasing load to failure on a cycle ergometer using a Cyclus 2 exercise bike and a Simi aktisys motion capture system. The testing procedure included the following steps: installing the athlete's personal bicycle on the exercise bike; 15-minute warm-up on the cycle ergometer; attaching markers (active and passive) to key anatomical landmarks: shoulder joint; ilium of the pelvis; upper thoracic region; lower thoracic region; hip joint; knee joint; ankle joint; little toe joint; bicycle crank; performing a test with a linearly increasing load

(15 W/min) and a regulated pace (n=70 rpm) until failure (the starting load was 120 W).

«Motion capture» was performed in the sagittal plane using an industrial video camera with a data recording frequency of n=100 frames/sec, mounted on a tripod at a distance from the athlete in such a way that the size of the object of study occupied at least 70% of the measurement volume. A marker was attached to each anatomical landmark with double-sided hypoallergenic tape, which was tracked by the motion capture system during pedaling.

Then, minute-long segments of pedaling were isolated from the general video sequence, after analyzing which the following parameters were calculated: values of joint angles (ankle, knee and hip); torso tilt in the sagittal plane relative to the horizontal; angle of rotation of the bicycle crank.

Results of the study and discussion. Identification of the kinematic features of pedaling technique is inextricably linked with rational pedaling technique, which involves effective performance of the motor task mainly due to the main control movements with minimization of auxiliary ones [3]. The presence of auxiliary movements can be the reason for the imperfection of the technical training of the athlete, and also characterize the process of fatigue during the exercise. Therefore, the proposed test on a bicycle ergometer is informative for identifying the most variable biokinematic links, determining the presence of auxiliary movements, their localization, nature and possible causes of occurrence [1, 4]. Based on the results of the analysis of video sequences recorded using the «motion capture» system and their computer processing, the most pronounced changes in the measured joint values in the dynamics of the test task were revealed for the ankle joint and the position of the body relative to the horizontal. In order to clearly reflect the dynamics of the measured values, we constructed graphs reflecting the work for each athlete in the first and last minute of pedaling, and also determined the amplitude of these movements. The analysis of the results allowed us to identify the regular changes in pedaling technique in the last minute of work, which are typical for all athletes, accompanied by high-amplitude auxiliary movements. As an example, the graph of one of the athletes is presented, which reflects the identified patterns (Fig. 1-3).

The graph shown in Fig. 1 shows that the magnitude of the tilt of the trunk and the amplitude of its oscillations by the end of the test task (against the background of fatigue) changes significantly, which characterizes the change in landing and is an indicator of the occurrence of auxiliary movements aimed at stronger pressing of the pedal in the press area with significant involvement of body weight.

In Fig. 2 and 3, the nature and amplitude of vibra-

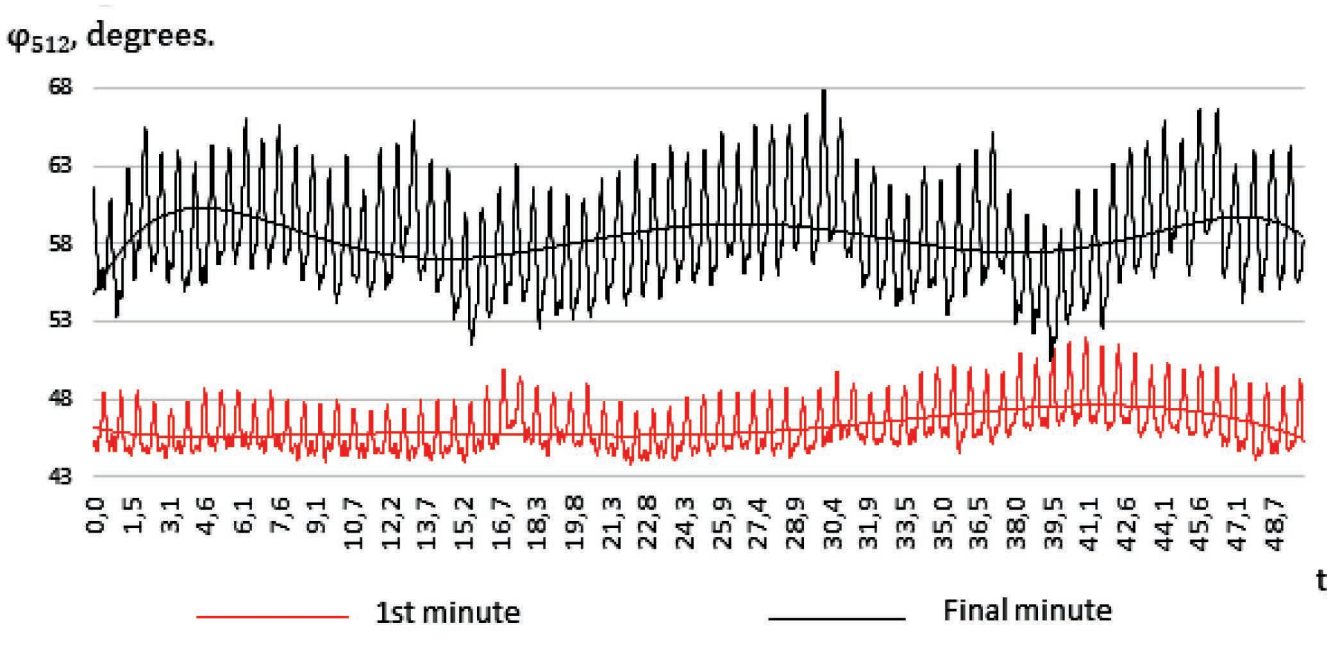

Fig. 1. Dynamics of the angle of inclination of the body relative to the horizontal when performing a load test on a bicycle ergometer

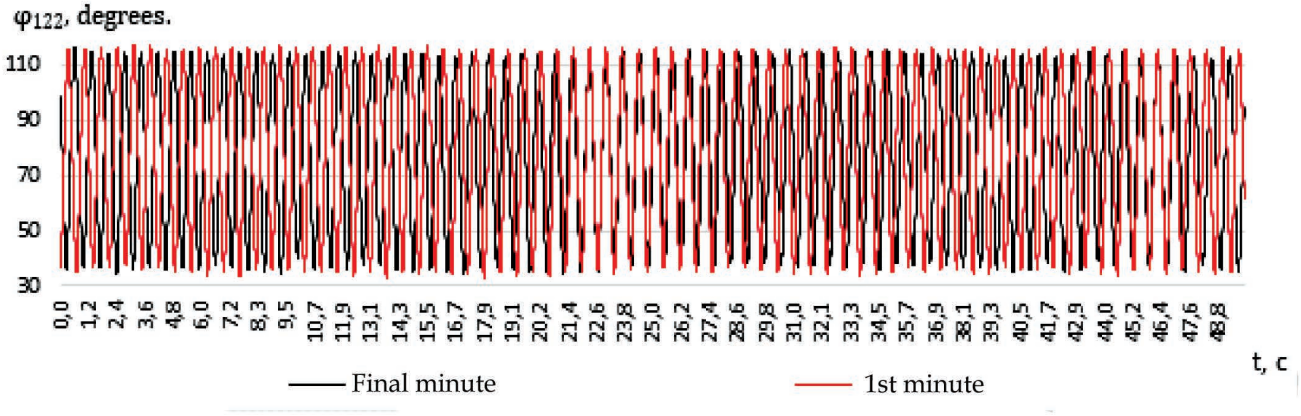

Fig. 2. Dynamics of the angle in the knee joint during the load test on a bicycle ergometer

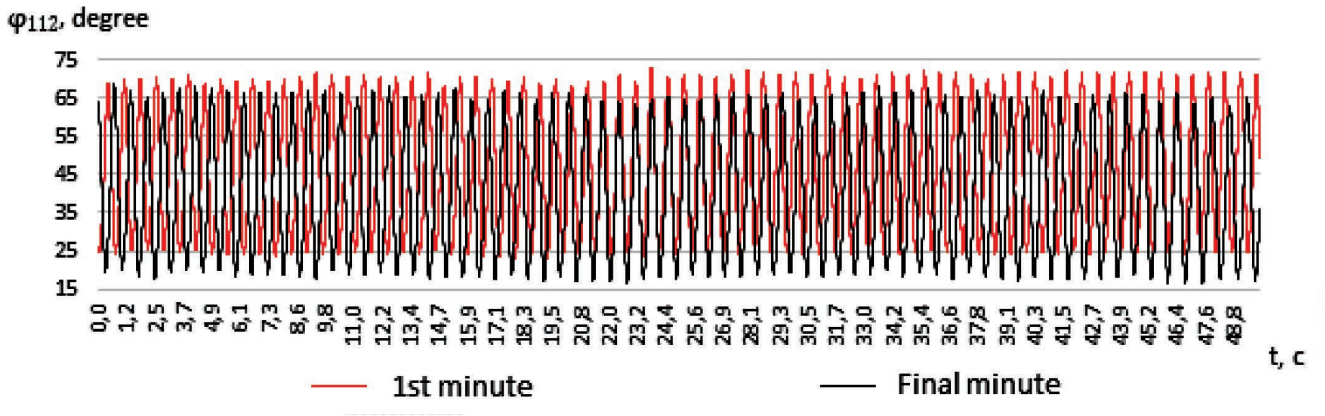

Fig. 3. Dynamics of the angle in the hip joint during the load test on a bicycle ergometer

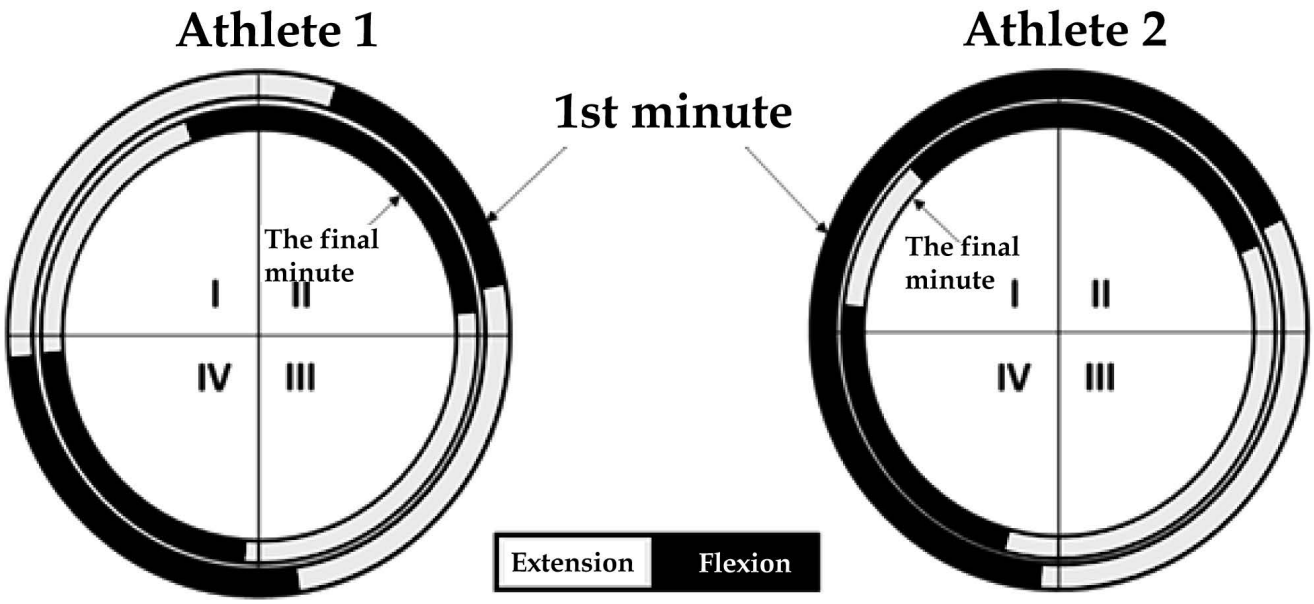

Fig. 4. An annular diagram of the dynamics of flexion-extension of the ankle by pedaling phases in different athletes

tions in the dynamics of pedaling with a change in load did not change significantly, which allows us to conclude about the relative stability of these biokinematic links.

The most variable nature of the work according to the results of the study was revealed for the ankle. When pedaling, the nature of the work may vary significantly. The differences in pedaling stereotypes among different athletes, as well as the high variability of the ankle when performing a test task with an increasing load, are clearly reflected in the ring diagrams shown in Fig. 4.

The key points for constructing the diagram are the boundary positions of the bicycle connecting rod, determined by the change in the nature of the ankle during pedaling in each motor cycle (alternating flexion and extension in the ankle joint in different phases). From the point of view of rational and effective technique, the work of the first athlete is more preferable, since he works effectively with his ankle not only in the pushing phase (III), but also in the pull-up phase (I).

Conclusions. Pedaling on a bicycle ergometer in a test to failure is informative for identifying the most variable biokinematic links, determining the presence of auxiliary movements, their localization and nature. Determination of the kinematic features of the pedaling technique is inextricably linked with a rational pedaling technique, which involves effective performance of the motor task mainly due to the main control movements with minimization of auxiliary ones. The greatest variability in the pedaling process is characterized by movements associated with a change in the angle of inclination of the body relative to the horizontal and the amplitude of ankle movements, which is associated in the first case with a change in the athlete's posture, and in the second - is determined by the established individual motor stereotype. Progress in the study of kinematic characteristics and the development of applied technologies is an important component of the training process of professional cyclists, which allows coaches to improve the methods of monitoring the training process and contributes to an increase in the performance of athletes.

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Changes in biomechanical parameters under the feet while maintaining balance in basketball players before and after training

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Abstract

Objective of the study was to determination of the nature of changes in the biomechanical parameters of the load under the foot and the postural status of basketball players under the influence of training.

Methods and structure of the study. The experiment involved 28 athletes from women's and men's basketball teams of the first division of the Republic of Serbia. On the podometric platform «RSscan» (500Hz), the subjects performed two modified Romberg tests with eyes open and eyes closed. The measurement was taken immediately before and after training. The parameters of the trajectory of the displacement of the center of pressure, the speed of movement of the center of pressure, the pressure values under the entire foot, as well as in the metatarsal and heel zones of both legs were recorded.

Results and conclusions. Despite the training, the pressure in the heel zone relative to the metatarsal zone remained 10% higher. After training, in both tests, the trajectory of the center of pressure movement in men significantly decreased. The difference between men and women affected only the speed of movement of the center of pressure in the metatarsal zone of the feet, recorded after training. Basketball players of both sexes are characterized by a shift in the center of pressure predominantly in the medial-lateral direction.

Keywords: *balance, foot zones, center of pressure, CoP, AP, ML.*

Introduction. Modern basketball is due to an ever-increasing range of dynamism and intensified load, placing increased demands on the psycho-physiological mechanisms of the body and the athletes musculoskeletal system. During the game, basketball players are forced to continuously move, stop quickly and suddenly, change the direction and speed of movement, perform jumps, throws, etc. from different positions, in interaction with and without an opponent. Their skills require high acceleration in the joints of the lower extremities, for sudden changes in direction of movement and landing during jumps, where the recuperative properties of the foot play a key role [1]. In addition, an important factor for the high-quality performance of technical and tactical actions in basketball is the athletes developed sense of balance. It is believed that a basketball player who rarely or never loses it, and one who quickly restores it when it is impaired, has good balance [2]. For this reason, in the training of basketball players, much attention is paid to exercises to develop a sense of balance, with special emphasis placed on training in conditions of dynamic play, and not just performing, even if specific to basketball players, jumping and running exercises [3].

Balance, or postural static control, can be defined as the ability to maintain a posture through an internal regulation mechanism of keeping the body in a stable and unchanged position, and the tendency to sway, or shift the center of gravity of the body, indicates a loss of proprioception in a person [4].

There are enough studies on the factors influencing the parameters of postural control, one of which is muscle fatigue [5, 6, etc.].

Objective of the study was to determination of the nature of changes in the biomechanical parameters of the load under the foot and the postural status of basketball players under the influence of training.

Methods and structure of the study. The experiment was carried out three days before an important match of the Serbian major league tour. The study involved 28 athletes from basketball teams of the first division of the Republic of Serbia: 14 men, 14 women, average age - 23 and 20 years, sports experience – 12,3 and 9,1 years, body weight – 93,5 kg and 69,5 kg , foot size – 47 and 41,5 (EU), respectively. To record the indicators, the podometric platform «RSscan International» (Belgium) was used, with resistant sensors located on a 128x64 matrix. Platform size 40x100 cm with operating frequency 500 Hz. The experiment included the use of two modified Romberg tests with eyes open (OE) and eyes closed (EC) for 100 s, according to the method [7]. Testing was carried out immediately before and after training. The training lasted 2 hours and included practicing technical and tactical actions. The parameters of the trajectory of the center of pressure (CoP) displacement, the speed of CoP movement, the pressure values under the entire foot, as well as in the metatarsal and heel zones of the right and left legs were recorded.

Results of the study and discussion. Table 1 presents the results of measurements in the Romberg tests with eyes open (OE) before and after training. The only indicator that was influenced by the training process was the magnitude of the CoP movement trajectory in men, which significantly decreased after training ($p<0,025$).

The same picture is observed in the eyes closed (EC) test ($p<0,031$) (Table 2). In women, a change in this parameter is also observed, but is characterized as a tendency to decrease ($p>0,05$).

From the point of view of gender differences, the analysis revealed a significant difference only in the repeated test with eyes closed in the rate of movement of the center of pressure in the metatarsal zone: in women it was greater (6,24±2,8 mm/s) than in men (4,24±1,1 mm/s) (F4,86 $p>0,039$).

Considering the nature of the load distribution under the feet, it was noted on average that there was a right-sided asymmetry and a greater load on the heel zone than in the metatarsal zone by 10%. But since these indicators have a high degree of variation, here we can only talk about a trend and a high degree of individualization of these values.

In any study, it is important to have criteria for assessing the results obtained. As a criterion, it is pro-

Table 1. Results of measurements in the test with eyes open, before and after training

Indicators	Foot	Women		Men	
		Before	After	Before	After
Metatarsus (%)	Left	14,5±9,3	20,1±11,1	19,2±10,6	16,2±7,0
	Right	21,0±9,0	24,6±11,0	26,3±9,8	25,1±7,5
Heels (%)	Left	32,0±16,4	28,2±12,7	26,6±9,8	29,1±6,9
	Right	32,5±12,1	27,1±9,6	27,9±9,6	29,6±8,7
Swing max travel CoP	dX [mm]	12,4±5,7	13,5±5,9	11,9±5,9	12,2±4,5
	dY[mm]	23,1±16	26,8±13,9	24,9±7,2	24,3±10,3
Trajectory	CoP [mm]	485,3±124,5	474,2±132,6	*545,4±86,3	*474,6±71,1

**statistically significant results p<0,025.*

Table 2. Results of measurements in the test with eyes closed, before and after training

Indicators	Foot	Women		Men	
		Before	After	Before	After
Metatarsus (%)	Left	15,4±10,7	17,2±10,2	18,4±10,0	16,6±7,0
	Right	23,3±12,4	23,2±11,4	26,6±7,7	25,3±6,6
Heels (%)	Left	27,4±11,2	29,3±11,8	27,2±10,1	29,2±6,5
	Right	33,9±12,8	30,3±11,1	27,8±9,1	28,9±7,8
Maximum movement	dX [mm]	15,3±5,8	13,7±6,1	15,4±7,2	12,6±6,1
	dY[mm]	31,6±18,7	33,1±14,6	27,7±9,6	30,2±13,1
Trajectory	CoP [mm]	662,4±229,3	615,9±182,8	*728,9±116,4	*623,0±130,4

**statistically significant results p<0,031.*

Table 3. Comparison of the obtained values in the study [14] with our own results

Indicators		OE	EC	EC	EC	EC / OE	EC /OE	OE	EC
		Before	After	Before	After	Before	After	After/ Before	After/ Before
Results from the study [18]									
CoP mm	L	254,7	368,8	281,5	363,4	1,11	0,99*	1,45	1,29
CoP speed, mm/s	AP	5,2	10,6	5,8	8,1	1,12	0,76*	2,04	1,40
	ML	5,9	8	6,3	8,4	1,07	1,05	1,36	1,33
Maximum movement, mm	AP	10,2	23	12,5	23,7	1,23	1,03	2,25	1,90
	ML	11,2	16,4	10,6	19,7	0,95*	1,20	1,46	1,86
Results of our own research									
CoP mm	L	478	464,7	631,8	583,2	1,32	1,26	0,97*	0,92*
CoP speed, mm/s	AP	2,82	3,07	4	3,79	1,41	1,23	1,09	0,94*
	ML	4,08	3,87	4,63	4,10	1,13	1,06	0,94*	0,88*
Maximum movement, mm	AP	11,8	13,3	14,8	13,9	1,25	1,05	1,13	0,94**
	ML	21,8	27	32,3	33,7	1,48	1,25	1,24	1,04**

Difference: according to the proposed standards of trajectory and speed***

posed to calculate the CoP trajectory coefficient through the ratio of its values – «after training/before training». The required range of the coefficient is also indicated - from 1,2 to 2 units [8-11]. In our case, the values of the trajectory ratio coefficient are less than the proposed limits. In table For comparison, Figure 3 presents the results of a study on football players aged 14,5±0,2 years, using measuring equipment similar to ours, performing the Romberg test on it for 30 s [11], which explains the difference in the lengths of the trajectories.

Similar to the approach to estimating the trajectory length, a criterion is proposed for the speed of CoP movement. The recommended value is between 1,22 and 3,73 [11]. In our study, the speed of CoP movement, as well as in relation to the trajectory, is below the specified range. The reason for the differences in results, apparently, must be sought in the specifics of the sport and the stage of preparation. Nevertheless, this approach to assessing balance ability is of interest and has grounds for further development. Table 3 presents the results of the ratio of the indicators of the EC/OG tests as the influence of the factor of visual perception.

The result of the formed dynamic stereotypes is also indicated by the predominance of the direction of movement of the center of pressure. In football players, the shift in the center of pressure occurs predominantly in the AR direction. In basketball players, the center of pressure shifts more in the ML direction, as other authors point out in their works [12]. In this case, the speed of CoP movement in the AP direction is lower than the speed in the ML direction.

The experiment confirmed the statement of many authors about the increase in the area of contact of the foot with the support as a result of a vertical shock load (walking, running, jumping) [13]. All subjects observed an increase in the area of contact with the support after the training.

Conclusions. After training, the trajectory of the CoP center of pressure movement in men both in the balance test with open and closed eyes decreased significantly. Significant differences between men and women affected only the rate of movement of the center of pressure in the metatarsal zone of the feet, recorded after training. Basketball players of both sexes are characterized by a shift in the center of pressure predominantly in the medial-lateral direction. The contact area of the foot with the support increases after training load.

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Kinematic characteristics of the movement technique of highly qualified biathletes

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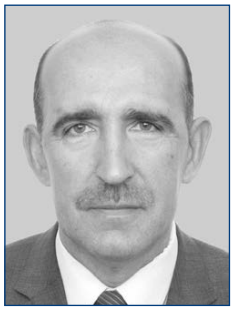

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Abstract

Objective of the study was to identify the features of the use of tactical techniques and differences in the kinematic parameters of the movement technique of biathletes with a simultaneous two-step skating move and a simultaneous one-step skating move in conditions of competitive activity.

Methods and structure of the study. The article examines the kinematic and dynamic indicators when moving with simultaneous two-step and simultaneous one-step skating moves (ODKH and OOKH) of highly qualified biathletes during the races of the Russian Championship 2023 in Khanty-Mansiysk.

Results and conclusions. The analysis made it possible to establish that leaders, when covering a competitive distance, change the ratio of the length and frequency of steps and the amount of effort when pushing off. The first lap of the distance is overcome by climbing with great rolling and a relatively low frequency of movements, the second lap is completed by increasing the frequency of the cycle and minimizing effort. On the third circle, an increase in speed is achieved by increasing the cycle frequency and cycle length relative to the 2nd circle. For athletes who did not make it into the top ten of the final protocol, the limiting factor in maintaining a high speed of completing a distance with a simultaneous one-step skating stroke is power potential.

Keywords: *technical and tactical training, kinematic parameters of movement technique, simultaneously two-step skating, simultaneously one-step skating, cycle phase filmogram, frequency, linear length of the skate, coefficient of running activity (KBA indicator).*

Introduction. Improving technical and tactical preparedness at the stage of maximum realization of the athlete's capabilities becomes a priority [2, 4]. Moving along the distance with the most rational technique, choosing the optimal way of movement on various sections of the track, using individual strategies and tactical techniques can increase competitive speed without increasing the intensity of movement [1, 2]. The ability of athletes to adapt the kinematic and dynamic structure of skiing to competitive conditions in order to maximize the realization of motor potential is one of the reserves for improving the results of Russian biathletes [3, 4].

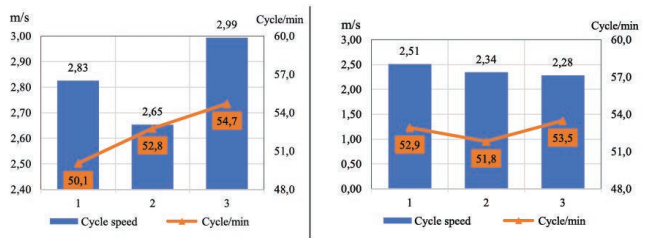
The purpose of the study is to identify the features of the use of tactical techniques and differences in the kinematic parameters of the movement technique of biathletes of the ODKH and OOKH in conditions of competitive activity.

Methodology and organization of the study. The scientific work was carried out at the Russian Biathlon Championship in Khanty–Mansiysk on 27.03 – 02.04.2023. To analyze the technique of the moves, Sony HDR-AX53 cameras were used and installed perpendicular to the ski track, sideways, motionless in various sections of the distance. The frame was scaled relative to the track and the kinematic param-

eters of the athletes' movement were measured using the Kinovea computer program. In the course of the study, a comparative analysis of kinematic and dynamic indicators was carried out when moving OOKH and ODKH in 13 biathletes competing at the Russian championship, and indicators of the coefficient of running activity (KBA) were also compared between the race leaders and outsiders. It was assumed that the best athletes in terms of speed, competing at the Russian Biathlon Championship, more effectively realize their potential and maintain a high speed of movement over a distance by varying the kinematic parameters of movement techniques in different sections and circles of the competitive distance.

The results of the study and their discussion. The fixation of the time parameters of linear advancement in the ODKH was carried out in two phases: in the first – from the moment of pushing off with the "main" hand and the moment of complete setting of the ski of the supporting leg to the separation of the heel from the ski at the moment of leaving the supporting leg; and in the second phase - from the moment of the end of the first phase at the moment of leaving the supporting leg to the moment of setting the sticks of the "main" hand.

When passing the competitive distance, the cycle speed on the 1st, 2nd and 3rd laps of the leaders is 2.83 m/s; 2.65 m/s and 2.99 m/s, respectively. The leaders on the second lap have a decrease in speed and linear cycle length, and the number of cycles per minute (step frequency) increases with each subsequent lap – 50.1, 52.8 and 54.7, respectively (Fig. 1A and 2A).

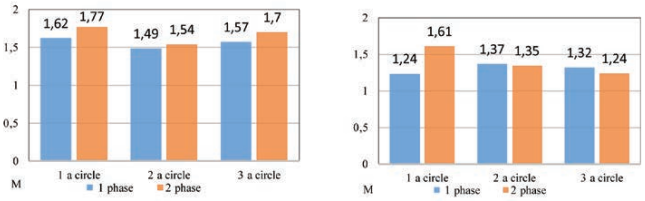


A B

Fig. 1. Dynamics of the speed and frequency of cycles in the leaders (A) and other athletes (B) during the movement of the CSTO

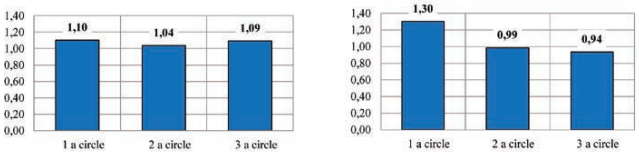
At the same time, the length of the linear advance on the 2nd lap is reduced for the leaders in both the 1st and 2nd phases of the cycle (Fig. 2A).

For the leaders, the speed decrease occurs due to a change in the repulsive forces, since the coefficient of running activity on all three laps is greater than one (1.1; 1.04; 1.09) (Fig. 3A). Thus, when passing a competitive distance, the leaders change the ratio of the length and frequency of steps and the amount of effort when pushing off. The first round of the race is overcome by climbing with a large roll and a relatively low frequency of movements, the second round is passed, increasing the cycle frequency and minimizing effort, the third round – increasing the cycle frequency and cycle length relative to the 2nd circle.



A B

Fig. 2. Dynamics of the linear length of the rental of the leaders (A) and the rest of the athletes (B) during the movement of the CEC



A B

Fig. 3. The coefficient of running activity of the leaders (A) and the rest of the athletes (B) during the movement of the housing and communal services.

The average movement parameters of the CEC biathletes, who are not leaders, are characterized by a slight change in the number of cycles per minute on the 1st, 2nd, 3rd laps of the distance and are 53, 52 and 53.5, respectively (Fig. 1B). At the same time, the cycle speed decreases on the ascent (1 lap – 2.51 m/s, 2 lap – 2.34 m/s, 2.28 m/s), and the cycle length decreases on each subsequent lap (2.85 m; 2.72 m and 2.56 m) (Fig.2B).

For athletes who are not leaders, maintaining speed on the finish lap is more due to the pace of movement, rather than due to strength potential. Confirmation is the linear length of the rolled product in the 2nd phase, which decreases from the second round relative to the linear length of the rolled product in the 1st phase (Fig.2B). The coefficient of running activity is less than "1" from the second round (1st - 1.30; 2nd – 0.99; 3rd – 0.94) (Fig. 3B).

In the analysis of the OOCS of biathletes, time and distance (linear advance) were recorded when pushing

off with hands and foot as a reaction to support (from the beginning of the moment of setting the sticks in the phase of pushing off from the "attacking" position until the moment of heel separation in the final phase of pushing off with the foot); time and distance (linear advance) in the rolling phase – from the moment of separation the heels are in the final phase of pushing off with the foot until the sticks are placed in the "attacking" position of the beginning of pushing off with the hands. The athlete, who took 2nd place in speed, overcomes this section with a fairly high pace (71.4; 73.1; 73.1 cycles per minute), but with the shortest repulsion time (the average for 3 laps is 0.38 seconds) and with an average rolling length of 1.56 m. The athlete, who took 3rd place in speed, maintains high speed due to a lower pace (68.1; 68.18; 68.2 cycles per minute), but with the longest linear roll (average for 3 laps is 1.58 m), while the average repulsion time is 0.4 s.

The athlete with the best speed on the ski track shows the highest average cycle speed – 3.65 m/s, increasing the pace on each subsequent lap (62.5; 68.2; 75 cycles per minute). The time of repulsion on 3 laps of the distance also varies: 1 lap – 0.38 s; 2 lap – 0.44 s; 3 lap – 0.36 s. The leader's largest rental was recorded on the 1st lap - 2.13 m. On the 2nd and 3rd lap, the length of the rolling is 1.55 and 1.65 m, respectively. We assume that the leader of the race varies by the force of repulsion, rolling and pace of movements throughout the competitive distance, overcoming the 1st lap with a large roll and a short "impulse" repulsion. On the 2nd lap, the leader increases the pace of movement, but reduces the repulsive force, as evidenced by a reduction in the time of repulsion and the athlete's ride. The leader passes the 3rd lap of the competition distance with the least repulsion in time (0.36 s) and the highest power relative to the power on the first two laps, developing a maximum cycle speed of 3.89 m/s.

Considering the KBA indicator (the ratio of reaction to support for hire), we note that the race leaders have this indicator greater than "1", which indicates a more effective realization of the power potential in the technique of movement of athletes in this section of the distance. We note that the athlete, who took 16th place in the "clean" time of the race, has a fairly high pace of movement during 3 laps (75; 71.4; 71.4 cycles per minute), however, the indicators of the length of the roll and the speed of the cycle are lower than those of the leaders, while the KBA on the second and third laps is less "1".

Conclusions. The leaders of the race are able to vary the force of repulsion, the length of the roll and the pace of movements throughout the competitive distance. The best athletes in terms of distance travel time overcome the 1st lap with a large roll and a short "impulse" repulsion, while on the 2nd lap increasing the pace of movement and reducing the repulsion force, as evidenced by a reduction in the time of repulsion and the length of the roll. The leaders complete the 3rd lap of the competition distance with the shortest repulsion time (0.36 s), and the highest power relative to the power on the other two laps, developing a maximum cycle speed of 3.89 m/s.

The best athletes in terms of speed have a more effective realization of their power potential in the technique of movement, as evidenced by the KBA indicator equal to more than one. The athletes who did not make it into the top ten of the final protocol have a KBA of less than one, and, as a result, the limiting factor in the ability to maintain a high speed of passing the OOKH distance is the power potential.

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Increasing the performance of techniques of rowing on yalks with a roll-up system based on kinematic analysis and computer simulation

UDC 797.12

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Abstract

Objective of the study was to identify, on the basis of kinematic analysis and modeling, the effectiveness of using the developed rowing technique on yawls with a rolling system in the training process.

Methods and structure of the study. The work used methods of kinematic analysis and modeling using electronic digital models, processing of experimental results using methods of mathematical statistics. Athletes specializing in rowing at YaL-6 (n=32) took part in the pedagogical experiment (from April 2022 to October 2023).

Results and conclusions. It was found that kinematic analysis of digital layouts makes it possible to increase rowing efficiency on YaL 6. Changes made to the rowing technique based on kinematic analysis provide a statistically significant increase in rowing efficiency on YaL 6 ($p \leq 0,05$).

Keywords: *rowing on yawls, kinematic model, rolling system, YaL-6, sports.*

Introduction. Rowing is a cyclic sport, and efficiency improvements have been mainly achieved using traditional methods: photo and video recording, time control devices for covering the distance, duration of stroke phases, as well as physiological data from athletes: heart rate, respiration, and blood pressure. These methods are primarily empirical in nature, based on practical results. The research paper attempts to develop a rowing technique based on a prognostic method, including modeling, analysis, and a pedagogical experiment [1-3].

Objective of the study was to identify, on the basis of kinematic analysis and modeling, the effectiveness of using the developed rowing technique on dinghies with a rolling system in the training process.

Methods and structure of the study. The work involved the methods of kinematic analysis and modeling using electronic digital models, and processing the experimental results using mathematical statistics methods. The pedagogical experiment (from April 2022 to October 2023) involved athletes specializing in rowing on the YAL-6 (n=32), KG and EG boys/girls (8 rowers each). The time of passing the distance on the YAL 6 was recorded using a stopwatch according to GOST 5072, the parameters of performing exercises on the Concept 2 simulator were recorded using the means built into the simulator.

Results of the study and discussion. In order to improve the rowing efficiency on the YAL-6, a computational experiment was conducted on simulation models in the CATIA software environment, which includes modules for constructing three-dimensional models, kinematic analysis, and analysis of the interaction of a digital dummy with a three-dimensional model. When constructing a three-dimensional model, the X axis was directed along the

longitudinal axis of the vessel, the Y axis was perpendicular to the longitudinal axis of the vessel horizontally, and the Z axis was upwards [5].

The search for the optimal rowing method was carried out using the following method:

1. Constructing a three-dimensional model

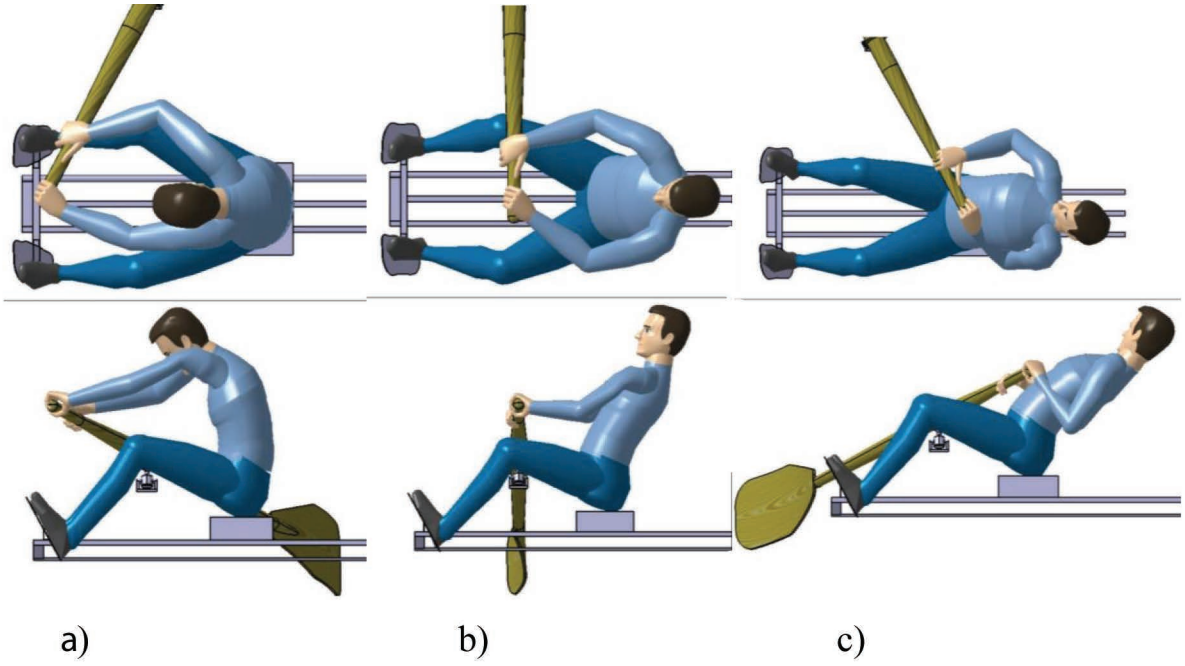

Fig. 1. Characteristic moments of the power phase of the stroke on the YL-6 of traditional design with fixed seats-benches: a) – beginning of the stroke; b) – middle of the stroke; c) – end of the stroke.

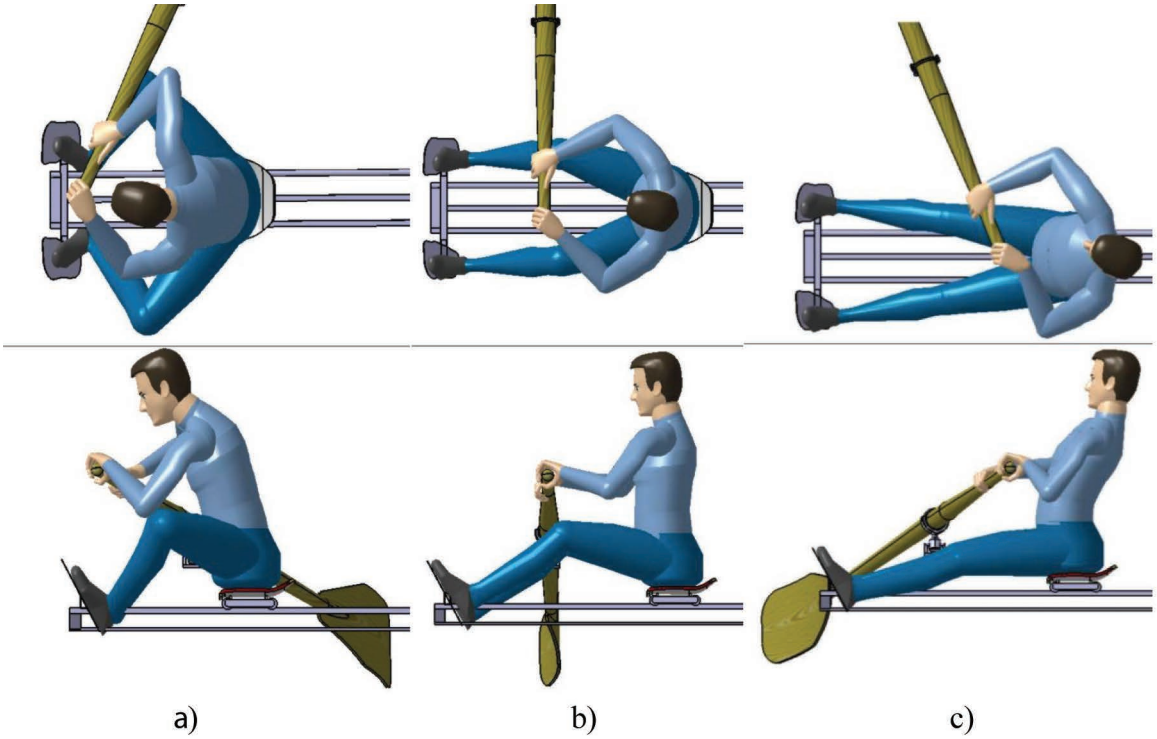

Fig. 2. Characteristic moments of the power phase of the stroke in an academic boat: a) – the beginning of the stroke; b) – the middle of the stroke; c) – the end of the stroke

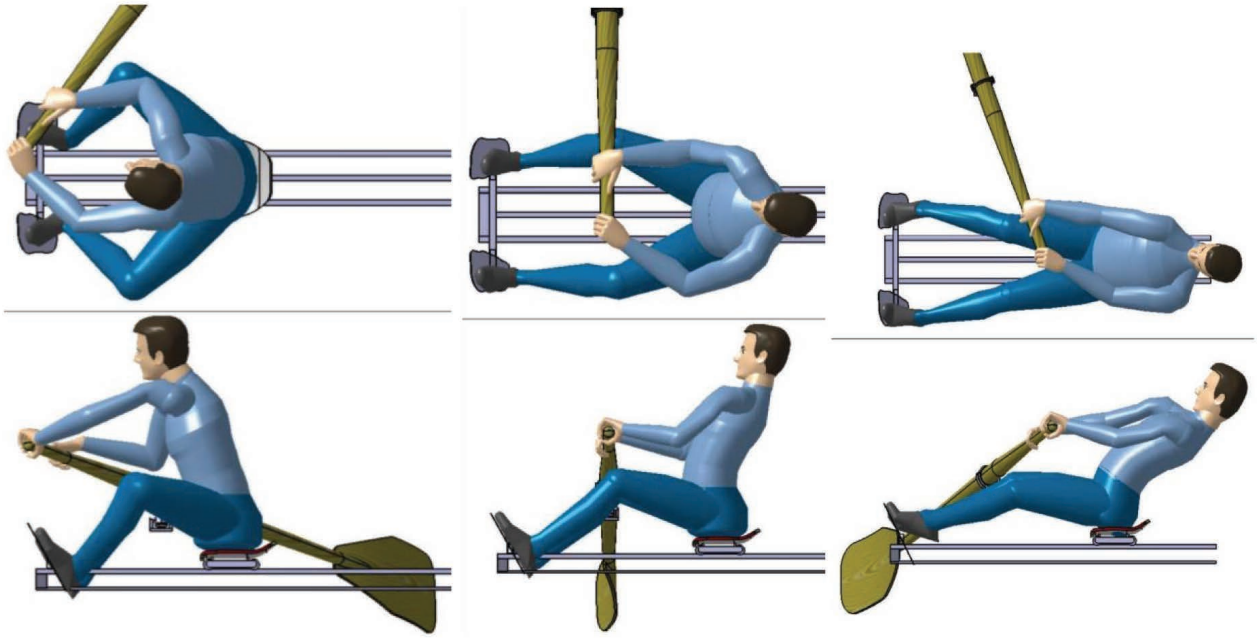

Fig. 3. Characteristic moments of the power phase of the stroke on the YAL-6 with the installed rolling system:a) – beginning of the stroke; b) – middle of the stroke; c) – end of the stroke

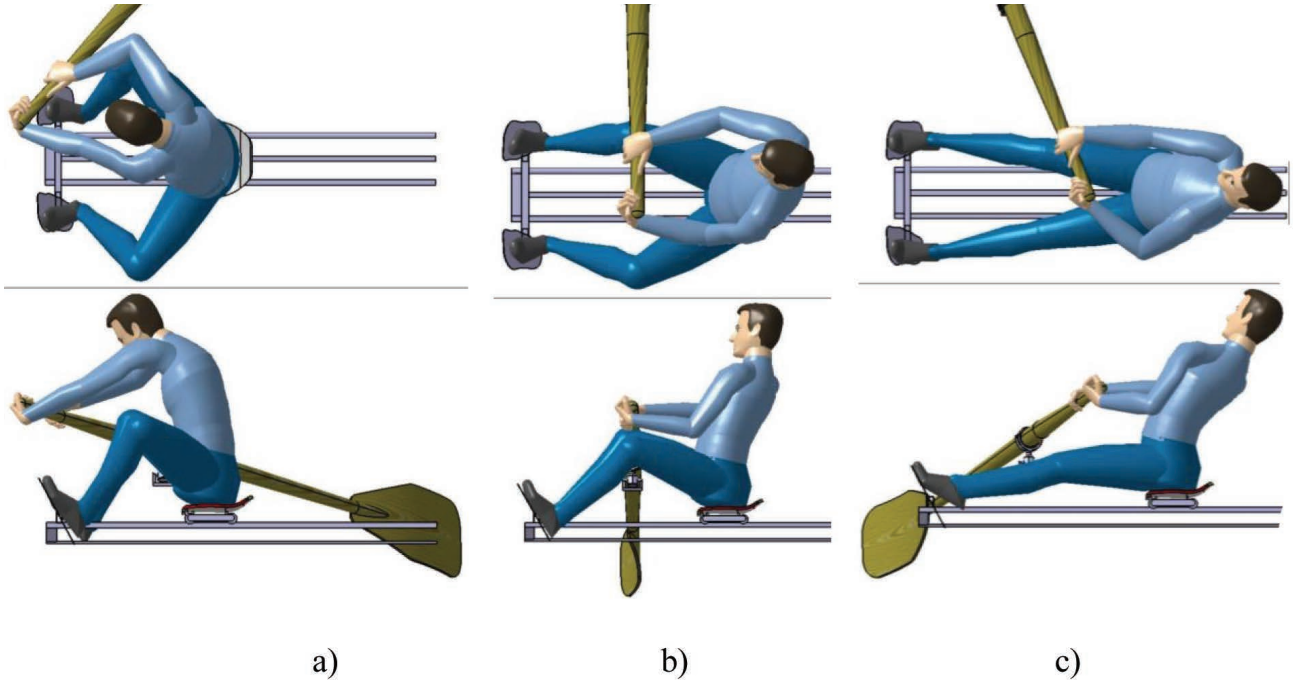

Fig. 4. Characteristic moments of the power phase of the stroke on the YAL-6 with the installed roll system and modified rowing technique: a) – beginning of the stroke; b) – middle of the stroke; c) – end of the stroke

that takes into account the main geometric features of the rower's location in the vessel (taking into account the position of the support elements, oars, etc.)

2. Kinematic analysis of the rower's movements taking into account the anthropometric characteristics of the digital dummy.

3. Correcting the movements of the digital dum-

my in order to make the power phase of the stroke as efficient as possible.

A digital dummy of a white man, 50% percentile, built into the application software package, was used as a dummy. The computational experiment included placing a digital dummy in the following conditions:

1. YL-6 of traditional design (fixed bench seat).

2. A typical academic boat with a movable bench seat.

3. YL-6 with a rolling system installed on it, including a movable carriage seat.

At this stage of the experiment, it was established:

1. When rowing on a YL-6 of traditional design with a fixed seat, the main work of the rower is performed by the muscles of the back and arms, the leg muscles are not used. To increase the length of the stroke, the rower is forced to lean back up to 30 ˚ relative to the horizontal plane (Fig. 1).

2. When rowing on an academic boat, mainly the leg muscles are involved, the back leans back slightly, up to 70 ˚ relative to the horizontal plane (Fig. 2).

The installation of a rolling system with movable seats on the YAL-6 allowed athletes to more fully exploit the possibilities of using stronger leg muscles (Fig. 3), but at the same time it was found that the rowing technique on the YAL-6 with a rolling system needed to be changed to achieve higher results. Changes in rowing technique are aimed primarily at increasing the length of the stroke by changing the grip of the hands, as well as turning the rower's body towards his side (Fig. 4) [4].

Fig. 5 shows the results of changing the passage of the 500 m distance on the Concept 2 rowing machine KG and EG of boys and girls at a pace of 16-18 strokes (training pace in the traditional YL-6). Fig. 6

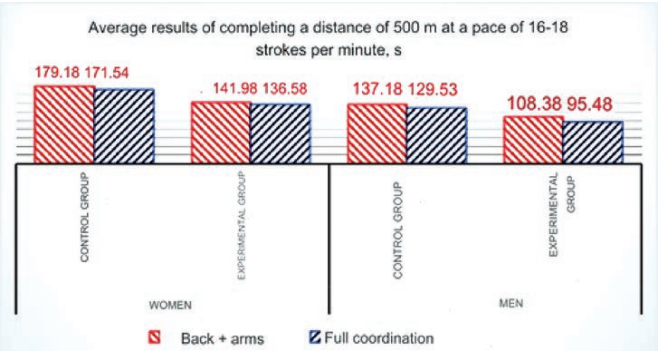

Fig. 5. Average results for passing the 500 m distance

and 7 show the results of changing the passage of the 1000 m rowing distance under different weather conditions among men's and women's teams.

The time indicators were recorded on a traditional yawl and on a yawl using a rolling system.

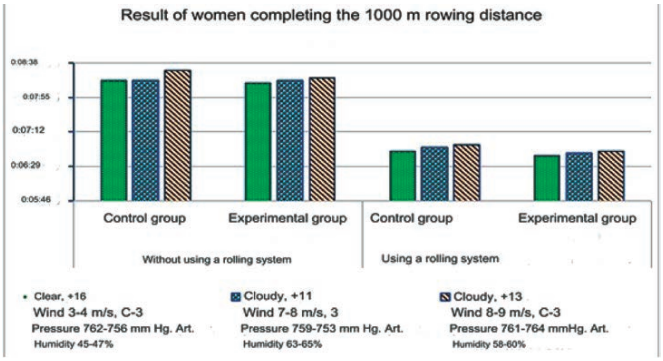

Fig. 6. Results of women's 1000 m rowing distance, m

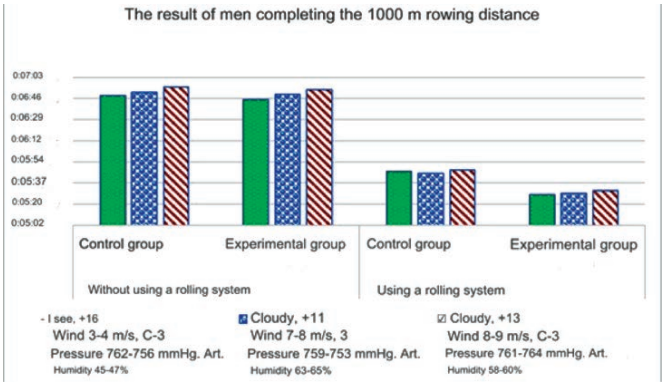

Fig. 7. Result of passing the 1000 m rowing distance by men, m

Conclusions. It has been established that the use of a prognostic method to improve the efficiency of rowing on the YL-6 using a rolling system gives a statistically significant reliable increase in the result ($p \leq 0.05$). To improve results in cyclic sports, it is advisable to use computer modeling of athletes' movements based on digital models with their subsequent analysis and adjustment of the methodology. The effectiveness of the adjusted methodology can be assessed by traditional methods, after which such a methodology, providing higher results, can be introduced into the training process to improve results.

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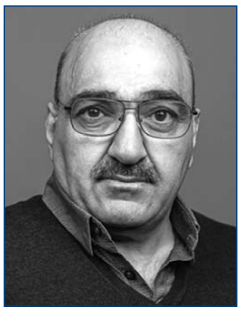
The relationship between athletes' coping strategies and indicators of dominant states

UDC 159.9.072.43



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Abstract

Objective of the study was to identify the features of coping strategies for coping with stress among martial arts athletes with different experiences of successful competitive activities.

Methods and structure of the study. The experimental base of the study consisted of martial arts athletes specializing in martial arts of the Institute of Physical Culture and Sports of Peter the Great St. Petersburg University. A total of 60 athletes took part, aged 18-24 years. Of these, 30 were successful (15 boys and 15 girls) and 30 were unsuccessful (15 boys and 15 girls). To identify coping strategies, the Youth Coping Scale methodology was used, authored by Erica Frydenberg and Ramon Lewis, adapted by T.L. Kryukova.

Results and conclusions. In a situation of coping with stress, successful athletes actively use all types of coping strategies, choosing them depending on the characteristics of the situation, which allows them to cope with stress most effectively at the moment. Unsuccessful athletes have a much smaller set of coping strategies. In a stressful situation, such athletes try to cope with stress, first of all, by continuing to work hard in training.

Keywords: *coping strategy, mental state, psychological preparation, martial artists, athletes, stressful state, coping behavior.*

Introduction. In modern sports, especially in high-performance sports, the complexity of the technologies used, as well as the cost of an error in the methods of training an athlete, is very high, so a narrow specialization of all participants in the training process becomes a necessary condition. This fully applies to psychological preparation, which can be most effectively carried out by a purposefully trained specialist - a sports psychologist.

The relevance of this work is also determined by the results that martial artists have shown in competitions in the last few years. Achievements are growing, and with them, daily loads, after which it is no longer enough to restore only the original physical condition, it is also necessary to monitor the psychological one.

To date, the relationship between coping strategies and dominant states has not been sufficiently studied, taking into account the success of sports activities, in particular, among martial artists.

Objective of the study was to identify the characteristics of coping strategies for coping with stress in martial artists with different levels of successful competitive activity.

Methods and structure of the study. The experimental base of the study was made up of martial arts athletes from the martial arts specialization of the Institute of Physical Culture and Sports of Peter the Great St. Petersburg University. A total of 60 athletes aged 18-24 took part. Of these, 30 were successful (15 boys and 15 girls) and 30 were unsuccessful (15 boys and 15 girls). To identify coping strategies, the «Youthful Coping Scale» technique was used, authored by Erica Freidenberg and Ramon Lewis, adapted by T.L. Kryukova.

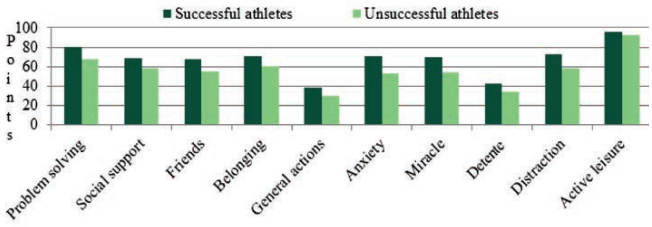
The technique consists of 80 questions, where 79 statements with five answer options on the R. Likert scale and one question with a free answer, in which respondents must list the methods they use to cope with a stressful situation and anxiety. From the 79 statements of the questionnaire, 18 scales or coping strategies are formed. The boundaries for determining the levels of use of coping strategies are shown in Table 1.

Table 1. Boundaries for determining the levels of use of coping strategies (Youthful Coping Scale by E. Friedenberg, R. Lewis)

Evaluation of the indicator	Level characteristic
60-100	High values
30-60	Medium values
0-30	Low values

Results of the study and discussion. Figure 1 and Table 1 present the mean values of significantly different indicators of coping strategies.

Table 2 and Figure 1 clearly show the frequency of use of certain coping strategies in stressful situations by successful and unsuccessful athletes. Successful athletes are significantly more likely to use such strategies as «Problem Solving», «Social Support», «Friends», «Belonging», «General actions», «Anxiety», «Miracle», «Detente» «Distraction» and «Active Leisure».



Average values of reliably different indicators of coping strategies of high-ranking and low-ranking martial artists according to the YUKSh method (E. Frydenberg, R. Lewis)

The obtained results primarily mean that successful athletes, unlike unsuccessful ones, consciously use the whole range of coping strategies: productive, social and unproductive. Depending on the situation, they choose how to cope. This conclusion is confirmed by the data in the table: the indicators of successful athletes are higher than those of unsuccessful ones on 17 scales. This means that successful athletes are, in principle, more familiar with coping strategies and

Table 2. Average values of coping strategy indicators in athletes of the studied groups according to the YUKSh method (E. Frydenberg, R. Lewis)

Coping strategies	Average indicators		Mann-Whitney U-test of significance of differences	Average indicators		Mann–Whitney U-test of significance of differences
	Successful athletes	Unsuccessful athletes		Young men	Girls	
Problem Solving	80.34	67.76	0,001**	75.68	73.86	0.910
Work, achievements	74.43	74.82	0.978	73.92	75.73	0.515
Spirituality	46.30	42.64	0.490	41.80	49.66	0.059
Positive focus	69.78	66.17	0.581	69.00	67.00	0.778
Social support	68.69	58.11	0,001**	62.88	66.40	0.242
Friends	67.30	54.82	0,024*	61.92	62.13	0.955
Belonging	70.43	59.76	0,027*	64.96	67.46	0.603
General actions	38.47	29.41	0,007**	34.80	34.33	0.843
Professional help	52.17	48.23	0.783	51.60	48.66	0.800
Anxiety	70.95	53.17	0,003**	65.28	60.26	0.340
Miracle	69.21	53.64	0,005**	60.80	65.60	0.340
Mismatch	39.13	37.17	0.649	35.84	42.40	0,010**
Detente	42.95	33.88	0,037*	36.48	43.46	0,045*
Ignoring	45.43	40.88	0.407	43.20	44.00	0.735
Self-accusation	60.21	53.52	0.144	57.80	56.66	0.800
Withdrawal into oneself	55.69	50.00	0.377	50.80	57.40	0.331
Distraction	72.73	58.47	0,005**	66.08	67.66	0.978
Active Leisure	95.47	93.00	0,024*	94.32	94.60	0.895

**- significance of differences p≤ 0,05, **- significance of differences p≤ 0,01*

know how to use them effectively. The indicators of unsuccessful athletes prove the opposite: unsuccessful martial artists «get lost» in a stressful situation and often do not understand how to cope with it [2, 5].

The social coping style includes 5 coping strategies of the YUKSh methodology, of which 4 strategies are significantly more often used by successful athletes. (Social support, Friends, Belonging, Social actions). Such results prove that successful athletes qualitatively analyze the situation and consciously resort to the help of others: specialists, friends or relatives. At the same time, the average score of unsuccessful athletes on the scale «Community Actions» is very close to the minimum value on this scale (29.41).

High-ranking athletes also more often resort to such coping strategies as «Miracle» and «Anxiety». This may be related to the level of responsibility. The higher the achievements, the higher the responsibility. When faced with a stressful situation, under such pressure and daily workloads, the level of anxiety increases and sometimes you want everything to be resolved miraculously. Unsuccessful athletes do not have such a problem, although their indicators are in the average range, this suggests that they resort to these coping strategies, but not as often as successful athletes [1, 4]. Successful athletes also resort to the strategies «Distraction» and «Active rest» significantly more often than unsuccessful ones. Such a spread of indicators on the «Distraction» scale: 72,73 for successful and 58,47 for unsuccessful ($p \leq 0{,}005^{**}$) confirms the conclusion that successful athletes use all possible resources to cope with stressful situations, regardless of what coping style they belong to. The authors of the technique characterize this scale as: distraction from the problem, using such relaxation methods as reading books, television, entertainment in society.

The presence of high indicators on the «Active rest» scale creates a balance of stress and rest: successful athletes make a choice, decide on how to cope with a stressful situation. This can be a quiet rest, as in the «Distraction» scale (relaxation, reading books) or «Active rest» in contrast.

According to the results of statistical data processing, significant differences were also revealed between the groups of boys and girls. Girls significantly more often use such coping strategies as «Discoping» and «Discharge». These coping styles include tears, screaming, letting off steam, and painful conditions. The «Disability» scale also includes such a parameter as refusal to take any action aimed at solving the problem. However, in this case, it cannot be said that girls tend to refuse to solve the problem, since the indicators on the «Problem Solving» scale are 73,86, which means a high frequency of using this coping strategy. The data obtained only indicate that girls are more likely than boys to refuse to solve the problem, but this does not mean that girls always do this [3, 5].

Conclusions. In a situation of coping with stress, successful athletes actively use all types of coping strategies, choosing them depending on the specifics of the situation, which allows them to most effectively cope with stress at the moment. Unsuccessful athletes have a much smaller set of coping strategies. In a stressful situation, such athletes try to cope with stress, first of all, by continuing to work hard during training.

The results obtained can be used to improve the training of athletes by introducing psychological support for sports activities, with the aim of forming the personal qualities necessary for a successful career.

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Formation of motives of martial arts students in pc educational psychophysical activities

UDC 796. 03

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Abstract

Objective of the study was to theoretically and experimentally substantiate the methodology for forming motives for psychophysical activity among student martial artists.

Methods and structure of the study. The experiment was conducted on the basis of Peter the Great St. Petersburg Polytechnic University and was aimed at developing stable motives for psychophysical activity among student martial artists.

Results and conclusions. To increase the effectiveness of training of martial arts athletes at a university, it is important to substantiate a system of priority areas that ensure the effective functioning of their psychophysical activity, the basis of which, first of all, is the optimal level of development of psychomotor, conditioning and coordination abilities.

Keywords: *formation of cognitive motives, psychophysical activity, student martial artists.*

Introduction. Cognitive motives of educational psychophysical activity of a student-athlete-martial artist, as a concept, denote such a subjective attitude of the student to his education, which is based on a consciously set and in a certain way justified goal aimed at developing their psychomotor, conditioning and coordination abilities.

The reality of the goal depends on an objective consideration of the possibilities and conditions for its achievement. As a result of the successful solution of a number of problems, a certain result is achieved, which may or may not coincide with the goal.

The discrepancy between the results and the goal is a signal for correction of the organization and methodology of training. The degree of this discrepancy indicates the quality of teaching.

Objective of the study was to theoretically and experimentally substantiate the methodology for forming motives for educational psychophysical activity in student martial artists.

Methods and structure of the study. A comparative pedagogical experiment involved 120 3rd-4th year students involved in martial arts. The methodology for conducting training sessions was aimed at developing sustainable motives for psychophysical activity in student martial artists.

In the process of organizing the pedagogical experiment, 2 experimental groups of 30 student athletes and 2 control groups were formed. Educational and training sessions in the experimental groups were conducted according to the developed author's methodology, and in the control groups - in accordance with traditional approaches to organizing training sessions.

During the study, it was established that important factors contributing to the formation of internal incentives for educational and sports activities of student martial artists are: scientific content of educational and sports information, its connection with practice; sports and educational information, with the chosen profession; the problematic nature of the presentation

of educational information; organization of problem-searching sports and cognitive activities of students-martial arts athletes in theoretical and practical classes when solving problems that make it possible to develop creative abilities, evaluate the effectiveness of educational and sports achievements.

In order to successfully train student-martial arts athletes, we have identified several forms of their educational activities: educational (lectures, seminars); quasi-professional (business game, etc.); educational and professional (scientific research work of students, internship); physical education and sports. The listed forms mainly transfer and assimilate information, model integral fragments of the future activities of student-martial arts athletes, their subject and social-role content.

With the transition from one type of activity to another, student-martial arts athletes at the university have a real opportunity to acquire professional experience, while a natural entry into the profession, including physical education and sports, occurs.

Results of the study and discussion. When conducting training sessions with students actively involved in sports, teachers use the following forms of organizing the students' activities: semiotic, imitation and social.

Semiotic include tasks, objectives and problem situations that ensure the assimilation of objective knowledge by student martial artists.

In imitation models, the student athlete goes beyond the meanings, correlating the acquired knowledge with professional and sports situations and using them as a means to achieve a goal, expressed in actions and deeds.

As a result, student martial artists experience a wide range of positive experiences that influence the development of internal learning incentives, satisfaction with the learning process, awareness of their own growth, advancement in the content of what is being learned, pride in their successes and the successes of their comrades. First of all, this interaction of professional and cognitive stimuli of students actively involved in sports leads to successive interdependent changes in their expression and the hierarchical organization of the general motivational syndrome of learning, which is transformed during the transition from educational activity to sports (see table).

With the help of correctly selected forms and pedagogical technologies of training students-martial athletes in the university, their movement from educational to sports activities is determined. All this occurs against the background of the transformation of cognitive stimuli into professional ones. It becomes possible to implement a dynamic model of the movement of students' activities, from among martial artists, from study to work.

The study identifies and substantiates the most important psychological and pedagogical conditions and motives for the formation of internal stimuli for the educational activities of student-martial athletes. Among them:

- improving the content of the process of training student-athletes on a modular-synergetic basis, introducing special courses, expanding the variable component of education;

- updating the technology of the educational process, introducing innovative forms, methods and means of teaching student-martial athletes;

- developing a system of training students from among athletes that promotes the development of their cognitive interests, observation, memory, thinking, etc.; - creation of an atmosphere of cooperation, trust and respect between the subjects of training, an environment for creative and cognitive development of student-athletes-martial artists;

- gradual complication of educational tasks as the students accumulate experience in both educational and professional activities;

- constant management of the educational process of student-athletes, which involves monitoring

Comparative indicators of the effectiveness of the formation of motives for educational and physical education and sports activities among martial artists from among students of the experimental and control groups during a pedagogical experiment

Indicators	EG			CG		
	Before	After	t	Before	After	t
- educational (lectures, seminars)	3,4±0,2	4,5±0,3	1,5	3,6±0,3	3,9±0,5	1,3
- business game, etc.	3,7±0,4	4,8±0,6	1,2	4,0±0,3	4,1±0,7	1,3
- educational and professional (research work)	4,2±0,4	4,7±0,8	2,2	4,2±0,4	4,3±0,6	1,9
- physical education and sports activities	3,8±0,6	4,7±0,2	1,8	3,9±0,6	4,1±0,4	1,5

the progress of mastering knowledge, skills, abilities, obtaining data on the state and level of their athletic training;

Another important condition for activating internal motivation for learning in student-athletes-martial artists is the gradual complication of tasks as they accumulate both educational and practical skills.

All this is associated with the manifestation of mental, physical, and intellectual abilities of students.

Conclusions. The leading role in stimulating the activity of a student-athlete-martial artist, as a developing personality in the implementation of their cognitive motives for educational psychophysical activity, belongs to training.

This provision is due to the fact that the effective development and formation of the personality of a student-athlete-martial artist occurs mainly under the condition that it shows high activity in educational activities.

Activity is usually defined as an active state of the subject, i.e. the actor. It is desirable that the activity and activity of the personality of a student-athlete-martial artist coincide, only under this condition is it possible to form positive and stable motivation.

An important condition for the formation of internal motives and incentives for learning student-athletes-martial artists is constant monitoring of the course of their mastery of knowledge, skills and abilities, high demands on their preparation and objective assessment.

In the process of studying at a university, along with sports interest, stable motives for educational activity and behavior should become an important motivating force for the activity of a student-athlete-martial artist.

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Relationship of morphofunctional indicators with indicators of general physical training of mongolian wrestlers according to the results of multiple regression analysis

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Abstract

Objective of the study was to identify the relationship between morphofunctional indicators and indicators of general physical fitness of Mongolian athletes.

Methods and structure of the study. The work analyzes the most important characteristics and indicators of the body condition (anthropometric data, body composition data, functional parameters) of highly qualified athletes, providing significant connections with physical fitness tests. To achieve this goal, 181 highly qualified athletes, mainly involved in martial arts, were examined.

Results and conclusions. Based on the results of multiple regression analysis, morphofunctional models of the motor qualities of Mongolian highly qualified athletes were built, which are based on morphological characteristics, body composition indicators obtained using the bioimpedansometry method, and functional characteristics that can be used in sports selection, at the initial stage of preparation and at the stage of individualization sportsmanship in a long-term training process.

Keywords: *functional indicators, athletes, physical training.*

Introduction. Monitoring the effectiveness of training processes, along with studying the physical and functional fitness of athletes, involves identifying the relationships between the morphological and functional parameters of the most successful individuals [1-9].

Objective of the study was to identify the relationship between morphofunctional indicators and indicators of general physical fitness of Mongolian athletes.

Methods and structure of the study. The paper analyzes the most important characteristics and indicators of the body condition (anthropometric data, body composition data, functional parameters) of highly qualified athletes, providing significant links with physical fitness tests. To achieve the set goal, 181 highly qualified athletes were examined, mainly those involved in martial arts.

Results of the study and discussion. The influence of morphofunctional characteristics and indicators of body component composition on the results of the «Standing long jump» test.

Results of multiple regression analysis, in which the independent variables are morphological and functional characteristics, assessments of body component composition, and the dependent variables are the indicators of motor activity according to the results of the «Standing Long Jump» test, which characterizes the explosive strength of the leg muscles of Mongolian athletes.

According to the results of multiple regression analysis, it was revealed that a person's ability to jump from a place for a distance, which determines the explosive strength of the lower limb muscles, is most

closely associated with such indicators as the length of the lower limbs, the index of the length of the lower limbs to the body length (R = 0,765, p < 0,000), hip circumference, lean mass (R = 0,460, p < 0,005), peak expiratory volume flow rate (R = 0,610, p < 0,0046). The results of the «Standing Long Jump» test have a positive relationship with the values of the length of the lower limbs (β = 1,151, p = 0,002), hip circumference (β = 0,364, p = 0,000), lean mass (β = 0,194, p = 0,033), peak expiratory flow rate (β = 0,499, p = 0,022). Skeletal muscle mass is also positively, although insignificantly (β = 0,028, p = 0,682), associated with this motor quality. Negative relationships were noted for the values of BMI (β = -0,173, p = 0,032), as well as the index of the length of the lower limbs to the body length (β = -0,434, p = 0,024). Other analyzed indicators did not have a reliable significant effect on this motor quality. Thus, the constructed model for the indicator «Explosive power of the lower limb muscles» is determined, first of all, by the length of the lower limbs, hip circumference, respiratory system indicators and muscle mass.

The influence of morphofunctional characteristics and indicators of body component composition on the results of the «Shuttle run - 10x3» test.

Results of multiple regression analysis of the Shuttle Run 10x3 m test indicators, which determine the dependence of coordination abilities on morphofunctional characteristics and body component composition assessments.

It was revealed that the results of the Shuttle Run 10x3 m test are associated with such indicators as the diameter of the distal part of the shin and the sagittal diameter of the chest with a high degree of reliability (R = 0,752, p < 0,000). It should be noted that the indicators of coordination abilities are inversely related to the amount of time spent on this test. Therefore, the results of the Shuttle Run 10x3 test are positively influenced by the diameter of the distal part of the shin - the width of the ankle (β = -0,351, p = 0,003).

The sagittal diameter of the chest has a negative effect on coordination abilities, although the β coefficient is positive (β = 5,938, p = 0,008). It should be noted that there is a positive, albeit unreliable, tendency for the relationship between such indicators as BMI, leg length, exhalation POS, and a negative one for thigh circumference with the quality of agility. No reliable dependencies were found between the coordination abilities indicator and other functional characteristics and indicators of body component composition.

Thus, the model for the quality of agility is based with a high degree of reliability on the diameter of the distal part of the shin as an indicator of the development of the skeletal system and the sagittal diameter of the chest, which may be associated with a more convex shape of the chest and better ventilation of the lungs.

The influence of morphofunctional characteristics and indicators of body component composition on the results of the strength endurance test «Bending arms in a lying position for 30 sec».

Results of multiple regression analysis of the parameters of the test «Bending of arms in a lying position for 30 seconds», which determine the strength endurance of the body, from morphofunctional characteristics and assessments of the component composition of the body. According to the results of multiple regression analysis, reliable relationships were found between strength endurance and such parameters as body weight, chest circumference, shoulder circumference in tension, diameter of the distal part of the shoulder, fat fold on the back of the shoulder, bone structure index (R = 0,811, p < 0,000); skeletal muscle mass (SMM), lean mass (LM), basal metabolism (BM) (R = 0,383, p < 0,000); peak expiratory flow rate, wrist dynamometry (R = 0,695, p < 0,000). At the same time, the results of the strength endurance test «Barbell curl in a lying position for 30 seconds» are positively influenced by the values of chest girth (β = 0,423, p = 0.039), shoulder girth in a tense state (β = 0,302, p = 0,044), diameter of the distal part of the shoulder (β = 5,084, p = 0,014), skeletal muscle mass (β = 0,213, p = 0,003), lean mass (β = 0,424, p = 0,000), basal metabolic rate (β = 0,378, p = 0,000), peak expiratory flow rate (β = 0,201, p = 0,001), and wrist dynamometry (β = 0,283, p = 0,009). Negative influence on this quality is exerted by body weight (β = -8,981, p = 0,002), bone structure index (β = -5,069, p = 0,013).

Thus, the model characteristics for the quality of strength endurance of the body are, first of all, the indicators of the muscular and respiratory systems of the body.

Conclusions. Based on the results of multiple regression analysis, morphofunctional models of the motor qualities of highly skilled Mongolian athletes were constructed, which are based on morphological features, body composition indicators obtained us-

ing the bioimpedancemetry method, and functional characteristics and can be used in sports selection, at the initial stage of preparation and at the stage of individualization of sports skills in the long-term training process.

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Functional state of the circulatory and respiratory systems in highly qualified athletes when using hyperbaric oxygenation in training conditions in the middle mountain region

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Abstract

Objective of the study was to study of the dynamics of the functional state of the circulatory and respiratory systems in highly qualified athletes using HBOT in training conditions in mid-mountains.

Methods and structure of the study. The study of the effects of HBO in the training of athletes in mid-mountain conditions was carried out during training camps with 11 highly qualified female athletes at an altitude of 1240 meters in Kislovodsk, on Mount Maloe Sedlo. The course of HBOT procedures was carried out in a BaroOx 1.0 pressure chamber with the following parameters: excess pressure – 30 kPa, oxygen content – 93±2%, air flow – 45 l/min, compression/decompression rate – 6 kPa/min. The duration of one procedure is 30 minutes, the course is at least 7 procedures, 1 procedure per day.

Results and conclusions. Positive effects of the use of HBOT in female athletes during training in mid-mountain mountains were observed after the course in terms of heart rate variability parameters in the form of an increase in parasympathetic activity, while after the 1st session the power indicators of very slow waves indicated a hyperadaptive reaction. After a course of 7 procedures, changes in central hemodynamics also occurred: vascular tone and blood pressure decreased. The general condition caused by increased tone of the parasympathetic part of the autonomic nervous system in women led to a relaxing effect, including on the respiratory muscles

The results obtained allowed the authors to propose an effective strategy for training athletes in mid-altitude areas, designated as «Live high - train high, recover with additional oxygen». This method is recommended for general recovery of the body after a training day, micro- and mesocycle, and during the off-season training period.

Keywords: *athletes, functional state, cardiovascular system, respiratory system, mid-altitude, hyperbaric oxygenation.*

Introduction. Hyperbaric oxygenation (HBO) is an artificial increase in the oxygen capacity of the blood due to additional dissolution of oxygen in the plasma as a result of an increase in the partial pressure of oxygen in the inhaled gas mixture due to an increase in the total barometric pressure of the external environment [5].

The use of HBO to improve the functional capabilities of athletes in a number of studies has shown a positive effect, consisting in improving the functional state and increasing physical and mental performance [1, 2, 3, 4, 6, 7]. Scientists have also noted that under HBO conditions, not only accelerated recovery of the body occurs, but also an expansion of physiological reserves, as evidenced by the achievement of initial values by most of the studied indicators by the 30th minute of recovery, and then even exceeding them [4]. However, the issue of using HBO to restore athletes in the conditions of training in the mid-altitude areas remains unexplored.

Objective of the study was to identification of the dynamics of the functional state of the circulatory and respiratory systems in highly qualified female athletes using HBO in training conditions in the mid-altitude areas.

Methods and structure of the study. The study of the effects of HBO in the preparation of athletes in

mid-mountain conditions was conducted during the training camp at an altitude of 1240 meters in Kislovodsk, on the Maloye Sedlo mountain, among 11 highly qualified female athletes (CMS, MS; mixed group in sports: sambo, cross-country skiing, figure skating, handball).

The course of HBO procedures was carried out in the BaroOx 1.0 pressure chamber using a Covidien LLC mask, USA, in a preset program with the following parameters: excess pressure - 30 kPa, oxygen content - 93±2%, air flow - 45 l/min, compression/decompression rate - 6 kPa/min. The duration of one procedure is 30 minutes, the course is at least 7 procedures daily, body position - reclining. The study of central hemodynamics and heart rate variability (HRV) parameters was conducted using the ESTECK System Complex (LD Technology, USA). Spirometry parameters of athletes were determined using the Carefusion MicroLab Mk8 spirometer (South Wales, UK).

All participants gave informed consent to participate in the study in accordance with the World Medical Association Declaration of Helsinki (WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, 2013), as well as permission to process personal data. The study was approved by the Bioethics Committee of the Federal State Budgetary Institution SKFNC FMBA of Russia.

Statistical data processing was performed using the Statistica 13.0 computer program. Comparison of parameters was performed using the nonparametric Wilcoxon test. The parameters are presented as medians and quartiles.

Results of the study and discussion. Comparison of the HRV parameters before the HBO sessions, immediately after the 1st session, 10 minutes after the 1st session and after the course of procedures in female athletes did not reveal statistically significant changes, but there was a tendency for the HR to decrease 10 minutes after HBO compared to the baseline level (Fig. 1A). For the HF parameter - the power of fast high-frequency waves, there was a positive tendency for it to increase 10 minutes after HBO in athletes who had not previously had COVID-19 (before – 758,38 (585,11; 1015,1) ms²; 10 minutes after – 1734,57 (998,57; 2086,71) ms²). The LF indicator – the power of slow low-frequency oscillations – significantly decreased after the HBO course (before – 731,07 (505,87; 984,3) ms²; immediately after the 1st session – 711,66 (441,24; 894,39) ms²; 10 minutes after the 1st session – 808,8 (619,2; 1086,15) ms²; after the course – 426,23 (265,4; 940,66) ms²). There was also a tendency for the VLF index to decrease after the entire course of HBO, while after the 1st session it increased (up to – 665,24 (618,97; 848,75) ms²; immediately after the 1st session – 695,94 (639,81; 992,72) ms²; 10 minutes after the 1st session – 1219,29 (577,34; 1759,04) ms²; after the course – 620,17 (414; 712,03) ms²). There was a tendency for the tension index to decrease (Fig. 1 B) immediately after the 1st session of HBO (before – 100.3 (73,8; 128,2) conventional units; immediately after the 1st session – 81,55 (39,7; 111,5) conventional units; 10 minutes after the 1st session – 48,35 (44,9; 113,35) conventional units; after the course – 107,3 (65,1; 149,4) conventional units).

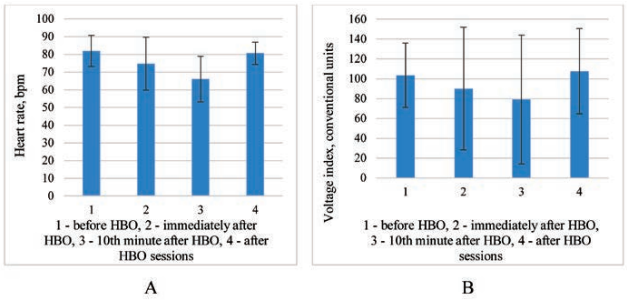

Fig. 1. Heart rate (A) and stress index (B) in highly qualified female athletes under the influence of hyperbaric oxygenation during training in mid-altitude conditions

When analyzing the central hemodynamic parameters, a decrease in the stiffness index (Fig. 2A) was observed, characterizing the blood pressure in large arteries both in one session and after a course of HBO procedures (before – 6,22 (5,26; 6,86) m/s; immediately after the 1st session – 6,02 (5,27; 6,29) m/s, p<0,05; 10 minutes after the 1st session – 6,15 (6,02; 6,62) m/s; after the course – 5,94 (5,24; 6,56), p<0,05) m/s.

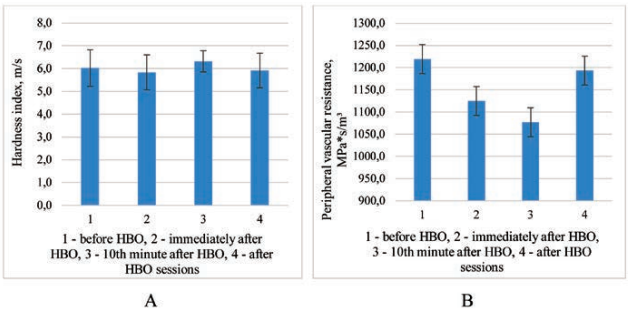

Fig. 2. Rigidity index values in highly qualified female athletes under the influence of hyperbaric oxygenation during training in mid-altitude conditions

After the first session, the PSS values decreased (before – 1207,6 (1132,9; 1243,8) MPa*s/m³; immediately after the 1st session – 1180,3 (975,5; 1243,5) MPa*s/m³, p<0,05; 10 minutes after the 1st session – 1062,9 (823,15; 1330,2) MPa*s/m³, p<0,05; after the course – 1156,6 (1074,3; 1342,5) MPa*s/m³ (Fig. 2 B) and BPd (before – 67 (64; 74) mm Hg, p<0.05; immediately after the 1st session – 64 (59,5; 69,5) mm Hg, p<0,05; 10 minutes after the 1st session – 65,5 (61,5; 70) mm Hg; after the course – 64 (61; 69)) mm Hg.

According to the indicators of external respiration function, after the course of HBO, FVC statistically significantly decreased (before – 4,25 (4; 4,77) l; after the course – 4,13 (3,85; 4,53) l, p<0,02).

C**onclusions.** Thus, the positive effects of HBO in highly qualified female athletes in the conditions of training in the mid-altitude areas according to the HRV parameters were manifested in the form of an increase in parasympathetic activity after the entire course. Changes in the functional indices of central hemodynamics in athletes under the influence of HBO consisted of a decrease in vascular tone of blood pressure and a hyperadaptive reaction after the 1st HBO session. The general condition caused by an increase in the tone of the parasympathetic division of the ANS in women led to a relaxing effect, including on the respiratory muscles. In general, this method is recommended for general recovery of the body after a training day, micro- and mesocycle, and in the off-season training period. The results obtained allowed us to propose an effective strategy for training athletes in the mid-altitude areas, which we designated by analogy with the existing ones [6, 7], as «Live high - train high, recover with additional oxygen».

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Mineral density of skeletal bones in persons participating in northern complex sports

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Abstract

Objective of the study was to evaluate the mineral density of bone tissue of skeletal segments in young men involved in northern all-around events.

Methods and structure of the study. Bone mineral density was studied in 24 young men aged 19-23 years, place of birth and place of permanent residence - Khanty-Mansi Autonomous Okrug-Yugra. The experimental group (EG) (n=12) included young men involved in the national sport - northern all-around (average age: 22,1±0,7 years), experience in sports 6-8 years. The control group (CG) (n=12) included young men who do not regularly engage in physical education and sports (average age 21,8±0,8 years). Using dual-energy X-ray absorptiometry, the mineral density of the bones of the skeleton and its segments, as well as the total content of minerals in them, was determined.

Results and conclusions. The total mineral content and total mineral density of skeletal bones did not reveal statistically significant differences between the control and experimental groups. In the EG subjects there was a statistically significant ($p<0,05$) increase in the mineral density of the bones of the pelvis, spine and lower extremity bones, respectively, by an average of 5,7%, 5,4% and 6,6%. Statistically significant (at $p<0,05$) increased values of the level of mineral density and the level of mineralization of the proximal femur and lumbar vertebrae (L1-L5) were found in the subjects of the experimental group relative to the control group. It is recorded that in young men involved in northern all-around, an area of increased mineral density of skeletal bones is formed within the boundaries of the lumbar spine - the pelvic girdle - the proximal femur. In young men involved in northern all-around, in contrast to those who do not regularly engage in sports, an increase in bone mineral density is observed in certain segments and zones of the skeleton, forming a special support zone.

Keywords: *bone mineral density, skeletal segments, northern all-around, boys.*

Introduction. The development of national sports is an important area of physical culture and sports development in the country, as it carries not only an element of physical culture, health and sports orientation, but also an important social and ethnocultural function [5, 7, 8]. In the northern regions of the Russian Federation, northern all-around events have become widespread among national sports [2, 9]. Many researchers see the prospects for developing this sport specifically for solving the problems of preserving the health of residents of the northern regions, not only as a culturally and evolutionarily established practice of preserving and maintaining the physical fitness of the indigenous population, but also as a practice that can be transmitted and ensure the maintenance of health of newcomers [3, 4]. The existing research in this area mainly concerns individual aspects of sports training of athletes in this sport [1, 6, 10]. At the same time, it is obvious that the existing lack of research in terms of studying the characteristics of the development and formation of physiological changes when practicing this sport definitely hinders its development not only as a sport, but also as an element of physical culture.

Objective of the study was to evaluate the mineral density of bone tissue of skeletal segments in young men involved in northern all-around events.

Methods and structure of the study. Bone mineral density was studied in 24 young men aged 19-23 years, place of birth Khanty-Mansiysk Autonomous Okrug-Yugra, place of permanent residence Khanty-Mansiysk Autonomous Okrug-Yugra. The experimental group (n=12) included young men involved in a national sport – northern all-around (mean age: 22,1±0,7 years). The control group (control group, n=12) included young men who do not regularly engage in physical education and/or sports (mean age 21,8±0,8 years). Bone mineral density of the skeleton and its segments (BMD, g/cm2), as well as the total mineral content (TMC, kg) were estimated using dual-energy X-ray absorptiometry on an X-ray bone densitometer from Lunar Prodigy GE Medical Systems. The study was conducted at the District Clinical Hospital (Khanty-Mansiysk). The results in the tables are presented as median, 1-3 quartiles (Me, Q1-Q3). The procedure for statistical evaluation of the significance of differences in indicators between groups was carried out using the Mann-Whitney t-test. The minimum significance level (p) was taken to be 0,05.

Results and conclusions. The results of the study showed that the total mineral content (TMC) and bone mineral density (BMD) of the skeletal bones as a whole did not show statistically significant differences between the subjects of the main group and the comparison group (Table 1). An insignificant increase in total mineral density was found in the subjects of the main group.

Table 1. *Indicators of total skeletal mineralization in subjects of the compared groups, Me (Q1-Q3)*

Subject group	TMC, kg	BMD, g/cm²
Nordic all-around (n=12)	3,01 (2,93-3,12)	1,23 (1,19-1,27)
Comparison group (n=12)	3,03 (2,89-3,14)	1,22 (1,18-1,23)

However, the study of bone mineral density by skeletal segments revealed reliable intergroup differences (Table 2). Thus, in the subjects of the EG relative to the control group, a statistically significant (at p<0,05) increase in the mineral density of the pelvic bones, spine and lower limb bones was observed, respectively, on average 5,7%, 5,4% and 6,6% higher relative to the CG.

Further assessment of mineralization of individual zones of the femur and lumbar vertebrae (L1-L5) also revealed statistically significant

Table 2. *Mineral density (BMD, g/cm²) of different skeletal segments in subjects of the compared groups, Me (Q1-Q3)*

Skeletal segment	Nordic all-around (n=12)	Comparison group (n=12)
Scull	1,76 (1,70-1,85)	1,84 (1,77-1,88)
Torso	0,98 (0,96-1,03)	0,99 (0,94-1,02)
Upper limbs	0,98 (0,92-1,01)	0,98 (0,93-1,00)
Lower limbs	1,45 (1,42-1,51)*	1,36 (1,33-1,42)
Pelvis	1,30 (1,26-1,32)*	1,23 (1,18-1,25)
Spine	1,18 (1,15-1,20)*	1,12 (1,09-1,15)

*Note: * - differences between groups are significant at a significance level of p<0,05.*

increased values of both the level of mineral density and the level of mineralization of these segments in subjects of the experimental group relative to the control group in all studied zones (Table 3). The maximum differences in mineral density were noted for the L1 vertebra – in the EG it was higher relative to the comparison group by an average of 11,8% (p<0,05).

Table 3. *Bone mineral density (BMD, g/cm²) and total mineral content (TMC, g) in the proximal femur and lumbar vertebrae (L1-L4) in subjects of the comparison groups, Me (Q1-Q3)*

Skeletal segment zone	Indicator	Nordic all-around (n=12)	Comparison group (n=12)
Proximal femur	TMC	44,8 (42,5-45,9)*	41,4 (39,8-42,2)
	BMD	1,26 (1,23-1,32)*	1,18 (1,16-1,23)
Vertebra - L1	TMC	17,1 (16,6-17,9)*	13,7 (13,1-14,9)
	BMD	1,23 (1,20-1,29)*	1,10 (1,08-1,16)
Vertebra - L2	TMC	20,2 (18,8-21,9)*	16,9 (15,8-17,5)
	BMD	1,30 (1,25-1,33)*	1,21 (1,18-1,23)
Vertebra - L3	TMC	22,3 (20,8-24,1)*	19,4 (18,3-19,9)
	BMD	1,33 (1,28-1,35)*	1,25 (1,23-1,28)
Vertebra - L4	TMC	23,6 (22,3-25,2)*	20,2 (19,2-21,9)
	BMD	1,34 (1,30-1,36)*	1,24 (1,22-1,27)

*Note: * - differences between groups are significant at a significance level of p<0,05.*

In young men involved in Nordic all-round sports, an area of increased mineral density of the skeletal bones is formed within the boundaries of the lumbar spine - pelvic girdle - proximal femur. In fact, in the absence of differences in mineral density in other segments, athletes of this type were observed to form a kind of «support» hypermineralized skeletal girdle, which is not observed for athletes of other sports in our previous studies.

Conclusions. It has been established that young men involved in northern all-round events have an increase in bone mineral density in individual

skeletal segments that form a special support zone. Elements of northern all-round events can be included in health programs to increase bone mineralization in support zones - the lumbar spine, pelvis and proximal femur, as it can be used in the future to prevent osteopenia, osteochondrosis, and fractures of these segments.

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Normative scales for assessing static equilibrium in junior schoolchildren

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Abstract

Objective of the study was to develop normative scales for assessing static balance in younger schoolchildren.

Methods and structure of the study. The scientific work was carried out on the basis of school 1476 in Moscow, in which 570 elementary school students took part. A comprehensive assessment of the physical development of children of primary school age was carried out. For static balance of junior schoolchildren, a complicated non-instrumental Romberg test was used. The use of the Romberg test is based on the assessment of vertical stability and stability of a person's posture, which involves identifying the degree of contribution of different sensory systems. Maintaining a stable posture is ensured by: vision, vestibular apparatus, proprioception. In the Romberg test, performed in a calm state on a stationary support, provided there are no disorders of the vestibular apparatus, the activity of the visual system and proprioception is assessed to a greater extent. In the practice of physical education and sports, the Romberg test is also quite often used for comprehensive testing of schoolchildren.

Results and conclusions. Centile scales have been developed to evaluate the Romberg test on one leg with open and closed eyes; visual control has a significant impact on primary school students when performing a test exercise for static balance. The experiment revealed the dominance of the right leg relative to the left.

Keywords: *Romberg test, static balance, centile scales, children of primary school age.*

Introduction. The Romberg test is a universal diagnostic exercise used in medicine to identify dysfunctions of the vestibular apparatus and cerebellum, and in physical education and sports activities to assess static balance. Stability and steadiness of the vertical posture are provided by three main components: the visual sensory system, the vestibular apparatus, and proprioceptive sensitivity. The Romberg test, depending on the complexity and method of its implementation, allows for varying degrees of quantitative assessment of the stability of the vertical posture and the contribution of certain sensory systems to maintaining it. The visual component is involved in ensuring the vertical posture at all levels of complexity of the Romberg test. Evaluation of its contribution allows for determining important aspects, such as a person's "sensory profile" – the degree of dominance of vision or proprioception in organizing a person's movement and posture. Vision, in particular, determines the involvement of conscious control and perception of the position of one's own body in space when organizing movement and posture [2, 4, 5]. Balance develops based on the improvement of reflex mechanisms in the process of maturation of the vestibular analyzer. The sensitive period of balance development is the age of 7-12 years, respectively, it is important to control and identify violations in this age period. By the age of 13-14, the indicators of body stability reach the value characteristic of an adult [1]. As a result of the analysis of the literature, it was revealed that most of the normative values for the studied samples are not oriented towards children, which does not allow for a quantitative and qualitative assessment of the physical condition of primary school children.

Objective of the study was to develop standard scales for the Romberg test indicator and to assess the level of static balance in primary school children.

Centile scales for assessing the Romberg test on one leg with open and closed eyes for students in grades 1-4 (seconds)

Eye position	Leg	Very low	Low	Below the average	Average	Above average	High	Very high
1-2 grades								
Open	Right	2	2-5	5-7	**7-15**	15-20	20-25	25
	Left	1	1	1-3	**3-4,2**	4,2-4,3	4,3- 5,2	5,3
Closed	Right	1	1-3	3-6	**7-10**	11-15	15-18	18
	Left	1	1	1-2,5	**2,5-3**	3-4,2	4,2-5,2	5,3
3-4 grades								
Open	Right	5	5-10	10-15	**15-20**	20-25	25-30	30
	Left	1	1	1-2	**2-4,5**	4,5-8	8-9	9
Closed	Right	3	3-6	7-9	**9-12**	12-15	15-20	20
	Left	1	1	1	**1-4**	4-7	7,1-8	8

Methods and structure of the study. The research work was carried out on the basis of school 1476 in Moscow, in which 570 primary school students took part. A comprehensive assessment of the physical development of primary school children was carried out. For the static balance of primary school children, a complicated non-instrumental Romberg test was used. However, there are no standard scales for an objective quantitative and qualitative assessment of primary school children using the Romberg test. Centile scales include a quantitative assessment and the corresponding qualitative values: «very high», «very low», «high», «low», «average», «below average», «above average» [3].

Results of the study and discussion. Centile scales for the age sample of primary school students were determined (see table). Each age is represented by a sample of 100 people, since no reliable differences in indicators between classes were found - combined scales are presented.

As a result of the testing, taking into account the developed standard scales, it was found that among schoolchildren in grades 1-2 in a position with open eyes: «very low» – 3% of schoolchildren: right – 2 sec, left – 1 s; «very high» – 3% of schoolchildren: right 25 sec, left – 5,3 sec; «low» – 7% of schoolchildren: right 2-5 sec, left – 1 sec; «high» – 7% of schoolchildren: right 20-25 sec, left 4,3-5,3 sec; «below average» – 15% of schoolchildren: right 5-7 sec, left 1-3 sec; «above average» – 15% of schoolchildren: right 15-20 sec, left 4,2-4,3 sec; «average» – 50% of schoolchildren: right 7-15 sec, left 3-4,15 sec. In the position with eyes closed: «very low» – 3% of schoolchildren: right – 5 sec, left – 1 sec; «very high» – 3% of schoolchildren: right 30 sec, left –9 sec; "low" – 7% of schoolchildren: right 1–3 sec, left – 1 sec; «high» – 7% of schoolchildren: right 16-18 sec, left 4,3-5.2 sec; «below average» – 15% of schoolchildren: right 3-6 sec, left 1-2,5 sec; «above average» – 15% of schoolchildren: right 11-25 sec, left 4,2-4,3 sec; «average» – 50% of schoolchildren: right 7-10 sec, left 2,5-3 sec. It was found that for schoolchildren of grades 1-2 the influence of the visual analyzer was significant and the indicators obtained when performing the test with closed eyes were significantly lower than with open eyes. Schoolchildren showed a pronounced asymmetry of stability on the right leg.

As a result of the testing, taking into account the developed standard scales, it was found that among schoolchildren of grades 1-2 in a position with open eyes: «very low» - 3% of schoolchildren: right - 2 sec, left - 1 sec; «very high» - 3% of schoolchildren: right 25 sec, left – 5,3 sec; «low» - 7% of schoolchildren: right 5-10 sec, left - 1 sec; «high» - 7% of schoolchildren: right 25-30 sec, left 8-9 sec; «below average» - 15% of schoolchildren: right 10-15 sec, left 1-2 sec; «above average» - 15% of schoolchildren: right 20-25 sec, left 4,5-8 sec; «average» - 50% of schoolchildren: right 15-20 sec, left 2-4,5 sec.

With eyes closed: «very low» - 3% of schoolchildren: right - 3 sec, left -1 sec; «very high» - 3% of schoolchildren: right 20 sec, left -8 sec; «low» - 7% of schoolchildren: right 3-6 sec, left -1 sec; «high» - 7% of schoolchildren: right 15-20 sec, left 7.1 - 8 sec; «below average» - 15% of schoolchildren: right 7-9 sec, left 1-2 sec; «above average» - 15% of schoolchildren: right 12-15 sec, left 4-7 sec; «average» - 50% of schoolchildren: right 9-12 sec, left 1-4 sec.

Relative to schoolchildren in grades 1-2, students in grades 3-4 have increased performance indicators

for the Romberg test on the right leg. Relative to asymmetry, the indicators are higher, which emphasizes the clear dominance of the right leg. Performing a complicated Romberg test does not cause difficulties for primary school students in the position of «standing on the right leg with open eyes», however, with age, the difference in results increases towards a significant dominance of the right leg.

Conclusions. Centile scales have been developed to evaluate the Romberg test on one leg with open and closed eyes; visual control has a significant effect on primary school students when performing a test exercise for static balance. The experiment revealed the dominance of the right leg relative to the left.

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Psychological characteristics of healthy lifestyle and self compassion in socially active elderly persons

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Abstract

Objective of the study was to identify the relationship between the components of a healthy lifestyle and self-compassion in socially active elderly people.

Methods and structure of the study. To achieve the goal, tools were used - psychodiagnostic testing using the questionnaire «Profile of a Healthy Lifestyle» by M.D. Petrash, O.Yu. Strizhitskaya, I.R. Murtazina, self-compassion scales by K. Neff, adaptation by K.A. Chistopolskaya, E.N. Osina, S.N. Enikolopova. The study involved 86 respondents aged 57 to 79 years. Testing was carried out on the basis of the Novosibirsk State Technical University.

Results and conclusions. An average level of self-compassion was revealed in socially active older women and a high expression of most components of a healthy lifestyle. Correlation analysis using Spearman's Rs test showed the presence of significant connections between the components of a healthy lifestyle and the parameters of self-compassion, in particular, correlations were found between mindfulness, self-kindness, and over-identification with such components of a healthy lifestyle as internal growth and stress management. Socially active older women who show a balanced, friendly and attentive attitude to their experiences at a high level have high rates of desire for self-realization and the ability to recognize and counteract sources of stress. The results of the study suggest that incorporating psychological and self-compassion techniques can improve healthy lifestyles, increase resilience to stress, and promote healthy aging.

Keywords: *healthy lifestyle, healthy aging, self-compassion, social activity, elderly people.*

Introduction. Modern society is characterized by an increase in life expectancy with a decrease in the birth rate. The following features of the demographic structure have been identified: an increase in life expectancy; a change in the boundaries and ratios of age groups; the emergence of new age stages – «digital childhood», entry into adulthood; an increase in the stage of productive professional activity; the emergence of a period of productive post-professional life [2].

E.A. Sergienko identifies as factors of successful aging «the ability to maintain one's own individuality, the development of new opportunities for interaction with the environment, self-realization, the ability to adapt, flexible use and reorganization of one's own resources, and access to external resources, the ability to cope, resist and compensate for diseases, constructive behavior patterns, and further building one's life path» [5]. Productive post-professional life implies high social activity of elderly people, which can contribute to a subjectively positive perception of aging and promote a healthy lifestyle. The authors study the conditions of positive aging and generativity, confirming the high importance of interaction with the social environment for successful aging [4]. Factors of social activity of elderly citizens using the example of the Belgorod region were studied by O.V. Besschetnova and L.V. Tarasova. According to their data, «marital status, health status, living conditions, education and professional expe-

rience, internal motivation, the opportunity to participate in cultural and leisure, labor, social, volunteer activities have a positive effect on social activity in old age, and a negative socio-political situation in the country, loneliness, biased attitude towards elderly citizens – negative» [1]. In this regard, 2 groups of factors influencing successful aging are distinguished: external - inclusion in socio-cultural life and interaction with loved ones, internal - certain personal characteristics and behavioral features that make up the adaptive potential of a person in old age. Thus, the relevance of the study is due to the need to identify socio-psychological factors that contribute to successful aging, in connection with current demographic changes.

Objective of the study was to determine the relationships between healthy lifestyle components and self-compassion in socially active elderly individuals.

Methods and structure of the study. The testing was conducted at the Novosibirsk State Technical University, in which 86 respondents aged 57 to 79 years took part. The main tools were psychodiagnostic testing using the questionnaire «Healthy Lifestyle Profile» by M.D. Petrash, O.Yu. Strizhitskaya, I.R. Murtazina, the self-compassion scale by K. Neff, and the adaptation by K.A. Chistopolskaya, E.N. Osin, S.N. Enikolopov [3, 6]. Statistical analysis was conducted using the jamovi Desktop program.

Results of the study and discussion. An analysis of the average results using the Healthy Lifestyle Profile method showed a high expression of most components of a healthy lifestyle. The highest values were found on the scales of Interpersonal Relationships and Internal Growth (M=30,65 and M=27,05, respectively, with a maximum possible value of 36), and the lowest on the scale of Physical Activity (M=18,88 with a maximum possible value of 32). In this regard, socially active elderly women are able to enjoy communicating with others, build relationships with loved ones, are prone to a benevolent perception of other people, have goals in life and strive for self-development and self-realization, but at the same time do not pay enough attention to physical exercise on a regular basis. The assessment of the data on the self-compassion scale showed that all components are expressed by respondents at an average level (mean values vary from 2,83 to 3,53), except for the self-criticism indicator (M = 2,45), which is closer to the upper limit of the low level. The obtained result gives grounds to say that, in general, socially active representatives of the elderly are characterized by a sympathetic idea of themselves, despite the severity of condemnation of their shortcomings and actions.

Correlation analysis using Spearman's Rs-criterion showed the presence of significant relationships between the parameters of self-compassion and the components of a healthy lifestyle in socially active elderly women. The greatest number of correlations with the components of a healthy lifestyle (interpersonal relationships, internal growth, stress management) was found with the «mindfulness» subscale of the self-compassion scale (Rs = 0,22; Rs = 0,39; Rs = 0,33; $p<0,05$, respectively). This means that socially active elderly women who demonstrate a balanced and attentive attitude to their experiences at a high level have high rates of readiness for communication and positive attitudes towards other people, desire for self-realization, and the ability to recognize and counteract sources of stress. The subscale «Kindness to oneself» of the self-compassion scale has direct correlations with the scales «inner growth» (Rs = 0,33, $p<0,01$) and «stress management» (Rs = 0,28, $p<0,01$), which allows us to talk about the importance of a benevolent and loving attitude towards oneself in socially active elderly women in difficult situations for their self-development and self-regulation when faced with stressors. Negative correlations with the scales «internal growth» (Rs=-0,24, $p<0,05$) and «stress management» (Rs=-0,34, $p<0,01$) were found with the subscale «excessive identification»: if socially active elderly women tend to dwell on their experiences and react sharply to failures, then their abilities for self-development and self-regulation in stressful situations are also reduced.

Conclusions. A study of the characteristics of self-compassion and a healthy lifestyle in socially active elderly women showed a connection between these psychological constructs. The results of the study suggest that the inclusion of psychological techniques and methods for developing self-compassion helps improve a healthy lifestyle, increase stress resistance, and promote successful aging.

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Realization of individual-personal development potential of children with intellectual disabilities in the process of adaptive physical education

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Abstract

Objective of the study was to determination of the leading principles of adaptive physical education aimed at realizing the individual development potential of students with intellectual disabilities.

Methods and structure of the study. A theoretical analysis of scientific and methodological literature in the field of adaptive physical education on the psychological and pedagogical characteristics of children with intellectual disabilities was carried out.

Results and conclusions. The concept of «individual-personal development potential of children with intellectual disabilities» is formulated as a set of their biological-individual and personal-social characteristics that make it possible to realize what is inherent in nature (physical abilities, functional capabilities and mental (cognitive) processes) and to form socially necessary qualities in the process of various activities. General pedagogical and specific principles of adaptive physical education are identified, which make it possible to realize the individual and personal development potential of children with intellectual disabilities.

Keywords: *children with intellectual disabilities, individual and personal development potential, principles of adaptive physical education.*

Introduction. The humanization of the modern social worldview has led to a change in the medical paradigm to a socially-oriented path of development of children with disabilities. The group that is particularly in need of adaptation to life's realities is children with intellectual disabilities (hereinafter referred to as ID), who are characterized by weakness and inertia of excitation and inhibition processes, insufficient development of cognitive functions, difficulty in understanding and using abstract concepts and complex tasks; delayed development of motor skills, which causes difficulties in performing simple everyday actions; emotional and behavioral problems; lack of communication skills and difficulties in establishing and maintaining social relationships and adapting to new life situations. For a long time, this category was considered by specialists in the aspect of comparison with normotypic children, which determined the tasks of a predominantly corrective plan, solved in the process of education and upbringing. It should be noted that scientists have repeatedly proven that children with ID, like any other children, develop throughout their lives. Moreover, the emergence and formation of various mental properties is determined by the child's lifestyle during ontogenesis under the influence of education carried out in specific socio-historical conditions [2, 4, 5].

Objective of the study was to identify the leading principles of adaptive physical education aimed at realizing the individual and personal development potential of students with intellectual disabilities.

Methods and structure of the study. The theoretical analysis and generalization of scientific

and methodological literature in the field of adaptive physical education (APE), as well as generalization of pedagogical experience based on pedagogical observation of children with disabilities (2015-2024) were carried out: conducting physical education and sports classes under the program of the Special Olympics of Russia; implementation of the projects: «Sports Express of the Special Olympics», «Inclusive Sports Saturday», «Inclusive Swimming Sea of Opportunities», «Inclusive Sports for All», «Unified Leader-Ship»; organization of the All-Russian Spartakiad of school sports clubs among students with disabilities and children with disabilities, the Unified Games of the Special Olympics - 2023, the Annual Swimming Tournament «Let's Win Together», etc.

Results of the study and discussion. At the present stage of the evolution of education, the conceptual humanistic views of the pedagogical community have formed the basis for changing the state's target settings in creating conditions for the maximum disclosure of individual potential, taking into account the unique characteristics of each person, without infringing on the interests of other people. The category of people with mental disabilities is characterized by numerous heterogeneous manifestations of intellectual disability, which predetermines a differentiated approach to the content of education, taking into account special educational needs. It is impossible to single out people of this category into some clear typological group, in accordance with standard and unified criteria, with specific learning outcomes that each student with intellectual disabilities must achieve. This is due to the fact that each of them has their own innate biological potential (interrelated physiological functions and anatomical structures, internal individual-psychological characteristics) and various socio-environmental conditions (actions, tasks and spheres of life, external social connections and socio-cultural environment), which significantly affect the nature and effectiveness of the social development of a special child. The methodological basis of our work was the research of L.S. Vygotsky, who substantiated the divergence of cultural and biological processes of development of this category of children. According to his theory, the development of higher mental functions (memory, attention, thinking, perception, imagination and speech) in children with disabilities is limited by the core signs of mental retardation (poor susceptibility and insufficient activity) and is possible in the process of cultural education by activating cognitive interests and the need for new impressions [2]. In our opinion, one of the most effective tools for social integration, development of the internal and cultural potential of students with disabilities is well-organized physical education and sports activities [3, 6, 8], the importance of which is due to its extrapolation to the indicators of development of cognitive processes and physiological functions of this contingent of children.

This conclusion defined the conceptual idea of our study, which determines the need to create conditions for the implementation of the individual-personal development potential of children with ID in the process of APE. Defining the substantive essence of the concept of «individual-personal development potential», we came to the conclusion that individual-personal potential is a complex structural organization and is considered by scientists from the position of studying personal potential and biological potential separately, often identifying the concepts of «individuality» and «personality». In his scientific works, A.N. Leontiev convincingly proves the inadmissibility of mixing the concepts of «individuality» and «personality», revealing the process

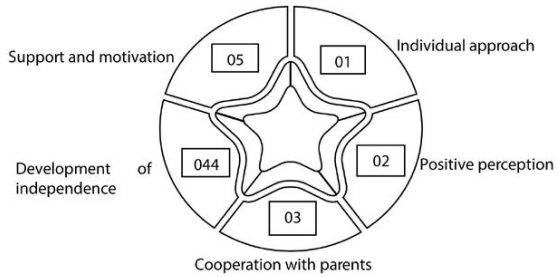
List of «life competencies» of children with disabilities

Name of the competency	Content of competence
Social competencies	Ability to communicate, build relationships, resolve conflicts, cooperate with other people
Communicative competencies	The ability to clearly and understandably express one's thoughts, listen to others, understand and interpret information
Emotional competence	Ability to understand your emotions and the emotions of others, regulate your emotions, manage stress
Cognitive competence	Ability to learn, solve problems, think critically, analyze information
Practical competencies	Ability to take care of oneself, run a household, earn money, use transport, manage finances

of formation of a person's personality in his activities [5].

We define the «individual-personal development potential of children with intellectual disabilities» as a set of their biological (individual) and personal (social) characteristics that allow, to one degree or another, to realize what is inherent in nature (physical abilities, functional capabilities and mental (cognitive) processes) and to form socially necessary qualities in the process of various activities. In order to realize the individual and personal development potential of children with disabilities in the process of physical education and sports activities, it is necessary to identify guidelines (principles) that update and supplement the groups of principles of AFC developed by the scientific school of S.P. Evseev, as applied to the AFC process, taking into account the modern needs of students with intellectual disabilities, social and state challenges that aim the educational process at ensuring psychophysical development, social adaptation and the formation of life competencies [4]. N.O. Bulanova understands the concept of «life competence» as «an integral characteristic that determines a person's ability to solve life problems and tasks in typical life situations using the experience of various types of activities» [1]. Therefore, for children with intellectual disabilities, life competencies are a set of knowledge, abilities, skills and personal qualities necessary for successful adaptation in society and independent life.

Successful implementation of the individual-personal development potential of children with intellectual disabilities is possible only with close cooperation between parents, teachers, specialists and the child himself. We have proposed key general pedagogical principles for the implementation of the individual-personal development potential of the child.



Key general pedagogical principles for the implementation of the individual and personal development potential of a child

In addition to the general pedagogical ones, we have established specific guidelines of the APE, which underlie the implementation of the individual and personal development potential of children with intellectual disabilities. These include: 1) sports ethics and communication; 2) ensuring psychological safety; 3) creating an inclusive sports environment; 4) integrating virtual (VR) and motor activities. Sports ethics and communication are determined by the uniqueness and specificity of sports activities, during which a system of principles, norms and values regulating the relationships between athletes, coaches, fans is formed, as well as the interconnection and interdependence of an individual athlete and the team as a whole. Ensuring psychological safety in classes with children with intellectual disabilities includes understanding the characteristics of children's development, creating safe and comfortable conditions for classes, developing confidence and self-esteem, as well as conflict management.

The creation of an inclusive sports environment plays an important role, since it is aimed at developing physical activity in all members of society, contributes to the creation of a more tolerant and socially responsible society, as well as maintaining the physical and psychological health of all people [7].

The integration of virtual and motor activity is a new and promising area in the development of children with disabilities, which allows creating interactive, motivating and effective educational and rehabilitation programs that help improve the physical and mental health of children, as well as develop their cognitive abilities, social skills and emotional intelligence.

When organizing APE for children with disabilities, it is necessary to take into account that the level of intellectual development, learning speed and personality traits of each child are individual, and regardless of the diagnosis, each child has unique talents and strengths that need to be identified and developed based on the conceptual position on the presence of individual-personal development potential for children with intellectual disabilities, which manifests itself with adequate support and the creation of a favorable environment. It is also important to realize that individual-personal potential is not static, but changes and is revealed throughout a person's life [1].

Conclusions. Adaptive physical education is a key factor in the disclosure and implementation

of the individual and personal potential of children with intellectual disabilities, contributing not only to physical development, but also playing an important role in the development of cognitive abilities, social adaptation, emotional stability and the formation of personality as a whole. The main specific provisions of APPE, which underlie the implementation of the individual and personal development potential of children with intellectual disabilities include: sports ethics and communication; ensuring psychological safety; creating an inclusive sports environment; integration of virtual (VR) and motor activities.

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Didactic integration of physical education and educational activities in the conditions of public service universities

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Abstract

Objective of the study was to develop and justify a model of combined learning that provides opportunities for stable and continuous development of sports skills and educational competencies.

Methods and structure of the study. Algorithmization of organizational and educational activities in iterations of project management has been implemented. Observations were carried out to assess the dynamics of professional competencies and sports readiness of 37 students (15 boys and 22 girls), aged 20,5±0,5 years.

Results and conclusions. Structuring educational and sports training activities in the areas of management functions of physical culture and sports management forms a high level of professional competencies and sports preparedness of student-athletes. Scaling multi-criteria tasks for training management personnel, synchronizing the processes of educational and sports activities of students, achieving a balance between basic and additional educational programs for training specialist managers, determine the representativeness of sources for increasing the professional and physical potential of management students.

Keywords: *students, combined learning model, professional competencies, sports skills.*

Introduction. Sports clubs created in universities are integrated student sports facilities that ensure mass participation in sports activities and growth of students' sports achievements. Participation in club sports activities contributes to obtaining higher professional education and sports improvement of gifted athletes in the chosen sport.

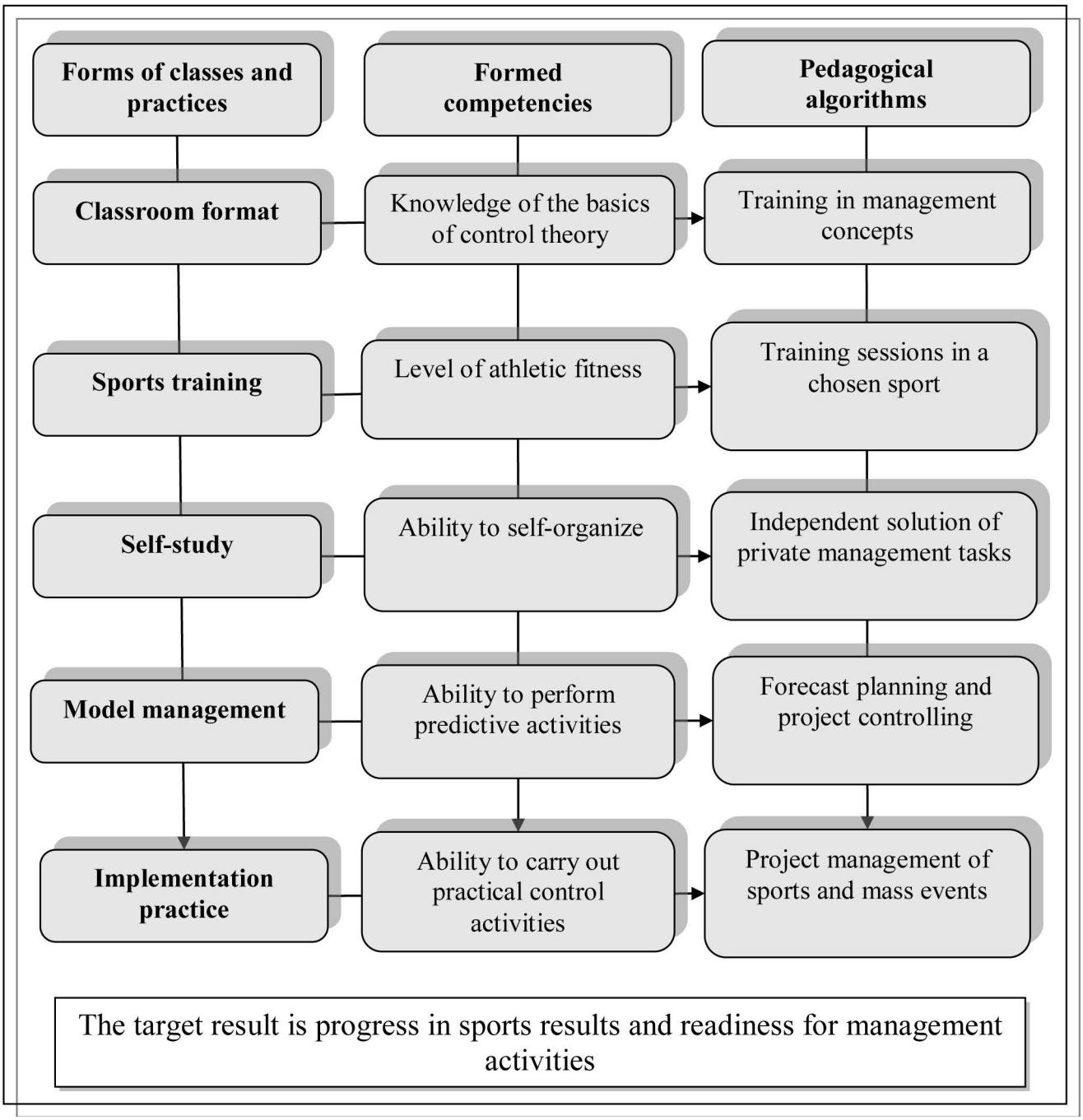
Features of the organization of educational and training processes in the conditions of civil service universities have specific goals and models of training students who are actively involved in sports and are part of the university national teams in various sports. The predicted increase in the involvement of student athletes in educational and training activities often leads to a forced suspension of sports activities and participation in competitions [1, 4]. On the other hand, systematic participation in long tournaments and competitions limits the routes of mastering professional competencies in accordance with educational standards.

Difficulties associated with resolving the identified problem are due to the need to choose social priorities, as well as the interdisciplinary disunity of the training and educational processes [3]. The solution to the identified problem requires the introduction of a technological component that allows for the prompt and targeted implementation of a binary development strategy: «obtaining professional education – improving sports skills», focused on the parametric regulation of the management effects of combining sports and education [2]. The a priori logic of studying this problem allows us to put forward a hypothesis that the transformation of operational educational tools based on combined

educational activity algorithms will increase the effectiveness of professional and sports development of university students with a management profile [5, 6].

Objective of the study was to justification of a combined learning model that provides opportunities for the integrated development of sports skills and professional competencies of management students.

Methods and structure of the study. The operational functionality of the combined learning model is focused on mastering additional educational resources, which implied the performance of administrative and managerial functions, duties of members of the student sports club in the areas, managers of sports teams by students of the Faculty of Public and Municipal Administration. A predictive model of social interaction of students in the field of sports



Combined model of sport and education

management with the development of professional competencies of employees of state and municipal administration bodies was developed.

The profile of management functions is structured by the areas of coordination of the activities of state and local structures for the management of physical education and sports activities:

- analysis of trigger zones in the development of a sport at the university, identification and processing of problematic aspects and physical education needs of students, development of strategies and programs for training and development of a sports team of the faculty and university, assessment of the effectiveness and results of the implementation of sports and mass projects;

- management of material resources, requisitioning, receipt and distribution of sports equipment, control over their intended use and reporting, search for additional sources of equipment for athletes;

- organization of work with students, conducting surveys, coordination of the work of the sports club, the Department of Physical Education and the management of the university on issues of physical education and sports activities;

- cooperation with information portals, the media, representing the interests of your sports club, popularization of the sporting achievements of the university;

- provision and holding of competitions in sports, development and preparation of sports documentation, refereeing and control over the implementation of competition rules;

- management of the personnel of sports organizers of educational departments, increasing motivation and stimulating the work of captains of sports teams and the fan club;

- conducting scientific research within the framework of the work of the student scientific society on the implementation of mass sports projects. At the second stage, observations were carried out to assess the dynamics of professional competencies and sports training of 37 students (15 boys and 22 girls) aged 20,5±0,5 years.

Participants in combined training underwent training seminars and trainings with further integration of training camps and organizational management activities into the structure of the training cycle and the educational process.

The representativeness of the developed model was assessed by monitoring the competencies, social characteristics and level of sports training of students.

Results of the study and discussion. Combined learning is an educational paradigm that combines various options for classes and practices, including a classroom format, independent training, sports training and practical performance of professional duties in simulated conditions of management activities. It has been established that the content of combined learning, focused on the aggregation of various types of classes of a comprehensive and selective focus, improves learning outcomes and contributes to the formation of an integrated sports and management potential of students. A multi-criteria system of additional factors stimulating students' creative activity in mastering sports and management competencies reduces the training of a specialist manager in personnel and staff management.

Combined learning resources scale students' motivation for sports and professional fields of activity, expand the possibilities of programming components of the educational and training process, mastering students' professional competencies and sports skills.

The instrumental field of work, based on the multifunctional focus of the educational environment, ensured the achievement of a synergistic effect due

Results of monitoring the competencies, social characteristics and level of sports training of students

Indicator	Before	After	t	p
Nominees for intercollegiate competitions in sports, %	15,6±0,3	23,7±0,2	2,6	< 0,05
Students who again achieved the standards for sports categories, %	24,7±0,5	36,8±0,2	2,8	< 0,05
Number of winners of interuniversity Olympiads, %	4,8±0,2	8,7±0,1*	3,6	< 0,05
Average score in mastering special disciplines	3,8±0,1	4,2±0,1	4,3	< 0,05
Ability to develop programs for the development of a sports team, points	3,6±0,4	4,5±0,7	2,6	< 0,05
Sports Record Keeping Skills, points	2,8±0,2	4,2±0,3	2,8	>0,05
Personnel management skills of sports organizers, point	3,3±0,6	4,4±0,7	6,8	< 0,05

to mastering the skills of organizing work with students, conducting surveys, coordinating the work of the sports club, the Department of Physical Education and the university management on issues of physical education and sports activities.

The multifunctional focus of the training and training process, combining various forms of classes and management algorithms of activity, differentiated by the content of management practices of physical education and sports activities, contributed to the high-quality development of the main professional programs of state and municipal administration. Parametric algorithmization of organizational and educational and training activities in iterations of project management leads to achieving a higher level of sports results, including through participation in organizational and managerial events held by the university sports club. 73% of students participating in the study met the requirements for assigning mass sports categories in the chosen sport (from the 3rd sports category and above).

The results of the study indicate that student-athletes who have completed combined training are highly motivated to master the profession of a manager and other aspects of management.

A universal criterion in assessing the effectiveness of the combined model of sports and education is the autocatalysis of professional self-development of students, ensuring the achievement of a high level of managerial and sports competencies in the competitive conditions of the professional and social sphere.

Conclusions. The results of the conducted research prove the effectiveness of the implementation of the combined form of the educational environment in the educational process of higher education institutions with a management profile. Structuring educational and sports training activities in the areas of management functions of physical education and sports management forms a high level of professional competencies and sports training of student-athletes. Scaling multi-criteria tasks of training management personnel, synchronizing the processes of educational and sports activities of students, achieving a balance between the main and additional educational programs for training a specialist manager determine the representativeness of sources for increasing the professional and physical potential of student managers.

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