



# T & P P C

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# Theory & Practice of Physical Culture

Athletic  
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psychology

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physical education

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physiology



**Key issues of the modern sports science for discussion**

### **Optimization of students' independent work in the system of physical education based on electronic educational resources**

In the pedagogical practice of physical education, it is generally recognized that independent work of a student is an activity aimed at the development of physical qualities, training in motor actions, regulated by the student himself, internally motivated and individually built into a set of actions to fulfill the set educational tasks. This type of educational activity requires a high level of self-awareness, reflection, self-discipline, personal responsibility from the student and is aimed at satisfying the need for physical self-improvement and self-knowledge. At the same time, independent work as a means of learning forms the necessary volume and level of knowledge, motor skills and skills for the development of mental activity, and for the effective solution of motor tasks; develops their psychological attitude to self-systematic replenishment of their knowledge and the development of skills

to navigate the flow of educational and scientific information when solving new cognitive tasks.

The algorithm for performing independent work consists in collecting, identifying factual material; selecting and applying certain logical operations specified by the teacher; understanding the problem and determining the sequence of the task.

It should be emphasized that independent educational activity in physical education is a form of education in which a student learns to work systematically, systematically, think, forms his own style of mental and motor activity. Its difference from theoretical disciplines is that, along with the student's ability to independently organize academic work, it allows him to develop and improve physical activity in accordance with the task.

Independent educational activity, in our opinion, can be implemented by students at different stages of the learning process: when acquiring new knowledge and consolidating it, performing physical exercises, repeating and testing knowledge, skills and abilities. The systematic reduction of the direct assistance of the teacher serves as a means of increasing the creative activity of students in solving tasks.

Based on the use of a computer learning tool, the teacher manages the process of teaching students and their independent work: determines the goals and forms of classes, builds a plan for organizing the student's work with teaching materials, monitors the student's work from his workplace, if necessary, intervenes in the process of student interaction with educational material within the electronic educational resource (EOR).

The student is the main user of EOR, using which he can display the necessary fragment of educational information on the monitor, practice solving tasks /tasks, perform calculations, simulate the objects under study, control his knowledge and motor actions.

*We invite scientists to publish articles that are aimed at finding new approaches in the development of the Olympic movement and large-scale sports events.*

**Chief Editor of TiPFC,  
Honored Worker of Physical Culture of the Russian Federation,  
doctor of pedagogical sciences, professor L.I. Lubysheva**

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Theory and Practice  
of Physical Culture

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# Special endurance of highly qualified judoists and the method of its quantitative assessment in preparation for responsible competitions

UDC 796.012



Dr. Hab., Professor **V.V. Shiyan**<sup>1</sup>

<sup>1</sup>Russian State University of Physical Education, Sports, Youth and Tourism (SCOLIPE), Moscow

Corresponding author: shiyanv@mail.ru

## Abstract

**Objective of the study** was to substantiate methods for assessing the level of development of special endurance of wrestlers on the basis of a comprehensive definition of pedagogical and biochemical indicators characterizing the effectiveness of performing a standard specific task with throws of a wrestling dummy.

**Methods and structure of the study.** As a result of exploratory research, the author developed a standardized test program with deflection throws of a wrestling dummy and a criterion for quantifying the level of special endurance of judo wrestlers. Based on the results of long-term observations of the dynamics of special endurance of highly qualified judoists, guidelines for a quantitative assessment of the special endurance of athletes at various stages of training are proposed. The author notes that the program of precompetitive training of wrestlers should be focused on achieving a level of special endurance that exceeds the limit value of the coefficient of special endurance (CSE) of more than five conventional units. With this level of special endurance, the load of a competitive duel does not lead to a pronounced activation of anaerobic glycolysis. The pH values after the fight will be in the optimal values (7.2-7.27 c.u.).

**Keywords:** judo, peak sports form, competitive activity, special endurance, blood pH, lactate.

**Introduction.** The results of the performance of highly qualified judokas are largely determined by the quality of the construction of the final stage of training, which provides for the achievement of the peak of sports form by the time of participation in important international competitions. Such a state (peak of sports form) is closely related and determined by the dynamics of the level of special endurance of athletes.

This fact determines the relevance of monitoring the level of special endurance of judo wrestlers, since higher absolute values of this indicator predetermine a less acute nature of the physiological reaction of athletes to the load of a competitive duel [3, 9].

From earlier studies [4, 8] it is known that a judoka with a higher level of special endurance has significantly lower acidotic shifts, reaching values in pH up to 6.85 c.u. (or lower values of lactate concentration in the blood up to 30 mmol/l) after the end of the fight (non-linear correlation coefficient ( $\eta=0.98$ )).

This indicates that selective laboratory testing of only individual indicators characterizing the level of

development of aerobic or anaerobic capabilities does not allow a reliable assessment of the special performance of wrestlers and can lead to incorrect conclusions and erroneous recommendations.

**Objective of the study was to** substantiate methods for assessing the level of development of special endurance of wrestlers on the basis of a comprehensive definition of pedagogical and biochemical indicators characterizing the effectiveness of performing a standard specific task with throws of a wrestling dummy.

**Methods and structure of the study.** Until now, the assessment of the level of special endurance of judo wrestlers has often been of a qualitative nature, based on the athlete's subjective feelings of the degree of his readiness for competitions according to the principle - ready or not ready. This indicates that at present there is an acute problem of searching for informative criteria for evaluating the effectiveness of the means and methods used for precompetitive training of qualified judokas.



In the practice of sports, this problem is solved in two ways:

- by accurate quantitative assessment of the level of development of individual metabolic functions of athletes during in-depth examinations using standard laboratory tests [6, 7, 9, etc.];

- by evaluating the manifestation of athletes' bioenergetic potentials under conditions simulating specific competitive activity and giving an integral quantitative assessment of the athlete's special endurance level [2, 5, etc.].

It is known from sports practice that the use of only laboratory tests does not allow a sufficiently reliable assessment of the level of special endurance. This is due to the fact that the potential capabilities of an athlete's body, determined under conditions of a strictly regulated laboratory load, do not necessarily manifest themselves to the same extent when performing specific competitive loads [3, 4, 9, etc.].

Taking this into account, we can conclude that the greatest amount of useful information can be obtained only when using specific loads that simulate the conditions of the upcoming competitive activity, typical for a judo duel.

Experimental substantiation [1-3, 6, etc.] was applied both to various means of modeling the competitive load (exercises of a special preparatory nature, throws of wrestling dummies, throws of one or several partners, etc.), and various methods of testing (exercises different in terms of work time, intensity, number of repetitions, etc.).

It has been established that for assessing the special endurance of wrestlers, the most appropriate is a five-minute test procedure performed after the usual training warm-up, which includes throwing a dummy through the chest (Yoko Guruma) weighing 1/3 of the weight of the athlete [2].

After a five-seven-minute rest, athletes perform the main testing task:

- on a signal, at regular intervals, the wrestler performs four mannequin throws through the chest (Yoko Guruma) in 40 seconds (background load);

- after the end of the background load, on a signal, the athlete performs eight mannequin throws through the chest (Yoko Guruma) at the maximum pace, with an accurate determination of the time (per second) for completing the task (spurt).

These tasks are performed in the specified sequence five times in a row.

When developing a special testing procedure, it was assumed that three mandatory conditions would be met: specific (according to the biomechanics of

performing a motor action) nature of the load; physiological comparability of the load of a competitive duel and a test; strictly regulated and reproducible load simulation mode, simulating a competitive duel.

Based on the results of studies of the bioenergetic structure of the special endurance of judo wrestlers [3, 4, 8, 9, etc.], in which it was shown that glycolytic anaerobic capabilities significantly limit the special endurance of wrestlers, it was proposed to assess the degree of realization of the functional capabilities of athletes by the value of acidotic shifts or values of lactate concentration in the blood after the test.

Studies conducted on qualified judoists have shown that a five-minute special test causes comparable (with the conditions of a competitive duel) changes in the acid-base balance of the blood [2]. The average value of the indicator of acid-base balance of blood taken from the tip of a heated finger at the third minute of rest after the end of the test was  $7,1 \pm 0,07$  (the lowest value of  $pH=6.95$ ). In addition, it should be noted that the values of acidotic shifts found after performing a special test were equal (differences are statistically unreliable with  $p > 0.05$ ) to shifts in blood pH after performing the limiting bicycle ergometric load of glycolytic anaerobic orientation (Wingate test), carried out under the conditions of a laboratory experiment [1, 3, 9].

**Results of the study and their discussion.** When developing a criterion for assessing the level of special endurance of judo wrestlers, we proceeded from the following premises:

- a) the value of the special endurance of a judoist is inversely proportional to the total time of performing five series of throws of a wrestling dummy in sprint tasks ( $1 / \sum t$ ). This means that the less time a wrestler spends on performing a standardized test task, the more special endurance he has;

- b) the value of the special endurance of a judoka is inversely proportional to the value of the value of acidotic shifts ( $\Delta pH$ ) caused by the performance of a standard specific load ( $1 / \Delta pH$ ), that is, the smaller the value of acidotic shifts ( $\Delta pH = pH_{initial} - pH_{after}$  the test) after testing, the higher the special athlete endurance.

Based on the above, a formula was proposed for calculating the coefficient of special endurance (CSE) for judo athletes.

For a quantitative assessment of the level of special endurance, the value of the value of the coefficient of special endurance was used, determined by the formula:





Normative values of the level of special endurance (CSE) qualified wrestlers of light, medium and heavy weight categories

Weight wrestlers	The level of development of special endurance (CSE values in arbitrary units)				
	Very low	Low	Medium	High	Very high
Lightweights	< 2.5	≥ 2.5 < 3.5	≥ 3.5 < 5.5	≥ 5.5 < 6.5	≥ 6.5
Middleweights	< 2	≥ 2 < 3	≥ 3 < 5	≥ 5 < 6	≥ 6
Heavyweights	< 1.5	≥ 1.5 < 2.5	≥ 2.5 < 4.5	≥ 4.5 < 5.5	≥ 5.5

$$CSE = \frac{100}{\sum t \cdot \Delta pH}$$

where: 100 is a numerical coefficient introduced for the convenience of calculations;

$\sum t$  (s) is the total time of the mannequin throws through the chest (Yoko Guruma) in five series of spurt tasks ( $\sum t = t_1 + t_2 + t_3 + t_4 + t_5$ );

$\Delta pH$  - the value of acidotic shifts caused by the performance of a special test.

From sports practice, it is known that for urgent monitoring of the reaction of athletes to high-intensity physical activity, a biochemical method for assessing blood lactate is often used. In this regard, we have modified the CSE calculation formula, which makes it possible to obtain comparable values of this indicator, regardless of the method of biochemical assessment of the response of the athlete's body to physical activity. This version of the formula looks like:

$$CSE' = \frac{4600}{\sum t \cdot \Delta lactat}$$

where: 4600 is a numerical coefficient introduced for the convenience of calculations and obtaining comparable CSE values;

$\sum t$  is the total time (s) for performing mannequin throws through the chest (Yoko Guruma) in five series of spurt tasks ( $\sum t = t_1 + t_2 + t_3 + t_4 + t_5$ );

$\Delta lactat$  is the value of acidotic shifts caused by the performance of a special test ( $\Delta lactat = lactat_{after} - lactat_{initial}$ ).

As shown by the results of many years of pedagogical observations of highly qualified wrestlers, the determination of CSE allows not only to accurately assess the level of development of special endurance of judo wrestlers, but also makes it possible to predict the performance results of these athletes in important competitions.

On the basis of the conducted studies, normative values of the SWR of qualified judokas were developed, which quantitatively characterize the level of development of special endurance of athletes at vari-

ous stages of preparation for important competitions, presented in the table.

It should be noted that the proposed method for evaluating the special endurance of wrestlers (CSE) makes it possible to assess the level of an athlete's preparedness with a high degree of accuracy. However, the obligatory use of biochemical equipment (assessment of pH or lactate in the blood) during the test significantly limits the practical use of this criterion. In this regard, the assessment of the SWR of judokas can be carried out when conducting exploratory scientific research and when working with highly qualified athletes of national teams.

#### Conclusions and practical recommendations:

- A test procedure and a formula for calculating the special endurance coefficient of judo wrestlers based on a comprehensive assessment of pedagogical and biochemical (pH or blood lactate) indicators are proposed.

- Based on the results of long-term observations of the dynamics of special endurance of highly qualified judoists, guidelines for a quantitative assessment of the special endurance of athletes at various stages of training are proposed.

- The wrestlers' precompetitive training program should be focused on achieving a level of special endurance that exceeds the limit value of CSE over five conventional units. With this level of special endurance, the load of a competitive duel does not lead to a pronounced activation of anaerobic glycolysis. The pH values after the fight will be in the optimal values (7.2-7.27 conventional units.).

- The state of the peak of sports form, which allows to successfully perform at important competitions, can be achieved with SWR values in the range from 7 to 10 conventional units.

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# Coordination of regulated breathing regimes at the fire range of qualified biathletes of different types of competitive readiness

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Dr. Hab., Associate Professor **V.V. Farbey**<sup>1</sup>

Applicant **E.G. Zhevlakov**<sup>1</sup>

PhD, Professor **I.N. Venediktov**<sup>1</sup>

<sup>1</sup>The Herzen State Pedagogical University of Russia, St. Petersburg

Corresponding author: farbey@mail.ru

## Abstract

**Objective of the study** was to reveal the effectiveness of coordination of regulated breathing regimes (RBR) of qualified biathletes of various types of competitive preparedness with actions at the shooting range.

**Methods and structure of the study.** The basis of the experimental training of biathletes was the RBR, developed on the basis of seven complexes of breathing exercises (CBE). Qualified biathletes (CMS) were divided into four groups. Three experimental (EG): "generalists"; "racers"; "shooters" and control (CG) with nine athletes each, 36 in total. Shooting training with the use of CBE and RBR in the annual cycle was 74 hours.

**Results and conclusions.** The use of RBR in the shooting training of qualified biathletes, taking into account the type of competitive preparedness in the experimental groups, contributed to: coordination of the rhythm of shooting and breathing between shots; reduction of the total time at the turn; an increase in the speed and accuracy of shooting; increase the effectiveness of passing the firing line.

The developed regulated breathing regimes should be used in the shooting training of qualified biathletes, taking into account: the mechanisms of the impact of breathing exercises on the athlete's body; functional and physical condition during shooting; in accordance with the type of competitive readiness.

**Keywords:** *biathlon shooting, breathing capabilities, regulated breathing patterns, breathing exercise complexes, types of biathletes' competitive readiness.*

**Introduction.** An important condition for the high-quality performance of technical actions at the firing line is the control of breathing by biathletes during a shot [1-3].

However, the modern biathletes' sports training program at the stage of improving sportsmanship does not include training sessions aimed at expanding the individual respiratory capabilities of athletes that ensure the quality of the shot [3].

Obviously, in the light of the severity of this problem, it is necessary to pay due attention to improving the level of respiratory capabilities of biathletes with the help of special exercises that allow stabilizing motor actions during shooting and on the way to the firing line in competition conditions [1-3].

In this regard, there is a need for scientific substantiation and development of regulated breathing regimes in the shooting training of biathletes,

aimed at improving shooting skills in competitive activities.

It was assumed that the use of RBR in the shooting training of biathletes of various types of competitive readiness at the stage of improving sportsmanship will increase its effectiveness, based on the growth of functional readiness, coordination of breath control with the rhythm of shooting in competition conditions, individualization in the training of biathletes.

**Objective of the study** was to reveal the effectiveness of coordination of regulated breathing regimes (RBR) of qualified biathletes of various types of competitive preparedness with actions at the shooting range.

**Methods and structure of the study.** The basis of the experimental training of biathletes was the regulated breathing regimes developed on the basis of seven complexes of breathing exercises (CBE): in a





calm state; with breath holding; breathing with power; with aiming the front sight at the target; on an elevated movable support; in front of a mirror with weapons; breathing exercises of a relaxation nature, aimed at the formation of breathing control skills, the combination of breathing rhythms with motor actions in shooting and racing, in various modes of intensity of competitive exercises.

RBR: No. 1 Forced inhalations and exhalations. Deep breaths with forceful exhalations (loud). Free breathing; No. 2 Forced inhalations and slow exhalations. Slow deep breaths with voluntary exhalations. Free breathing; No. 3 Slow deep breaths in and out. Slow deep breaths with forced exhalations. Free breathing.

Experimental shooting training was carried out in the preparatory, competitive and transitional periods. The experiment involved qualified biathletes (CMS), who were divided into four groups. Three experimental (EG): “generalists”; “racers”; “shooters” and control (CG) with nine athletes each, 36 in total.

**Results of the study and their discussion.** The use by biathletes of various types of competitive readiness of breathing exercises complexes during functional shifts during shooting made it possible to identify the most effective: “shooters” - “breathing with force” and “on an increased movable support”; “racers” - “with pointing the front sight at the target”; “generalists” - “with pointing the front sight at the target” and “in front of a mirror with a weapon” (see table).

*Influence of complexes of breathing exercises on the accuracy of shooting with a load*

Breathing exercises	Shooting position	The dynamics of shooting after the application of breathing exercises								
		Shooters			Racers			Generalists		
		Intensity			Intensity			Intensity		
		130-140 bpm	150-160 bpm	170-180 bpm	130-140 bpm	150-160 bpm	170-180 bpm	130-140 bpm	150-160 bpm	170-180 bpm
№ 1	prone position	+	+	+	+	+	+	+	+	+
	standing position	+	+	+	+	+	+	+	+	+
№ 2	prone position	+	+	-	+	+	+	-	-	-
	standing position	-	-	+	+	+	+	+	-	-
№ 3	prone position	+	+	+	+	+	+	+	-	-
	standing position	+	+	+	+	+	+	-	-	-
№ 4	prone position	+	-	-	+	+	+	+	+	+
	standing position	+	-	-	+	+	+	+	+	-
№ 5	prone position	+	+	+	+	-	-	+	+	+
	standing position	+	+	+	-	+	-	+	-	-
№ 6	prone position	+	+	+	-	-	-	+	+	+
	standing position	+	+	+	+	-	-	+	+	+

+ - increase in shooting accuracy;
 + - maintaining shooting accuracy;
 - - decrease in shooting accuracy.



Based on these data, three variants of regulated breathing regimes (RBR) were developed, used on the way to the firing line. The degree of their influence on the shooting results of biathletes of different types of competitive readiness is determined. The most favorable RBR in shooting exercises with a load have been identified:

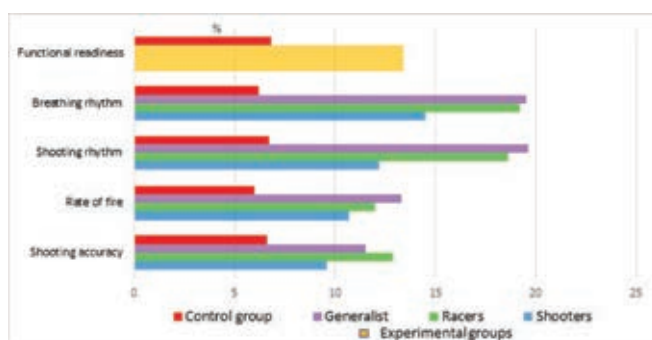
- for “shooters” - RBR No. 1. It affects the center of respiration regulation, is aimed at: providing the body with oxygen in the optimal volume, due to the intensification of gas exchange processes in organs and tissues; reduces tremor;

- for “generalists” - No. 2. It is aimed at reducing the frequency of breathing during shooting and psychoregulation, contributes to the formation of psychological attitudes corresponding to shooting actions at the turn;

- for “racers” - No. 3. It helps to change shallow breathing into deep, reduce muscle tremors and control breathing, due to the regulation of respiratory gases and a decrease in mental.

As a result of the use of RBR by biathletes from the EG in the gym, shooting range, shooting range with technical training aids, an increase in the speed and quality of shooting was revealed.

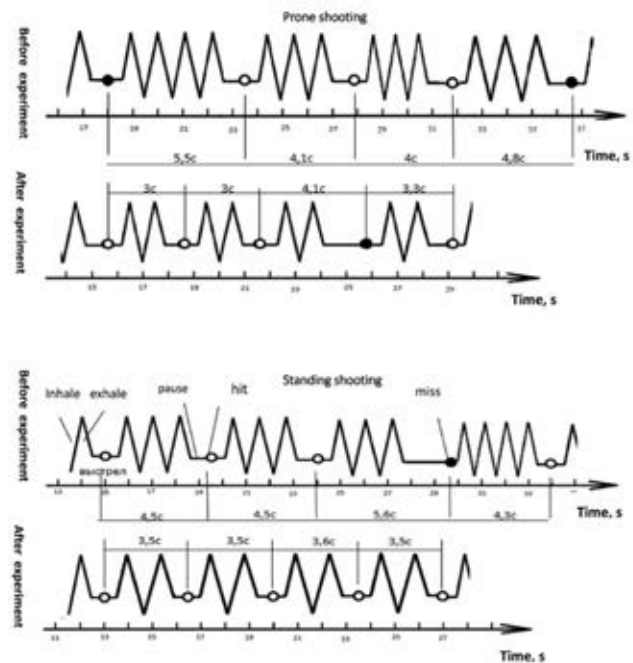
Analysis of the biathletes' functional state by the end of the experiment revealed that the athletes from the EG, along with the athletes from the CG, improved their VC indices; MVL; VO<sub>2</sub> max; heart rate; samples of Stange, Genchi; decrease in tremor ( $p < 0.05$ ). In the CG, a significant increase was found in BMD, HR in ANOT, Stange, Genchi tests ( $p < 0.05$ ) (Fig. 1).



**Figure 1.** Growth of functional and shooting readiness indicators of qualified biathletes at the end of the experiment

In terms of breathing rhythm in shooting, rhythm of speed and shooting accuracy, biathletes from the EG «generalists», «racers» and «shooters» showed a higher level ( $p < 0.05$ ), compared with biathletes from the CG ( $p > 0.05$ ).

The use of breathing exercise complexes in the shooting training of qualified biathletes contributed to the reduction of the total time at the turn and the time to the first shot, the stabilization of the rhythm and quality of shooting in competition conditions, by coordinating breathing with motor actions at the turn (Fig. 2).



**Figure 2.** Biathlete EG shooting schedule in the sprint race (rollers)

At the end of the experiment, there was a reduction in: the preparation time to the first shot lying down by 2.5 s, standing by 2 s; time between shots up to 3-4.1 s lying down and 3.5-3.6 s standing; the number of respiratory cycles between shots up to two; time in a series of five shots by 7-8 s with a decrease in the number of misses. The time of motor actions of qualified biathletes at the turn decreased by 18.8%.

Thus, the developed regulated breathing regimes should be used in the shooting training of qualified biathletes, taking into account: the mechanisms of the impact of breathing exercises on the athlete's body; functional and physical condition during shooting; type of competitive readiness.

**Conclusions.** The use of regulated breathing regimes in the shooting training of qualified biathletes, taking into account the type of competitive readiness in the experimental groups, contributed to: coordination of the shooting and breathing rhythm between shots; reduction of the total time at the turn; an increase in the speed and accuracy of shooting; increase the effectiveness of passing the firing line.



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# Individual optimization of the repulsion biomechanism When jumping up

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PhD, Associate Professor **A.G. Bilenko**<sup>1</sup>

Dr. Hab., Professor **B.E. Losin**<sup>1</sup>

Dr. Biol., Professor **G.P. Ivanova**<sup>1</sup>

<sup>1</sup>Lesgaft National State University of Physical Education, Sports and Health, St. Petersburg

Corresponding author: bilag77@mail.ru

## Abstract

**Objective of the study** was to find the optimal repulsion technique depending on the individual characteristics of the athlete.

**Methods and structure of the study.** The research procedure included performing an upward jump on a dynamometer platform and analyzing the vertical component of the support reaction.

**Results and conclusions.** As a result, according to the information received about the height and efficiency coefficient of each of the jumps performed using various techniques, the most rational individual movement stereotype of repulsion from the support is determined when the subject performs a series of jumps. The efficiency coefficient quantitatively assesses the quality of the organization of the jumping movement with the possibility of operational control of various variants of the repulsion biomechanism.

In the aspect of improving biomechanical analysis: the proposed research methodology implements one of the possible approaches to studying the operation of open biomechanical systems, in contrast to the previously used point mass models.

The results of the study will help to gain knowledge about the biomechanics of repulsion and form an individual technique based on operational feedback.

**Keywords:** *repulsion biomechanics, upward jump, efficiency coefficient.*

**Introduction.** Jumping up from a place from a regular stance according to the Federal standards is included in the standards of general and special physical fitness for enrollment in training groups at all stages of training in many types of sports games, first of all, as an indicator of a person's speed-strength abilities, taking into account specialization, skill level, age, anthropometry and more.

This test is a multicomponent one that assesses the level of development of complex coordination abilities of a person. With its help, a number of indicators are diagnosed: the strength of the leg muscles when jumping from a squat of different depths, the frequency of jumps, their type (with the swing of the arms or rotations around the vertical axis) and other manifestations of physical qualities.

In practice, many coaches still use the Abalakov tape drive mechanism to assess jumping ability, which significantly reduces the accuracy of measurements, and also gives an incomplete picture of the jumping capabilities of athletes. Much more accurate information about the jumping ability of an athlete can be obtained by measuring the time of the flight phase, which allows, according to the laws of kinematics for uniformly accelerated movement in the earth's gravity field, to calculate the height (h) of the rise of the common center of mass (CCM) of the body. It is possible to fix the flight time in hardware as a phase of the unsupported position by various methods, including light motion sensors, contact or force measuring systems. The main condition for the standard height measurement procedure is landing without cushioning on rela-





An additional contribution to the impulse of the repulsive force, which was not previously included in the motion analysis program, is realized due to plantar flexion of the rigidly tense muscles of the ankle joint and joints of the foot after the start of the rise of the common center of mass and the fall of the support reaction below the level of the weight force  $P_{st}$  (point «d» in Fig. 1). A similar effect was experimentally noticed by us and analyzed in the dissertation of N.V. Markarov [8] when studying trampoline jumping, where the masters, during high jumps, additionally pressed their feet on the extremely stretched trampoline net to control the height of the jump, doing the work of the “pushing” force in order to increase the flight height.

Simultaneously with the performance of the jump, the height ( $h$ ) and the efficiency coefficient ( $k$ ) of the jump are calculated according to the dynamometer chart:

$$h = \frac{gt_{\text{non.}}^2}{8}, \quad k = \left( \frac{P_{\text{ct.}} t_{\text{non.}}}{2S} \right)^2 100\%$$

where:  $h$  is the height of the jump;  $g = 9.81 \text{ m/s}^2$  – free fall acceleration;  $t_{\text{flight}}$  - the time of the flight phase, determined by the dynamometer;  $k$  is the jump efficiency coefficient;  $P_{st}$  - the weight of the subject;  $S$  is the impulse of the repulsive force, determined by the dynamometer.

As a result, according to the information received about the height and efficiency coefficient of each of the jumps performed using various techniques, the most rational individual movement stereotype of repulsion from the support is determined when the subject performs a series of jumps. The efficiency coefficient quantitatively assesses the quality of the organization of the hopping movement with the possibility of operational control of various variants of the repulsion biomechanism [3].

Theoretical and practical significance. When searching for the most rational individual technique of repulsion, it is important to create conditions under which a living system can find its own reserves, for this, according to N.A. Bernstein [2], it needs to be “let it try out” in order to form the best jumping stereotype. The so-called efficiency coefficient ( $k$ ), equal to the ratio of the “real” jump height ( $h$ ), calculated from the time of the flight phase, to its idealized, “model” value, determined by the impulse of the repulsion force, can serve as a quantitative criterion for the correct organization of repulsion. This coefficient shows the potential reserves of a living system and how effectively the

repulsion biomechanism is organized in a jumper. The greater the value of the repulsion efficiency coefficient, the better the living system works and the more rational individual technique a person can find, taking into account the characteristics of his own organism and the tactical tasks set.

The leading components of achieving a high result are the coincidence of the frequency properties of the organization of the musculoskeletal system and the external environment when controlling the rigidity properties of interacting systems and their phase composition, which should provide bioresonance in the “man-environment” system [1, 6, 7, 9]. These components are constantly variable, so the living system selects and adjusts them during long training sessions, and with the help of the repulsion efficiency coefficient  $k$ , these indicators can be quickly controlled.

**Conclusions.** The proposed research methodology allows to significantly expand the understanding of the theory of movement as a system of moving links, where, thanks to training, a person finds the best individual option for his jump with an accurate quantitative assessment of the quality of its performance by quickly calculating the parameters of each jump. Operational control of the jump parameters by force impulse and jump height allows to obtain an objective quantitative assessment of the quality of the athlete’s work, which is so important for the coach. In the aspect of improving biomechanical analysis: the proposed research methodology implements one of the possible approaches to studying the operation of open biomechanical systems, in contrast to the previously used point mass models.

The conducted research shows the knowledge on the basis of which an athlete can realize his potential motor abilities.

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# Comparative analysis of competitive and specially preparatory exercises of women's arm wrestling

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Dr. Hab., Professor **A.V. Samsonova**<sup>1</sup>

Dr. Hab., Professor **V.S. Stepanov**<sup>2</sup>

PhD, Associate Professor **F.E. Zakharov**<sup>1</sup>

PhD, Associate Professor **S.V. Serov**<sup>1</sup>

<sup>1</sup>Lesgaft National State University of Physical Education, Sports and Health, St. Petersburg

<sup>2</sup>St. Petersburg State University of Film and Television, St. Petersburg

Corresponding author: sergeserov1961@gmail.com

## Abstract

**Objective of the study** was to identify effective special-preparatory exercises for female armwrestlers based on the developed criterion for assessing the manifestation of speed-strength abilities.

**Methods and structure of the study.** During the experiment, the electrical activity of the five main muscles of the upper limb of female armwrestlers was studied, followed by statistical processing. The experiment involved nine female athletes (age -  $23.3 \pm 1.9$  years, height -  $164.5 \pm 1.2$  cm, weight -  $59.2 \pm 2.0$  kg) of the entry level, specializing in arm wrestling. After a ten-minute warm-up, the subjects performed competitive exercises using the "hook" and "top" methods and six special preparatory exercises.

**Results and conclusions.** The proposed method makes it possible to single out special preparatory exercises that are most effective for developing the power and strength of a certain muscle group. The most effective exercises for sports-women performing exercises using "hook" and "top" methods have been determined.

**Keywords:** arm wrestling, women, speed-strength abilities, special preparatory exercises, electromyography, efficiency coefficient.

**Introduction.** At present, a sport called arm wrestling has become widespread in the world - one of the types of arm wrestling between two participants. This sport allows you to quickly and evenly develop all muscle groups, and also improves health (S.Yu. Makhov, 2016).

For a long time, arm wrestling was a purely male sport, although female arm wrestling is also actively developing at present, however, studies devoted to studying the features of women's strength training are clearly not enough. This is especially felt in the field of strength training of female armwrestlers. It is still not clear how effective the used specially-preparatory exercises are for the development of the speed-strength qualities of female athletes.

**Objective of the study** was to reveal effective special-preparatory exercises of female armwrestlers.

**Methods and structure of the study.** Electromyography (EMG) was used to study the electrical ac-

tivity of five major muscles that move the arms of the upper limb in arm wrestling: flexor carpi radialis (FCR); brachioradialis (BR); long head of the biceps brachii (BBCL); the lateral head of the triceps brachii (TBCL) and the latissimus dorsi (LAT). To record the electrical activity of the muscles, telemetric sensors of the Trigno Avanti Research + system were used, localized above the muscle belly in the projection of the motor zone. The EMG signals were processed using the EMG Works Analysis software. The root-mean-square value of the signal amplitude (RMS) of the entire activity area (mV) was calculated.

The experiments involved nine female athletes (age -  $23.3 \pm 1.9$  years, height -  $164.5 \pm 1.2$  cm, weight -  $59.2 \pm 2.0$  kg) of the entry level, specializing in arm wrestling.

After a ten-minute warm-up, the subjects performed competitive exercises using the "hook" and "top" methods and six special preparatory exercises:

flexion of the hand with the forearm resting on the roller without tilting the body; flexion of the hand with the support of the forearm on the roller with the torso tilted; flexion of the hand in a static position without tilting the torso; flexion of the hand in a static position with an inclination of the torso; lifting the barbell for biceps with a regular grip; lifting the bar for biceps with a reverse grip. The weight of the rod was 90% of the maximum. All exercises were performed three times. In the future, the best attempt was chosen for comparative analysis. The figure shows the moment of the experiment.

Statistical data processing was carried out using the Statgraphics Centurion V.16 package. The arithmetic mean and the error of the arithmetic mean were calculated.



*The moment of the experiment*

**Results of the study and their discussion.** For a comparative analysis of competitive and special-preparatory exercises, the RMS indicator was chosen as the most accurately characterizing the manifestation of the speed-strength abilities of athletes (L.L. Tsipin, F.E. Zakharov, 2020).

It should be noted that the RMS values obtained by recording EMG in different subjects should be normalized, because the amplitude of the electrical activity of the muscles is affected not only by the degree of muscle excitation, but also by other factors, for example, the electrical resistance of the athlete ( DeLuca C.J., 1997). When normalized by amplitude, in the present study, the indicators obtained from the analysis of special preparatory exercises were compared with the result in the test exercise. Competitive exercises performed in two versions were chosen as test exercises: the “hook” method and the “top” method.

During the subsequent processing of the data of each exercise, the efficiency coefficient was determined (A.V. Samsonova, 1998; L.L. Tsipin, 2018), based on the calculation of the efficiency coefficients for the studied muscles.

The efficiency coefficient was calculated by dividing the  $RMS_{ex}$  value achieved during the performance of special preparatory exercises by the  $RMS_{comp}$  value obtained for the competitive exercise.

$$K_{ef} = \frac{RMS_{ex}}{RMS_{comp}} .$$

If the value of the efficiency coefficient was more than one, it meant that the specially-preparatory ex-

**Table 1.** Efficiency coefficients and rating of specially-preparatory exercises (competitive exercise by the “hook” method),  $n=5$

Exercises	Muscles					$\Sigma$	M	R
	FCR	BR	BBcL	TBcL	LAT			
Flexion of the hand with the support of the forearm on the roller without tilting the body	1,37	1,16	1,29	1,10	1,05	5,97	1,19	1
Lifting the barbell for biceps with a regular grip	1,35	1,49	1,38	0,84	0,72	5,78	1,16	2
Flexion of the wrist in a static position without tilting the torso	1,67	0,98	1,15	0,60	0,86	5,26	1,05	3
Flexion of the hand with the support of the forearm on the roller with a tilt of the torso	1,04	0,86	1,48	0,68	0,66	4,72	0,94	4
Lifting the bar for biceps with a reverse grip	1,20	0,60	1,26	0,79	0,61	4,46	0,89	5-6
Flexion of the wrist in a static position with a tilt of the torso	1,11	1,08	0,81	0,54	0,89	4,43	0,89	5-6

Notations:  $\Sigma$  – the sum of the values of muscle efficiency coefficients; M is the arithmetic mean of the efficiency coefficients; R is the exercise rating.





**Table 2.** Efficiency coefficients and rating of special-preparatory exercises (competitive exercise in the “top” way),  $n=4$

Exercises	Muscles					$\Sigma$	M	R
	FCR	BR	BBcL	TBcL	LAT			
Flexion of the hand with the support of the forearm on the roller without tilting the torso	0,94	0,96	1,44	1,43	2,27	7,04	1,41	1
Flexion of the hand with the support of the forearm on the roller with a tilt of the torso	0,84	0,76	1,30	1,02	1,53	5,45	1,09	2-3
Flexion of the wrist in a static position without tilting the torso	1,14	0,87	1,02	0,75	1,66	5,44	1,09	2-3
Lifting the barbell for biceps with a regular grip	1,08	1,06	1,24	1,09	0,75	5,22	1,04	4
Flexion of the wrist in a static position with a tilt of the torso	0,92	1,08	0,81	0,77	0,96	4,54	0,91	4
Reverse barbell lift	0,85	0,33	0,81	0,73	0,74	3,46	0,69	6

Notations:  $\Sigma$  – the sum of the values of muscle efficiency coefficients; M is the arithmetic mean of the efficiency coefficients; R is the exercise rating.

exercise exceeded the competitive exercise by some indicator.

After that, the average value of the efficiency coefficient was calculated for each muscle. Evaluation was made only for female athletes ( $n=5$ ) who performed the competitive exercise using the “hook” method. Then the rating of each exercise was determined, which was based on taking into account the efficiency coefficients of all the studied muscles. The obtained values of the efficiency coefficients and the rating of the exercises are presented in Table 1.

The efficiency ratios presented in Table 2 were determined in a manner similar to that described above. At the same time, the data of female athletes ( $n=4$ ) who performed the competitive exercise using the “top” method were used in the calculation.

**Conclusions.** For the development of speed-strength qualities of female athletes performing competitive exercises using the “hook” method, the following special preparatory exercises are the most effective:

- flexion of the hand with the support of the forearm on the roller without inclination of the torso;
- lifting the bar for biceps with a regular grip;
- flexion of the wrist in a static position without torso tilt.

For the development of speed-strength qualities of female athletes performing competitive exercises using the “top” method, the following special-preparatory exercises are the most effective:

- flexion of the hand with the support of the forearm on the roller without tilting the torso;

- flexion of the hand with the support of the forearm on the roller with the inclination of the torso;
- flexion of the wrist in a static position without torso tilt.

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# Construction of the annual macrocycle of short-distance runners at the stage of in-depth specialization

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**M.S. Kozhedub**<sup>1</sup>

**D. Godun**<sup>1</sup>

Dr. Hab., Professor **E.P. Vrublevsky**<sup>1</sup>

<sup>1</sup>Skorina Gomel State University, Gomel, Belarus

Corresponding author: vru-evg@yandex.ru

## Abstract

**Objective of the study** was to improving the sports training of sprinters aged 15-17 years based on the analysis of the dynamics of their training loads and the ratio of work of various directions in the annual cycle.

**Methods and structure of the study.** Variants of individual planning of year-round training were subjected to statistical analysis in 23 sprinters of the I sports category (n=18) and candidates for master of sports (n=5). The volume of fixed assets of training was fixed in specific units of measurement (kilometers, tons, number of times) and from the total annual volume, taken as 100%, the load dynamics by months of the annual training cycle was calculated as a percentage.

**Results and conclusions.** On the basis of statistical analysis, the issues of organizing the training load and the ratio of work of various predominant directions in the structure of the annual cycle of training for sprinters of a given level of sportsmanship are considered. The nature and dynamics of the distribution of training means for athletes by months of the annual macrocycle were determined. The data obtained indicate that the modulation of the load parameters in terms of magnitude and direction, as well as the content and nature, should not only correspond to the strategic goals of training in the macrocycle, but also be commensurate with the natural course of development of the athlete's motor function.

**Keywords:** analysis, training, annual cycle, load distribution, sprinters, means, volume, intensity, organization.

**Introduction.** The organization of the annual macrocycle is a kind of "road map" for the preparation of an athlete for the planned time cycle. This is due to the determinants that determine the effectiveness of its adaptation to the means and methods of influence characteristic of a given sport [1,4,7]. It should be emphasized that any approaches to optimizing the system of training athletes can be justified only if they are based on fundamental theoretical foundations. And the very individuality of athletes can be effectively expressed only within the framework of general provisions that characterize rational forms of building training [4,7,8].

The training process provides for both the predominant development of certain aspects of the athlete's preparedness, and their comprehensive improvement on individual structural formations of the annual cycle [3, 7]. At the same time, it is important to ensure the

continuity of tasks in the choice of training influences, and the final expression of the degree of rationality of the management of the training process and an objective characteristic of its productivity will be the sports result shown by the athlete at the main start of the season [2, 4, 7].

**Objective of the study** was to improving the sports training of sprinters aged 15-17 years based on the analysis of the dynamics of their training loads and the ratio of work of various directions in the annual cycle.

**Methods and structure of the study.** Variants of individual planning of year-round training were subjected to statistical analysis in 23 sprinters of the I sports category (n=18) and candidates for master of sports (n=5). A group of basic training means was analyzed, which are used in the training process of sprinters and are widely represented in the spe-



cial literature [5]. First, the volume of fixed assets of training was recorded in specific units of measurement (kilometers, tons, number of times), and then, from the total annual volume, taken as 100%, the dynamics of training loads was calculated in percent by months of the annual training cycle. This made it possible to compare and compare both the training impacts expressed in different units of measurement and the training strategy of individual runners in a given season.

It should be emphasized that we did not study the individual characteristics of the training of each athlete separately, since we were interested in the general trend in the organization of the annual training cycle for runners of this skill level.

**Results of the study and their discussion.** The average values of the total annual volume of fixed assets of special training and statistical parameters that determine the variability of training effects in sprinters were revealed (see table).

Noteworthy is the large variability (25.8%) in relation to the volume of running with an intensity of 80-90% on segments of 100-300 m and weight training (22.2%). The least variable means of training for female runners in this sample is running on segments over 300 m with an intensity of 80% or less, including cross-country running. Obviously, the organization of training in the annual cycle and on its structural formations in terms of content and volume has an individual focus, but at the same time it should not contradict the fundamental laws of building the training process [2,4,7].

Based on the calculated indicators, the orientation of the distribution of the main means of training female runners by months of the annual macrocycle was revealed. The obtained research results (Fig. 1, 2) indicate that the training process in October-December and March-April is mainly focused on solving the problems of special strength training of female

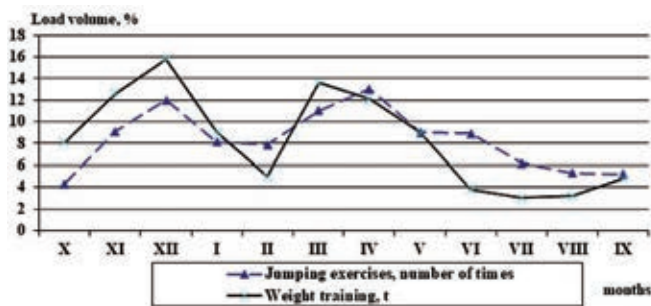
athletes. Thus, in November, much attention was paid to weight-bearing exercises ( $12.6 \pm 11.3\%$ ), and the volume of jumping exercises (various multi-jumps, jumps, jumps, etc.) amounted to  $9.1 \pm 5.4\%$  of the annual volume. In December, respectively, the monthly volume of speed-strength exercises amounted to  $15.8 \pm 14.2$  and  $12.0 \pm 7.2\%$ . This may indicate a certain concentration of the volume of means of special strength training at the basic stage of the annual macrocycle.

It is also important to note a certain delimitation in time of the maximum volumes of means of special strength and integral training (running at maximum speed) in female runners, which is typical for highly skilled female athletes [2]. At the same time, in October, athletes did not run at maximum speed (95-100%) and started running segments at maximum speed only in November, and the volume of such a run was only  $3.8 \pm 0.4\%$ . In December, the volume of running at maximum speed increased and reached  $8.3 \pm 0.9\%$  of the annual. The largest amount of running at maximum speed is observed in January, as well as in May, April and June.

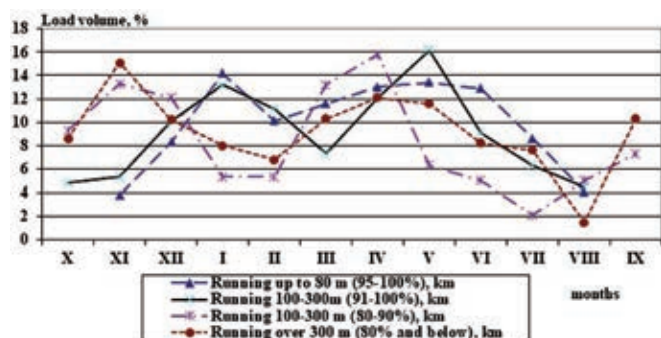
At the same time, in the light of modern ideas about the construction of training [1,3,6], it is not recommended to simultaneously perform significant amounts of strength training and training effects associated with an increase in maximum running speed. In this case, a large power load can adversely affect the current level of speed-strength fitness, which does not contribute to the quality of the training process associated with the adaptation of the motor apparatus of athletes to cyclic locomotions of maximum power. If in the autumn-winter period, after special strength training, speed-oriented work follows, which makes it possible to optimally use the cumulative effect of power load, then in the second preparatory period, these two types of loads are performed almost in parallel.

*Average values ( $\bar{X}$ ), standard deviation ( $\sigma$ ) and variability ( $V\%$ ) of the annual volumes of the main means of training sprinters aged 15-17*

Means of special training	$\bar{X}$	$\sigma$	$V\%$
Volume of running at a speed of 95-100% (segments up to 80 m), km	11,4	2,1	18,4
The volume of running at a speed of 91-100% (sections 100-300 m), km	10,3	1,7	16,5
The volume of running at a speed of 80-90% (sections of 100-300 m), km	25,5	6,6	25,8
The volume of running at a speed below 80% (sections over 300 m), km	70,6	5,3	7,5
Various jumping exercises, number of times	6000	1050	17,5
Various weight-bearing exercises, number of times	90	20	22,2



**Figure 1.** Distribution of means of speed-strength orientation among sprinters in the annual cycle of training



**Figure 2.** Distribution of the main means of running training among female runners for short distances in the annual cycle of training

In the process of special strength training, female athletes simultaneously use smooth running at low speed. So, in the first preparatory period (November), the load of a speed-strength nature coincides with the maximum ( $15.1 \pm 9.1\%$ ) of aerobic work (running on segments over 300 m with an intensity below 80%). As evidenced by special studies [6, 8], it is preferable to implement adaptation to training effects in the initial phase due to vegetative functions that prevail in the aerobic provision of muscle activity. The latter promotes an increase in the power of energy systems and acceleration of adaptive biochemical processes that occur during the anabolic phase of metabolism in the body [6]. In this regard, before the start of volumetric power loads (that is, in October), you should perform a maximum of aerobic running work.

In the second preparatory period (April and May), still significant amounts of running are recorded with an intensity below 80%. Such planning at this stage of the annual cycle is not entirely rational, since at this time the emphasis should be on training effects of a mixed aerobic-anaerobic orientation (running in segments of 100-300 meters with an intensity of 91-100%).

The largest monthly volume of running on segments of 100-300 m with an intensity of 91-100% is performed in the first preparatory period in December and January, in the second - in April and May. During the transitional period, which for athletes of this qualification falls in mid-June and August, all the main means of training are performed in a supportive mode, as evidenced by a significant reduction in the volume of training impact parameters.

**Conclusions.** The analysis of the given factual material of the organization of the training process by sprinters of the corresponding qualification showed that the athletes have a rather large variability in the volume of the main means of training, both by months of the annual cycle, and by the total volume for the year. In part, this fact can be explained by the lack of objective data on the required parameters of the main means of training female runners at the stage of in-depth specialization.

The organization of training in sprinting determines the necessity of constant clarification of the content and distribution of means of a speed-strength nature in the macrocycle, since due to the short duration of the support time in sprinting, it is not so much the increase in the level of absolute strength that becomes important, but local, "targeted", working out the muscles [1, 3, 11, 12] involved in cyclic locomotion of maximum power. The correct selection of speed-strength exercises, taking into account the operating modes of the musculoskeletal system in the structure of the movement system during high-speed running, can largely initiate a further increase in sports results.

To increase the level of special strength training in sprinting, "long" jumping exercises should be used to a greater extent. It should be noted that highly skilled sprinters perform about 20 km of such jumps per year. Jumping from foot to foot in segments of 30-60 m with the control of time and number of steps gives the greatest effect [2]. The results in these tests can also serve as informative indicators for assessing the preparedness of female athletes and adjusting the course of their training process.

It is very important that the modulation of the load parameters in terms of magnitude and direction, as well as the content and nature, correspond not only to the strategic goals of training in the annual cycle, be in proportion with the natural course of development of the athlete's motor function, but, at the same time, be adequate to the current state of her body. at the time of the training session. In this case, it is necessary to take into account the individual characteristics of a





particular athlete and rely more on her leading motor abilities.

Such an organization of the training process, based on the constant consideration of the characteristics of each athlete, is the most justified at the stage of in-depth specialization [9, 10], setting targets for building their training at the next stage of long-term improvement.

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# Criteria for the formation of spiritual and moral qualities of the personality of mixed martial arts athletes

UDC 796.015



Postgraduate student **F.V. Emelyanenko**<sup>1</sup>

Dr. Hab., Professor **V.L. Kondakov**<sup>1,2</sup>

Dr. Hab., Professor **V.N. Kormakova**<sup>1</sup>

PhD, Associate Professor **E.N. Kopeikina**<sup>1</sup>

<sup>1</sup>Belgorod State National Research University, Belgorod

<sup>2</sup>Putilin Belgorod Law Institute of Ministry of the Interior of Russia, Belgorod

Corresponding author: nikulin\_i@bsu.edu.ru

## Abstract

**Objective of the study** was to assess the level of formation of morality of young people involved in MMA.

**Methods and structure of the study.** During the experiment, a theoretical analysis and generalization of scientific data were carried out, as well as psychological diagnostics of athletes, in which 41 people (38 boys and three girls) aged 16-24 years old took part. For the diagnosis were used: "Diagnostics of moral self-esteem" (L.N. Kolmogortseva); "Study of Tolerance" and "Scale of Conscientiousness" (V.V. Melnikov, L.T. Yampolsky); "Personal aggressiveness and conflict" (E.P. Ilyin, P.A. Kovalev). The study took place on the basis of the sports school of the Olympic reserve named after Alexander Nevsky (Stary Oskol).

**Results and conclusions.** The majority of those involved in MMA have a level of self-esteem of moral qualities "below average" - 53.66% (according to the method "Diagnostics of moral self-esteem"); 58.54% of MMA athletes are characterized by an average level of tolerance, respect for other people's opinions and tolerance (according to the "Tolerance Study" methodology); 53.67% of athletes have the level of conscientiousness (according to the "Conscientiousness Scale" method) "below average"; the vast majority (85.38%) of MMA athletes had a low level of "positive aggression" and a high level (95.13%) of "negative aggression"; the majority of athletes (60.98%) had a level of conflict "above average" (according to the method "Personal aggressiveness and conflict").

Thus, the majority of athletes aged 16-24 involved in MMA showed an insufficient level of morality. Scientific substantiation and development of a program for educating the morality of a person and an algorithm for its implementation in the MMA training system are needed.

**Keywords:** *morality, moral education, athletes, mixed martial arts (MMA).*

**Introduction.** The moral education of young people is one of the important state goals, which is reflected in a number of legal documents [3, 4], according to which Russian society is tasked with counteracting "destructive ideology", ensuring "Russia's moral leadership in international relations as the guardian of universal human values".

Appeal to the experience of moral education and personal development is a significant aspect of the training of athletes in various sports. At the same time, moral education at the present historical stage of the

development of society needs to develop new approaches, based on national traditions of education, awakening the genetic memory of young people to their historical and cultural roots on the basis of universal values, strengthening the continuity of generations, patriotism, serving the Fatherland, actualization of the educational potential of the content of education [1].

**Objective of the study** was to assess the level of formation of morality of young people involved in martial arts (MMA).



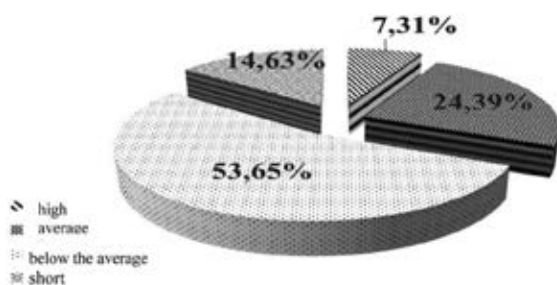
Methods and structure of the study. 41 people (38 boys and three girls) aged 16-24 took part in the ascertaining experiment. The study was conducted on the basis of municipal autonomous institution "Sports school of the olympic reserve named after Alexander Nevsky" (Stary Oskol, Belgorod region).

To conduct psychological diagnostics, the following were used: "Diagnosis of moral self-esteem" (L.N. Kolmogortseva); "Study of Tolerance" and "Scale of Conscientiousness" (V.V. Melnikov, L.T. Yampolsky); "Personal aggressiveness and conflict" (E.P. Ilyin, P.A. Kovalev).

**Results of the study** and their discussion. According to V.M. Voronov and other researchers (2015), the moral education of athletes specializing in MMA forms the basis of their moral behavior, which is based on deep motives that control human actions. However, the education of morality in the training system in MMA is carried out sporadically and unsystematically [2].

Foreign scientists substantiate the idea that in order to consolidate the moral values of athletes involved in various types of martial arts, it is necessary to introduce into the training system, including MMA, philosophical and ethical codes, including meditation, rules of conduct for fights with an opponent, which helps to reduce anger and aggression [5,6]. The theoretical analysis of the literature and the experience of educational activities indicate that the most significant synergy of the scientific and methodological substantiation of the organization of such work in the training system in MMA, which requires a comprehensive study of the state of formation of the morality of athletes.

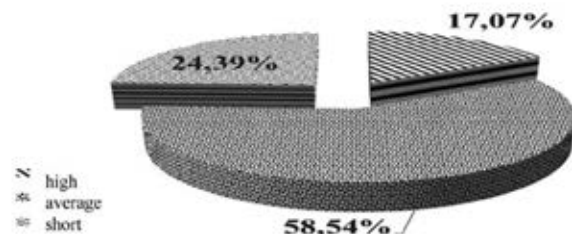
The obtained results of diagnostics of moral self-assessment indicate that a significant part of those involved in MMA have a level of self-assessment of moral qualities "below average" - 53.66% (Fig. 1).



**Figure 1.** The level of moral self-esteem of MMA athletes

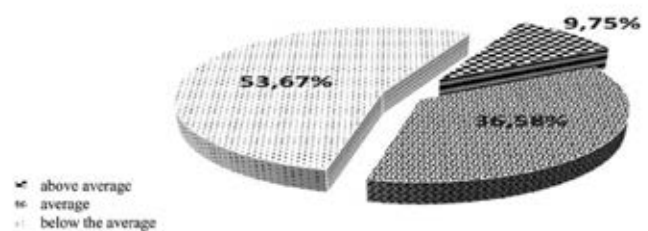
Analysis of the data presented in fig. 2 shows that 58.54% of those involved in MMA are characterized by

an average level of tolerance, respect for other people's opinions and tolerance. Such athletes rigidly defend their own point of view with its insufficient reasoning, while they may show disrespect for the opinions of others.



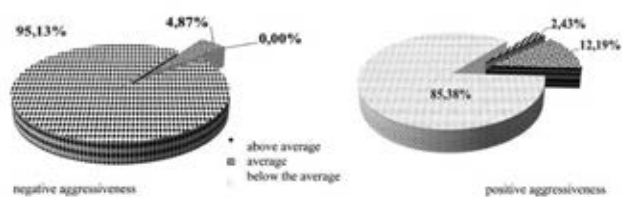
**Figure 2.** Tolerance level of MMA athletes

The results of the study of the degree of respect for social norms and ethical requirements using the Conscientiousness Scale method show that 53.67% of athletes have a "below average" level of conscientiousness, 36.58% have an average level, and only 9.75% have conscientiousness. are at the "above average" level (Fig. 3).



**Figure 3.** The level of conscientiousness of MMA athletes

The vast majority (85.38%) of MMA athletes had a low level of manifestation of "positive aggressiveness" and a high level (95.13%) of "negative aggressiveness" (Fig. 4). This indicates that these athletes are characterized by uncontrolled aggressive behavior.



**Figure 4.** The level of personal aggressiveness of MMA athletes

The total assessment of the indicators of uncompromisingness, irascibility, resentment, suspicion allows us to speak about the level of conflict among combatants. Thus, the majority of athletes (60.98%) had an “above average” level of conflict (Fig. 5).



**Figure 5.** *The level of conflict among MMA athletes*

**Conclusions.** At present, Russian society faces the problem of educating the morality of the personality of every citizen of Russia, including athletes involved in various types of martial arts. Theoretical analysis of the problem, as well as experimental work on assessing the level of morality of young people in the MMA training system, indicate that the majority of athletes aged 16-24 years have an insufficient level of morality formation. There is a need for scientific justification and development of a program for educating the moral qualities of a person, an algorithm for its implementation in the MMA training system.

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# Evaluation of the activities of a wrestling coach

UDC 796.8



Doctor of Pedagogical Sciences, Professor **F.I. Sobyenin**<sup>1,2,3</sup>  
Sh. **A. Makashev**<sup>2</sup>

Associate Professor **P.P. Kondratenko**<sup>1</sup>

<sup>1</sup>Belgorod State National Research University, Belgorod

<sup>2</sup>University of Innovation and Technology of Western Kazakhstan,  
Uralsk, Kazakhstan

<sup>3</sup>Utemisov Western Kazakhstan University, Uralsk, Kazakhstan

Corresponding author: Sobyenin@bsu.edu.ru

## Abstract

**Objective of the study** was to develop a methodology for evaluating the activities of a wrestling coach.

**Methods and structure of the study.** Scientific work is organized at the faculties of physical culture at the University of Innovation and Technology of Western Kazakhstan, Utemisov Western Kazakhstan University and Belgorod State National Research University in 2017-2021. The analysis of special scientific literature, a survey of coaches and athletes, the study of competition protocols and regulatory documents, analysis of performance results, and mathematical modeling were used as research methods.

**Results and conclusions.** The proposed methodology is based on the well-known and specific indicators of professional achievements of an individual coach and the received sports achievements of each athlete trained by him, entered into the formula for mathematical calculations. The meaning of these calculations is to determine the arithmetic mean from the sum of the achievements of the coach and his athletes, divided by the number of athletes with the coach.

The developed methodology for determining the effectiveness of the activity of a coach in freestyle wrestling and wrestling Kazakhsha-kures is a set of evaluative actions of the coach and his students, followed by the introduction of indicators into the proposed formula and the calculation of the coefficient of effectiveness of the coach. The technique is universal, practical, can be easily modified, and is widely used not only in martial arts, but also in other sports. It allows you to systematically monitor the dynamics of the effectiveness of the work of coaches and compare the effectiveness of both individual coaches and their groups within the same sports organization or between them.

**Keywords:** *evaluation, sports activity, coach, formula, Kazakhstan.*

**Introduction.** Evaluation of the work of a coach is extremely important. It determines the amount of wages received, his professional prestige, social status. To assess the performance of a coach, their category and the number of trained athletes are usually identified. Specialists also offer other ways to evaluate the work of a sports coach [1-4]. Sometimes there is a need to obtain data on the current performance of a coach for a month, six months, or the past year. A situation may arise when a coach who has achieved a high result for a long time noticeably reduces his effectiveness and no longer brings high sports results. In such cases, there is a need to create a system for monitoring the current performance of trainers.

The relevance of this study is to explore new approaches to solving this problem. In this case, the need to create an innovative methodology for evaluating the activities of a coach arose in children's sports schools in freestyle wrestling and Kazakh-Kures wrestling in Western Kazakhstan.

**Objective of the study** was to develop a methodology for evaluating the activities of a wrestling coach.

**Methods and structure of the study.** A survey was organized in the form of a conversation with coaches and athletes in freestyle wrestling and Kazakhsha-kures wrestling in the West Kazakhstan region (n=48), as well as mathematical modeling of the formula for evaluating the effectiveness of wres-



tling coaches. The data obtained were compared by the value of the efficiency coefficients of the trainers' activities. The work was carried out in 2017-2021 at two universities in Uralsk, West Kazakhstan region and Belgorod National Research University in Russia.

**Results of the study and their discussion.**

The analysis of the literature showed that the study of the problem of evaluating the effectiveness of a sports coach covers different aspects. The starting point for evaluating the work of a specialist with higher education is the quality training of students in universities [1]. In addition to the "efficiency" of the coach's activity [3], it is proposed to evaluate his "success", "efficiency", "quality" and other characteristics [2]. A number of authors propose to evaluate sports activities in general, while there are studies devoted to the evaluation of certain types of sports activities of coaches [2,3,4]. Given the versatility of approaches to the study of the problem, the most pragmatic option for evaluating the activities of coaches was chosen, which is always aimed at one main product - the achieved sports result. It was he who was considered as a system-forming factor in the coach's evaluation methodology.

To evaluate the performance of a coach, a formula was developed and tested for calculating the coefficient of effectiveness of a coach - CEC.

The composition of the estimated indicators for calculations included specific requirements for the level of qualification of coaches and the approval of sports categories and titles of athletes in accord-

ance with the provisions of the Law of the Republic of Kazakhstan "On physical culture and sports" [5] and the Rules for awarding sports titles, categories and qualification categories in Kazakhstan [6]. To evaluate the coach, conditional units (points) were assigned to all coaching categories (Table 1).

For the evaluation of athletes, the levels of sports categories and titles were chosen in accordance with the program and regulatory documents in the field of physical culture and sports of Kazakhstan (Table 2).

Next, the athletes were evaluated according to their participation in competitions of the republican scale (Table 3).

At the next stage, the results of the performance of athletes at the international level were evaluated (Table 4).

Evaluation of the efficiency of the coach's activity was calculated according to the formula:  $CEC = \frac{EC}{ES1 + ES2 + ES3 + N}$ , where CEC is the coefficient of the coach's efficiency, EC is the assessment of the effectiveness of the coach by categories and titles, ES1 is the effectiveness of the coach's students, taking into account the assigned sports categories and titles, ES2 - the effectiveness of students who competed in republican competitions, ES3 - the effectiveness of students who competed in international competitions, N - the number of subjects, including the coach. When performing calculations, all values were entered into the formula.

The methodology was tested by modeling the indicators of one group: the number of athletes with a

**Table 1.** Categories, titles for assignment to coaches of the Republic of Kazakhstan with their assessment (EC)

Coaching categories and titles in ascending order	Conventional units, points
Qualification category «trainer-teacher of the average qualification level of the highest category»	1
Qualification category «coach of average qualification level of the highest category»	2
Qualification category «trainer-teacher of the highest qualification level of the highest category»	3
Qualification category «trainer of the highest qualification level of the highest category»	4
Title «Honored Coach of the Republic of Kazakhstan»	5

**Table 2.** Sports categories, titles to be awarded to athletes of Kazakhstan with their assessment (ES1)

Sports categories and titles in ascending order	Conventional units, points
I sports category	1
Candidate Master of Sports	2
Master of Sports of the Republic of Kazakhstan	3
Master of sports of international class of the Republic of Kazakhstan	4
Title «Honored Master of Sports of the Republic of Kazakhstan»	5

**Table 3.** Places taken by athletes at the republican competitions with their assessment (ES2)

Sport competitions	Occupied places	Conventional units, points
Championship, Championship of Kazakhstan	Member only	1
Championship, Championship of Kazakhstan	3	2
Championship, Championship of Kazakhstan	2	3
Championship, Championship of Kazakhstan	1	4

**Table 4.** Places occupied by athletes in international competitions with their assessment (ES3)

No.	Sport competitions	Occupied places	Conventional units, points
1.1	European Championship, Asian Championship, Asian Games	Member only	5
1.2	European Championship, Asian Championship, Asian Games	3	6
1.3	European Championship, Asian Championship, Asian Games	2	7
1.4	European Championship, Asian Championship, Asian Games	1	8
2.1	Чемпионат мира	Member only	7
2.2	World Championship	3	8
2.3	World Championship	2	9
2.4	World Championship	1	10
3.1	Olympic Games	Member only	9
3.2	Olympic Games	3	10
3.3	Olympic Games	2	11
3.4	Olympic Games	1	12

coach and other indicators were randomly selected. Then the technique was applied to a group of freestyle wrestlers (n=26) and Kazakh-kures wrestlers (n=22). At first, the groups were evaluated according to traditional criteria, as approximately equal (the level of education of the coach, work experience, the number of athletes who received sports categories, titles for the entire period of work). Then, when comparing the two groups after calculations according to the formula, it turned out that the coefficient of effectiveness of the freestyle wrestling coach is higher than that of the Kazakhsha-kures coach.

As a result of a survey of coaches and athletes, a generally positive opinion about the proposed methodology was revealed.

**Conclusions.** The developed technique for evaluating the efficiency coefficient of a wrestling coach using a mathematical formula allows for an accurate quantitative analysis of his work for any period of time.

When evaluating the activities of coaches of the West Kazakhstan region in freestyle wrestling and wrestling Kazakhsha-kures using the proposed

methodology, it was found that it can be used to take into account previous and current changes in the effectiveness of coaching activities, compare efficiency ratios between coaches, sports schools, between periods of work of one and the same coaching staff.

The developed technique can be applied in different types of martial arts and other sports. It is universal, it can be easily adapted, improved, based on the characteristics of the contingent of wrestlers, other factors that affect the effectiveness of wrestling coaches.

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# Synchronization of breathing and aiming skills as a Basis for training rifle shooters at a moving target

UDC 796.015



PhD **O.Yu. Ilyakhina**<sup>1,2</sup>

PhD, Associate Professor **L.A. Kadutskaya**<sup>1,2</sup>

PhD **E.Yu. Domracheva**<sup>1</sup>

PhD, Associate Professor **I.N. Ozerov**<sup>3</sup>

<sup>1</sup>Belgorod State National Research University, Belgorod

<sup>2</sup> Putilin Belgorod Law Institute of Ministry of the Interior of Russia, Belgorod

<sup>3</sup>Moscow Academy of the Investigative Committee of the Russian Federation, Moscow

Corresponding author: kadutskaya@bsu.edu.ru

## Abstract

**Objective of the study** was to develop a pedagogical model for training rifle shooters at a moving target based on the synchronization of breathing and aiming skills.

**Methods and structure of the study.** Conducted: analysis of scientific and methodological literature on the problem under study; analysis of training programs for rifle shooters at a moving target; generalization of advanced pedagogical experience in the field of training athletes. The study examined the components of a pedagogical model for training shooters; carried out: the choice of means and methods of training; implementation of the training program; ensuring control over the growth of sportsmanship and results in shooting among athletes.

**Results and conclusions.** It was revealed that the motor action in shooting from a rifle at a moving target can be carried out in accordance with the target task only on the basis of coordination of muscle efforts in the production of a well-aimed shot. This is the basis for synchronizing breathing and aiming skills in the preparation of running target rifle shooters for competition. Based on this, motor memory arises, which stores a huge number of the simplest coordinations necessary for producing a well-aimed shot. The revealed components of the developed model most capaciously characterize the peculiarities of the training of shooters from a rifle at a moving target. The leading criterion for the effectiveness of the shooter training model is the synchronization of breathing and aiming skills. The use of the training model is aimed at ensuring a high level of development of the necessary muscles in rifle shooters at a moving target, increasing the level of sportsmanship, creating conditions for faster adaptation of athletes to the specific conditions of competitive activity.

**Keywords:** model, training, athlete, shooter, rifle, moving target, bullet shooting.

**Introduction.** The quality of the formation of breathing synchronization and aiming skills in shooting from a rifle at a moving target is determined by the ability to actively relax muscles during competitions. Relaxation is an important part of the motor skill in shooting a moving target with a rifle while synchronizing breathing and aiming skills. Synchronization of breathing and aiming skills in rifle shooters at a moving target leads to the creation of prerequisites for the full use of coordination abilities due to the formation of a relaxation skill during training [4].

The formation of breathing synchronization and aiming skills during the training of rifle shooters at a moving target is carried out on a certain basis. This

basis is the carrier of the consistency of means and methods of training rifle shooters on a moving target. Consistency of training methods and methods of developing breathing synchronization and aiming skills in rifle shooters at a moving target is the main direction of application of exercises for breathing synchronization and aiming [1].

The effectiveness of synchronization of breathing and aiming skills is associated with the level of development of coordination abilities in rifle shooters at a moving target. Regarding rifle shooters at a moving target, the abilities of coordination can be expressed by the ability to rationally organize efforts in space and time, to repeatedly reproduce



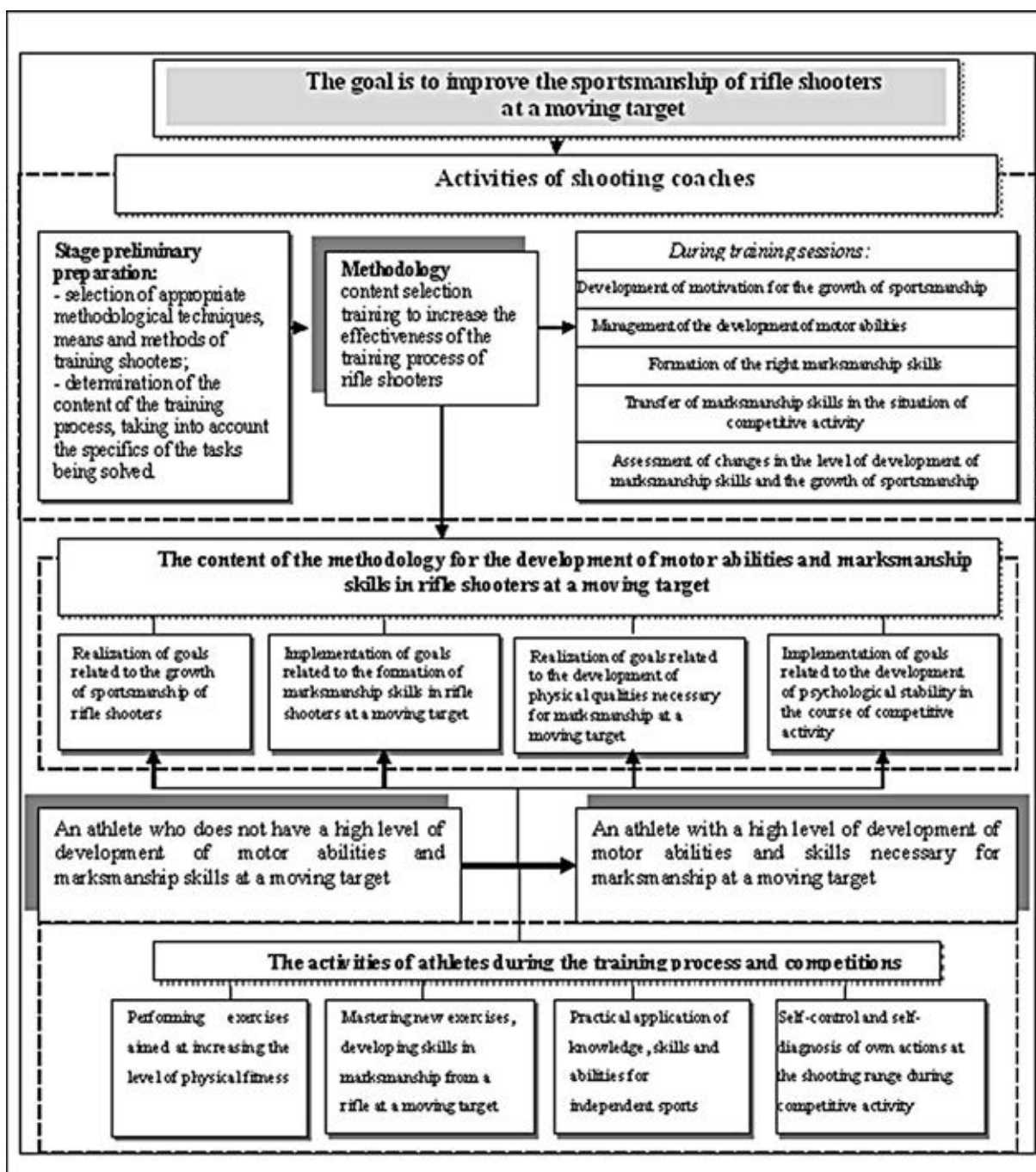
the movements associated with the production of a well-aimed shot, while maintaining their dynamics, tempo, rhythm and structure [2, 3].

**Objective of the study** was to develop a pedagogical model for training rifle shooters at a moving target based on the synchronization of breathing and aiming skills.

**Methods and structure of the study.** Conducted: analysis of scientific and methodological literature on the problem under study; analysis of training programs for rifle shooters at a moving target;

generalization of advanced pedagogical experience in the field of training athletes. The study examined the components of a pedagogical model for training shooters; carried out: the choice of means and methods of training; implementation of the training program; ensuring control over the growth of sportsmanship and results in shooting among athletes.

Results of the study and their discussion. The most important scientific approach to effectively synchronizing breathing and aiming skills during the training of rifle shooters at a moving target is the



Model of training shooters from a rifle at a moving target



applied work force during the production of a well-aimed shot. The work force of rifle shooters on a moving target can manifest itself in different ways: during a repeated shot, at a high speed of movement or not very quickly, in a relaxed or tense state of the muscles. The strength of muscle contraction is associated with the work of three groups of physiological systems: the central and peripheral nervous systems, as well as with the state of the muscular system of shooters from a rifle at a moving target.

Improving the quality of synchronization of breathing and aiming skills during the training of rifle shooters at a moving target is determined mainly by the development of their adaptive changes at the level of the central nervous system. This leads to an increase in the ability of motor centers to improve intermuscular coordination in rifle shooters at a moving target when making a well-aimed shot.

It should be noted that the effective synchronization of breathing and aiming skills during the preparation of rifle shooters at a moving target for competitions causes significant changes in their muscles. Synchronization of breathing and aiming skills is provided by a holistic reaction of their body, associated with the mobilization of mental qualities, functions of the muscular, nervous and other physiological systems.

It has been established that in the course of synchronization of breathing and aiming skills of rifle shooters at a moving target, the level of technical readiness for competitions increases.

The analysis of the current system of shooters' training shows that their training program does not involve the use of special exercises that require the development of the necessary muscle groups. Based on the foregoing, one of the main tasks of the training process is to improve the quality of training shooters. To solve this problem, a model for training shooters from a rifle at a moving target was developed (see figure).

When organizing the training process, it was taken into account that an effective increase in the readiness of shooters is possible only with positive interaction between all parties of training. It was also taken into account that other non-specific factors can also influence the training effect: the degree of success of shooters from a rifle at a moving target in competitions, training mode, etc.

The practical implementation of the developed model can make it possible to analyze changes in some fitness indicators of shooters based on the results of the training process in the course of preparing for competitive activities.

**Conclusions.** The revealed components of the developed model most capaciously characterize the peculiarities of the training of shooters from a rifle at a moving target. The leading criterion for the effectiveness of the shooter training model is the synchronization of breathing and aiming skills. The use of the training model is aimed at ensuring a high level of development of the necessary muscles in rifle shooters at a moving target, increasing the level of sportsmanship, creating conditions for faster adaptation of athletes to the specific conditions of competitive activity.

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# Integral assessment of the level of preparedness of kickboxers based on the harrington-mencher function

UDC 796.012



Dr. Hab., Professor **M.G. Kolyada**<sup>1</sup>  
Dr. Hab., Professor **S.I. Belykh**<sup>1</sup>  
PhD, Associate Professor **T.I. Bugaeva**<sup>1</sup>  
Postgraduate student **O.S. Oleinik**<sup>1</sup>  
<sup>1</sup>Donetsk National University, Donetsk, Ukraine

Corresponding author: kolyada\_mihail@mail.ru

## Abstract

**Objective of the study** was to reveal the mechanism for identifying a generalized assessment of the level of preparedness of kickboxers.

**Methods and structure of the study.** The application of the Harrington-Mencher desirability function to determine the level of preparedness of kickboxers is presented. The work of the desirability function is that it converts dimensional indicators into dimensionless ones, in fact, generalizes diverse indicators, bringing them to a single complex indicator.

**Results and conclusions.** The technique of an integral assessment of the level of preparedness of a kickboxer using the Harrington-Mencher function is given. A specific example shows the mechanism for converting actual indicators into a 10-point scale, and then into desirability coefficients. Thanks to a special system for translating desirability indicators into the usual rating scale, it is possible to obtain a complex indicator at the output that objectively evaluates their total set. Weight indicators of the significance of the preparedness of kickboxers were determined on the basis of expert assessments, which included reputable kickboxing coaches and referees.

**Keywords:** *Harrington-Mencher desirability function, integrative indicator, kickboxer's level of preparedness, defining indicators of preparedness.*

**Introduction.** As you know, the level of sports readiness is an indicator of sports and technical skills of an athlete. It is by comparing the values of the indicators of the properties of the athlete being evaluated with his previous indicators or with analogue samples that it is possible to determine whether there is an improvement in the training dynamics, or, accordingly, whether this athlete can be included in the team for competitions or high-level tournaments. Indicators of sports readiness related to the totality of its properties, according to which a coaching decision is made, are called defining indicators. But a set of less significant indicators sometimes makes such a significant contribution to the overall picture of the preparedness assessment that one has to resort to the definition of a complex (integrated) indicator.

There are many classifications of sports fitness, among which the main ones are those groupings

of properties and operating factors that show the functional (physiological - medical, anthropometric, biomechanical, etc.) capabilities of an athlete. But sometimes, having their high level, the athlete does not achieve the desired results, so it is necessary to take into account reliability indicators, as well as psychological, pedagogical and even social indicators. But these and many other indicators, as a rule, are expressed in different measuring scales, have a different order of numerical expression and different units of measurement. Therefore, decision makers have a problem with the generalization of indicators and the objective finding of an integrative overall indicator.

**Objective of the study** was to reveal the mechanism for identifying a generalized assessment of the level of preparedness of kickboxers.

**Methods and structure of the study.** There are many mathematical methods for integrating numer-





ous factors and causes that can generalize various indicators and, in this way, all of them can be reduced to a single integrative expression [9, 10].

American scientist E.S. Harrington [7, p. 37–41; 8] managed to translate the parameters, different in their essence and dimension, into a single dimensionless evaluation scale. For this, a separate evaluation indicator  $d$  (from the French desirable – “desirable”, “preferred”) is translated into a dimensionless scale from 0 to 1, moreover, the value  $d_i=0$  corresponds to an absolutely unacceptable level of this property of the indicator, and the value  $d_i=1$  – to the most the best value of this property, where  $i = 1, 2, 3, 4, 5, \dots, n$ ; where  $n$  is the number of such indicators.

The desirability evaluation indicator is considered as a specific reliability or unreliability of the  $i$ -th indicator (that is, its best or worst value in this scale).

The desirability function corresponding to the acceptable/unacceptable level for a one-sided restriction is described by the formula:

$$d = e^{-e^{x^*}}, \quad (1)$$

for a two-sided restriction – by another formula [5, pp. 24-30]:

$$d = e^{-e^{|x^*|}}, \quad (2)$$

where  $x^*$  – the encoded value of a specific parameter  $x$ , that is, its value in the conditional scale (scale) of the measurement.

When all specific parameters ( $x$ ) are listed in “their desirability” ( $d$ ), a generalized assessment parameter is calculated, which E.S. Harrington called the generalized *desirability function*  $D$ . It is determined through the geometric mean of specific desirability, that is, according to the formula [8]:

$$D = \sqrt[n]{d_1 \cdot d_1 \cdot d_1 \cdot \dots \cdot d_i \cdot \dots \cdot d_n}. \quad (3)$$

In our case, the function  $D$  acts as an integral indicator, that is, it takes into account all internal parameters and, therefore, generalizes them as a complex value.

But for the practical use of this formula as a single generalized indicator, this function had a drawback, which is that all internal indicators used in it are considered only equilibrium, and in real life, experimenters often have to deal with parameters that have different weights (significance).

A way out of this situation was found by E.M.

Mencher [4, p. 7-12], who proposed to correct the formula of E.S. Harrington, taking into account the indicated shortcoming. To do this, he introduced an *indicator of weight*. This desirability function began to be called by a double name: *the Harrington-Mencher formula* [1,6]:

$$D = \sqrt{\sum_{i=1}^n V_i} \sqrt{d_1^{V_1} \cdot d_2^{V_2} \cdot d_3^{V_3} \cdot \dots \cdot d_i^{V_i} \cdot \dots \cdot d_n^{V_n}}, \quad (4)$$

where  $d_i$  are dimensionless desirability parameters;  $V_i$  is their weight (significance);  $n$  is their number;  $i = 1, 2, 3, \dots, n$ .

When determining the value of the weight ( $V_i$ ), the most important indicator is assigned a value of 1, a little less important – 0.9, and so on in descending order, with a gradation step no more than 0.1, that is, in descending order: 1.0; 0.9; 0.8; 0.7; 0.6; 0.5; 0.4; 0.3; 0.2; 0.1.

To determine the final integral (generalized) indicator of desirability, a recalculation table is used, usually it looks like this (for five gradations) (Table 1).

**Table 1.** Table for converting desirability indicators into the usual rating scale

Result	Value D
Fine	1,00 – 0,80
Good	0,80 – 0,63
Satisfactorily	0,63 – 0,37
Badly	0,37 – 0,20
Very bad	0,20 – 0,00

**Results of the study and their discussion.** As indicators of the sports readiness of kickboxers, the defining indicators for different classification categories were selected.

From the section of functional fitness, from its subgroup of physical fitness, the following indicators were selected: speed, strength qualities, as well as the level of development of flexibility, endurance, coordination of complex movements, mobility in the joints, flexibility of the kickboxer. From the subgroup of technical readiness: an indicator of the versatility of motor actions, an indicator of implementation efficiency, an indicator of noise immunity. From the subgroup of psychometric preparedness: threshold of sensitivity in various modalities, features of perception of spatial relationships, the pace of mental processes under the influence of interference, features of attention in combat with a forced pace and with a lack of time. From the section of sports reliability, the following were selected: the effective-

**Table 2.** Table of conversion of actual indicators to a 10-point scale, and then to desirability coefficients

Designation, $V_i$	The name of the indicator, unit	Quantitative expression of the indicator	The value of the assessment by i-indicator, in a 10-point scale, $u_i$	Desirability ratio, $d_i$
$V_1$	Motor coordination, number / s	7,8/(0,31)	9,34	0,9274
$V_2$	Muscular endurance, right/(left hand) kg	52,5/(48,6)	7,08	0,6788
$V_3$	Simple visual-motor reaction (SVMR), ms	263,4	8,34	0,8174
$V_4$	Choice reaction (CR), ms	363,6	9,20	0,912
$V_5$	Concentration of attention, c. unit	1,04	8,17	0,7987
$V_6$	Switching attention, points	31,5	6,56	0,6216
$V_7$	Side impacts with the left and right foot for 30 s, quantity	78,5	8,95	0,8845
$V_8$	Frontal kicks with the left and right foot in 30 s, quantity	59,3	7,85	0,7635
$V_9$	Punches (P)	47,1	8,98	0,8878
$V_{10}$	Kicks (K)	18,2	6,24	0,5864
$V_{11}$	Number of attacking strikes	25,0	7,10	0,681
$V_{12}$	Number of retaliatory strikes	21,2	6,91	0,6601

**Table 3.** Values of expert weights of indicators of the level of athletic fitness of a kickboxer

$V_i$	$V_1$	$V_2$	$V_3$	$V_4$	$V_5$	$V_6$	$V_7$	$V_8$	$V_9$	$V_{10}$	$V_{11}$	$V_{12}$
$V_i$	0,7	0,5	0,6	0,7	0,4	0,4	0,8	0,7	1,0	1,0	0,9	0,8

ness of the athlete's actions, the stability of preparedness in extreme conditions. From the section of psychophysiology and psychomotor: the degree of motivation, the will to win.

It should be noted that the selected indicators are not comprehensive, a large number of other indicators remain behind the scenes, but due to their cumbersomeness, we will leave only the 12 most significant indicators (Table 2).

The desirability functions described by Harrington have sigmoidal forms (see formulas 1 and 2). The mechanism for converting dimensional indicators into dimensionless ones, taking into account the linear dependence, is described in many works [2; 3, p. 128; 5]. As the simplest solution, we will take the formula for calculating the desirability coefficients:  $d_i = 0.11x_{ui} - 0.10$ , where  $0.01 < d_i < 1$ . For substitution, values are taken from previously reduced values to a 10-point scale  $u_i$ . For example, for the "Motor coordination" indicator, the value of the desirability coefficient is obtained:  $d_1 = 0.1 \times 9.34 - 0.10 = 0.9274$  (see Table 2, first line).

Weight indicators of the importance of indicators

of sports readiness of kickboxers were determined with the help of experts, which included authoritative coaches and referees in cocktail boxing (10 people). Together, they adopted the following values of weights for 12 indicators of the preparedness of athletes (Table 3).

According to formula (4), the generalized desirability function D was calculated:

$$D = \sqrt[0.5]{0,927^{0,7} \cdot 0,679^{0,5} \cdot 0,817^{0,6} \cdot 0,912^{0,7} \cdot 0,799^{0,4} \cdot 0,622^{0,4} \cdot 0,885^{0,8} \cdot 0,764^{0,7} \cdot 0,888^{1,0} \cdot 0,586^{1,0} \cdot 0,681^{0,9} \cdot 0,660^{0,8}}$$

The value  $D = 0.760$  is interpreted according to Table 1 as "good".

So, the integrative indicator of the kickboxer's sports readiness for our case is interpreted as "above average".

**Conclusions.** The application of the generalized Harrington-Mencher function as a complex indicator of the preparedness of a kickboxer according to diverse indicators is considered. The technique for identifying a generalized assessment of the level of preparedness of athletes makes it possible to evalu-



ate the internal consistency of the answers of experts, it makes it possible to verify the correctness of their conclusions by calculating the coefficient of concordance and the correspondence of the ranking to the natural laws of nature. If we add to the integrative indicator such indicators as the athlete's productivity, as well as the value of statistical sensitivity to the indicators used, it becomes clear that it can be used as a criterion for optimizing sports preparedness.

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# Effectiveness of the combined use of fitness training and changes in the diet depending on the initial body weight

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PhD, Associate Professor **A.V. Elikov**<sup>1</sup>

Dr. Med., Professor **P.I. Tsapok**<sup>1</sup>

PhD **E.M. Karpova**<sup>2</sup>

PhD **D.B. Loktev**<sup>2</sup>

<sup>1</sup>Kirov State Medical University, Kirov

<sup>2</sup>LLC "Event", St. Petersburg

Corresponding author: anton\_yelikov@mail.ru

## Abstract

**Objective of the study** was to evaluate the effectiveness of the combined use of fitness training and dietary changes depending on the initial body mass index.

**Methods and structure of the study.** 81 untrained women aged  $48.9 \pm 2.4$  years were examined. Depending on the initial body mass index, women were divided into four groups. Fitness training was carried out using body weight and without the use of sports equipment, lasting 45 minutes, three times a week, in groups of 6-8 people.

**Results and conclusions.** In all groups, a decrease in the body mass index and circumference of the studied parameters was established, but the degree of change in individual anthropometric parameters depended on the initial body weight. At normal body weight, only a statistically significant downward trend in waist circumference was found; with overweight, a significant decrease was found in the circumference of the hips and arms; with obesity, a significant decrease was found in the circumferences of the chest, waist and hips, more pronounced in women with obesity of the 1st degree.

The use of a complex of fitness training with a change in diet helps to reduce the circumference of the chest, waist, hips, legs, arms, and body mass index.

**Keywords:** *physical activity, fitness, obesity, nutrition.*

**Introduction.** Involving the population in mass physical culture classes in order to prevent the most common diseases in the population is one of the leading tasks of today [4]. In this regard, fitness classes are of great interest, since they are not only a means of body shaping, but also promote health, increase the functional reserves of the body, endurance, stress resistance, coordination and development of aesthetics, physical image [6,9,10]. One of the most effective ways to reduce body weight and fight obesity is to control the daily diet and regular moderate physical activity [1,3]. At the same time, the effectiveness of measures taken to correct body weight will be influenced by the initial morphological and functional parameters of a person [7].

**Objective of the study** was to evaluate the effectiveness of the combined use of fitness training

and dietary changes depending on the initial body mass index.

**Methods and structure of the study.** A survey was conducted of untrained women (81 women in total), whose average age was  $48.9 \pm 2.4$  years, who had a medical permit for fitness. Body mass index (BMI) was calculated according to the generally accepted method:  $BMI = \text{weight (kg)} / \text{height (m)}^2$ . Subjects were divided into groups depending on the BMI: (Group 1) – with normal weight ( $n=7$ ); group 2 - overweight ( $n=32$ ); group 3 - with obesity of the 1st degree ( $n=30$ ); 4th group - with II degree obesity ( $n=12$ ). The follow-up period for all study participants was  $85 \pm 5$  days. Anthropometric studies were performed by measuring the circumference of the chest, waist, hips, legs (measured at the level of the middle of the thigh), arms (measured at the level





of the flexor, above the elbow), BMI. All parameters were controlled before, during and after the study.

Actual nutrition was assessed by the method of 24-hour (daily) reproduction of nutrition, on the basis of which, taking into account concomitant diseases, recommendations were given to each subject for the duration of the study in the form of a seven-day diet. Recommendations for women of the 1st group are given in accordance with individual preferences in the form of a moderate reduction in the energy value of the diet by limiting simple sugars and increasing the proportion of fresh fruits and vegetables. The subjects of the 2nd, 3rd and 4th groups were prescribed a diet with moderate and high carbohydrate reduction (ration No. 6) [8].

For the subjects, under the guidance of sports coaches, fitness training with their own weight was carried out without the use of sports equipment, with an emphasis on the duration and rhythm of the exercises, the principle of which was the exclusion of competitive elements and the achievement of a sports result [5]. Trainings were held for 45 minutes, three times a week, in groups of 6-8 people and included three stages: warm-up - 10 minutes, main part - 30 minutes, final part - 5 minutes. The warm-up consisted of alternating raising the knees to the chest, standing, circular movements of the shoulders, forearms and hands, turning the head to the sides, back and side, squats, lunges, balance on one leg. The main part of the workout is standing, sitting and lying on the floor. Standing exercises included: one-leg jump lunge, jump squat, straight leg toe raise, elevated heel drop, squat side lunge, palm and forearm plank (including dynamic plank

with alternating palm rest and forearms), side plank with a leg lift, in emphasis on the palm of your hand, alternately pulling your knees to your chest, from a standing position or a knee-elbow position, steps with your hands with push-ups. In a sitting position - turn the body to the sides. In the prone position: raising and holding the legs, alternately raising the legs while lying down, twisting the body while alternately pressing the knee to the chest.

The obtained data were processed by the Statistica 10.0 program with the determination of the arithmetic mean (M), standard deviation ( $M \pm$ ), representativeness error of the mean ( $M \pm m$ ) and 95% confidence intervals (95% CI) of the sample means. After checking for normality of distribution using the Shapiro-Wilk test, the significance of the difference was determined by Student's t-test. Differences were considered significant at  $p < 0.05$ .

#### Results of the study and their discussion.

Without taking into account the division into groups, after the study, a statistically significant decrease in the value of all indicators, except for leg circumference, was noted. The most significant decreases were: waist circumference (by 5.6%), arms (by 6.7%), body weight (by 5.4%) and BMI (by 5.2%). Similar data were obtained by other researchers [2]. Taking into account the duration of the study, the average weight loss per month was 1.8 kg.

For the subsequent evaluation of the effectiveness of the applied complex, an analysis of changes in anthropometric indicators by groups was carried out. The results are presented in the table.

In the subjects of the 1st group, at the end of the study, a decrease in all the studied indicators

*Anthropometric indicators of women with different body mass index before and after the study*

Group		Researched indicators, (95% CI)						Weight body, kg	BMI, Unit
		Circumference, cm				Arms			
		Chest	Waist	Hips	Legs				
1st n=7	Before	90,5 - 95,2	72,7 - 84,1	95,7 - 100,1	48,7 - 59,3	27,7 - 31,7	58,5 - 63,9	21,9 - 24,7	
	After	87,0 - 93,6	67,4 - 78,4	91,5 - 98,1	51,4 - 56,2	26,1 - 29,3	56,2 - 62,8	21,4 - 23,8	
2nd n=32	Before	99,0 - 103,8	86,4 - 91,4	106,0 - 109,6	54,5 - 59,9	31,6 - 36,0	69,7 - 75,1	27,5 - 28,3	
	After	96,5 - 100,9	82,8 - 87,8	100,4 - 104,0*	57,7 - 58,5	30,4 - 31,6*	66,3 - 70,7*	26,1 - 26,9*	
3rd n=30	Before	111,1 - 115,1	100,9 - 105,7	112,4 - 116,4	58,7 - 63,5	34,8 - 38,0	83,9 - 89,3	32,0 - 33,2	
	After	107,1 - 111,1*	94,7 - 98,7*	107,0 - 109,8*	57,1 - 61,9	32,7 - 36,3	79,1 - 83,9*	30,1 - 31,3*	
4th n=12	Before	115,8 - 120,5	105,7 - 113,5	118,2 - 126,0	59,8 - 68,8	36,6 - 40,2	92,4 - 99,8	36,6 - 38,2	
	After	111,7 - 116,7*	98,1 - 105,9*	113,5 - 120,5	60,3 - 68,5	34,3 - 37,5	87,3 - 93,9*	34,3 - 36,3*	

Note: \* - differences are statistically significant compared to the initial value of the indicator  $p \leq 0,05$ .



was noted, however, a statistically significant trend of 7.0% ( $p=0.098$ ) was found only in the waist circumference. It should also be noted the largest decrease in this indicator among all groups of women surveyed. This complex can be recommended to women with normal BMI values for waist circumference correction.

The subjects of the 2nd group also showed a statistically significant trend towards a decrease in waist circumference by 4.1% ( $p=0.072$ ), however, the largest and most significant decrease was found in the circumference of the hips by 5.2% ( $p<0.001$ ) and arms by 9, 2% ( $p=0.012$ ), which makes it possible to recommend this complex specifically for correcting these indicators. The average value of the leg volume increased slightly, which can be explained by the strengthening of the calf muscles due to regular physical activity.

In the subjects of the 3rd group, the use of the complex received the highest estimate of effectiveness, since a significant decrease was noted in the circumference of the chest by 3.5% ( $p=0.011$ ), waist by 6.4% ( $p=0.001$ ) and hips by 5.3% ( $p=0.001$ ). It can be assumed that this complex has the greatest place of application in the form of pronounced fat deposits, against the background of a sufficiently high amplitude of movements, namely in women with obesity of the 1st degree.

Quite effective, but less pronounced effect of the complex compared to women of the 3rd group, was found in women of the 4th group. Thus, there was a significant decrease in chest circumference by 3.4% ( $p=0.041$ ) and waist circumference by 6.9% ( $p=0.024$ ), against the background of a statistically significant trend towards a decrease in hip circumference by 4.2% ( $p=0.087$ ) and hands by 6.5% ( $p=0.052$ ). A somewhat smaller effect of the complex compared to women of the 3rd group can be explained by the forced relatively low mobility and a decrease in the amplitude of the exercises performed in women, due to a significant excess of body weight over normal.

It is important to note a significant decrease in body weight and BMI in women of the 2nd, 3rd and 4th groups.

**Conclusions.** The use of a complex of fitness training with a change in diet helps to reduce the circumference of the chest, waist, hips, legs, arms and body mass index. The effectiveness of using a complex of fitness training with a change in diet depending on the initial body weight is different, with the

greatest efficiency in women with obesity of I and II degrees. Women with normal and overweight can be recommended to use a complex of fitness training with a change in diet to correct individual anthropometric indicators.

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# Assessment of the knowledge of the subjects of the training process about psychological preparation in sports

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Dr. Med., Professor **I.L. Levina**<sup>1,2</sup>

PhD, Associate Professor **A.A. Artemiev**<sup>2</sup>

<sup>1</sup>Kuzbass Institute of the Federal Penitentiary Service of Russia, Novokuznetsk

<sup>2</sup>Kuzbass Humanitarian Pedagogical Institute, KemSU, Novokuznetsk

Corresponding author: levina\_i@mail.ru

## Abstract

**Objective of the study** was to assess the level of knowledge about the process and content of the psychological preparation of athletes among the subjects of the educational process, including athletes, coaches and parents of athletes.

**Methods and structure of the study.** An online survey of 195 people was conducted, of which 98 athletes, 35 coaches, 62 parents of young athletes. To conduct the survey, questionnaires were used to identify knowledge about psychological preparation and its content.

**Results and conclusions.** The survey revealed that the level of formation of ideas of coaches, athletes and parents of young athletes about the content of psychological preparation, ways to control the psychological state of an athlete in the process of training activities, preparation and participation in competitions, is low. Testing of the pre-start state has never been carried out in the majority of the athletes surveyed or was carried out using ineffective methods of suggestion and self-hypnosis, coach's settings and self-orders.

In practice, coaches pay little attention to the issues of goal-setting, familiarization with the tasks and plan of the training cycle, pre-competitive preparation, the composition of the participants in the competition, seconding on the eve of the competition, analysis of the results of the competition. The results of the study actualize the development of a system of psychological preparation for all subjects of the training process, including coaches, athletes and their parents.

**Keywords:** athlete, psychological preparation, subjects of the educational and training process.

**Introduction.** The psychological training of athletes is a powerful tool for achieving high results, as well as a means of individualizing the training process [4]. In the course of the psychological preparation of an athlete, the mental qualities necessary for the sport [4], stable professionally important features of perception, attention, emotional and volitional processes [6], psychophysical properties and functional characteristics that ensure effective training and success in competitions [8] develop.

At the same time, the analysis of the literature indicates a lack of attention on the part of the subjects of training activity, including athletes, coaches and parents of young athletes, to this component of sports training [1-6].

There are no studies in the literature devoted to assessing knowledge about the psychological preparation of parents of young athletes. But at the initial stages of sports training, it is the parents who play the leading role in psychological support and assistance to young athletes.

**Objective of the study** was to assess the level of knowledge about the process and content of the psychological preparation of athletes among the subjects of the educational process, including athletes, coaches and parents of athletes.

**Methods and structure of the study.** In the course of the work, methods of conversation and questioning were used, in particular, "Questionnaire for revealing knowledge about psychological prepara-





tion" and "Questionnaire for revealing the content of psychological preparation" [7]. 195 people took part in the survey using the online resource bizon365.ru, of which 98 were athletes, 35 were coaches, and 62 were parents of young athletes.

The survey made it possible to assess the level of ideas of the survey participants about the psychological preparation of an athlete and its content.

**Results of the study and their discussion.** To the question of the first questionnaire, "How important is the psychological preparation of athletes?" the vast majority of respondents (92.3%) answered "very important". This allowed us to assume that the majority of respondents not only have a positive attitude towards this component of sports training, but are also familiar with its structure and content. However, analysis of answers to other questions showed a slightly different situation.

First of all, it turned out that the amount of time allocated for psychological preparation is clearly not enough. This was indicated by 63.6% of respondents. Another 30.7% of respondents doubt that the time spent is enough to prepare the athlete psychologically. And only 5.6% of all respondents consider the time devoted to psychological preparation in the training process to be sufficient. Accordingly, athletes and parents of young athletes are most dissatisfied with this amount of time.

Testing the psychological readiness of an athlete for a competition has never been carried out in 92.8% of respondents. Only six people, of which four coaches and two athletes, indicated the regularity of this procedure before each competition. In the remaining 4.1% of cases, such diagnostics are performed sporadically, from time to time.

To the question "How often is the mental state of an athlete managed during competitions?" 13.8% answered "regularly", 32.8% "sometimes" and more than half - "never".

Only 35.9% of respondents know the signs of an optimal pre-launch state; 32.8% do not know at all, and another 31.3% know approximately.

According to respondents, the most common pre-competition state of an athlete is pre-start fever, which was indicated by 56.9% of respondents. The second place in terms of frequency of occurrence (24.1%) is occupied by prelaunch complacency. Prelaunch apathy occurs in 10.3% of cases. The optimal prelaunch state was found only in 9.3% of cases.

The answers to the question of whether work is carried out before the competition if the athlete experiences an unfavorable pre-start condition were logical. Only 18.9% of the respondents answered this question in the affirmative, among which the parents of young athletes predominated. In this case, 17% indicated episodic work, and the majority of respondents (64.1%) answered that such work is never done!

At the same time, all subjects of the educational and training process have an idea of the means for the athlete to enter the optimal pre-start state. Suggestion (37.9%) and self-orders (32.8%) are used most frequently. Autogenic training is used by about 10% of respondents, and psycho-regulatory training - by just over 7%. About half (40%) of those surveyed use other means (without specifying which ones).

The total score by the sum of answers to the questions of this questionnaire indicates the level of formation of the idea of the athlete's psychological preparation. None of the respondents scored 10 or more points, which indicates the absence of persons among them with a fully formed idea of the psychological preparation of an athlete. 17.4% of the respondents have less than 3 points, which indicates the absence or extreme insufficiency of understanding about this process. For the remaining 82.6% of respondents, the level of ideas about the psychological preparation of an athlete is very mediocre and requires purposeful formation. This is also evidenced by the average score for the entire group -  $4.62 \pm 0.56$ . The lowest value was found in the parents of young athletes -  $2.98 \pm 0.31$  points; athletes -  $4.47 \pm 0.48$  points. Coaches scored higher -  $6.21 \pm 0.73$  points.

Thus, the use of the questionnaire to identify knowledge about psychological preparation showed a very mediocre level of formation of ideas about psychological preparation among coaches, athletes and parents of young athletes.

With the help of the second questionnaire, knowledge of the content of psychological preparation was assessed. According to 100% of respondents, a positive emotional background during direct preparation for competitions predisposes to the fulfillment of the load, increases the desire to train and compete.

More than half of the respondents (58.5%) are sure that the presence of coaches at competitions



has a positive effect on the pre-start condition of athletes. However, 10.8% of them believe that this increases the excitement of the athletes. The remaining 30.7% did not indicate any noticeable impact on the state of the athletes of the presence of a coach at the competition. For all respondents, it is very important that the coach conducts a systematic analysis of competitive activity.

Several questions of this questionnaire related directly to the activities of a coach in the psychological preparation of an athlete, in particular, in matters of goal setting. To the question "Does the coach's setting goals and objectives for this competition matter to you?" only 55.8% of the respondents answered in the affirmative. For the remaining 43.2%, the setting of goals and objectives for the competition by coaches matters only sometimes. But to the question "Does the joint (coach and athlete) goal setting for this competition contribute to the optimization of the pre-launch state?" Already 76.9% answered in the affirmative.

For 79.5% of respondents, familiarization with the plan of training sessions at the stage of pre-competition preparation is not very important. Only 20.5% consider it important for themselves.

Information about the upcoming opponent before going to the start is not important for 56.9% of respondents versus 43.1% for whom this information is very important.

It turned out that familiarization with the referee protocols, the composition of the participants before participating in the competition is not important for 65.6% of the respondents. And only a third of them are interested in such information.

Two more questions related to the impact of difficult relationships with the coach and teammates on the condition of the athlete during pre-competition training. It is natural that for 81.5% of respondents such a situation worsens their attitude to the competition, but for 18.5% it does not have any effect.

Interesting were the answers to the question: "In your opinion, what influence does the feeling of readiness for competitions have on the athlete's attitude?". It turned out that for 10.8% of respondents this feeling leads to a weakening of motivation.

According to 44.1% of respondents, financial incentives increase the motivation of an athlete. At the same time, 24.1% of respondents believe that this has no effect, and another 31.8% - weakens sports motivation.

According to the key of this questionnaire, the number of points scored indicates the quality of the content of the athlete's psychological preparation.

So, if the number of points is 18 or more, this indicates a good content of the athlete's psychological preparation. Among the analyzed questionnaires, only 30.7% of them turned out to be such.

If the number of points is from 10 to 17, then the content content of the athlete's psychological preparation is insufficient. Questionnaires with answers to 10-17 points were 40%.

If the number of points is less than 10, then the content of psychological preparation is extremely insufficient, there are only individual elements of its structure. There were 29.3% of such questionnaires.

Thus, the use of the second questionnaire showed an insufficient level of knowledge about the content of the psychological preparation of an athlete in 70.7% of the respondents.

**Conclusions.** Despite the understanding of the importance of psychological preparation in sports, the level of formation of ideas about its content, ways of managing the psychological state of an athlete in the process of training activities, preparation and participation in competitions, among coaches, athletes and parents of young athletes is low. One of the possible reasons for this situation is the insufficient amount of time allocated for psychological preparation, which in the vast majority of cases is carried out sporadically or not at all.

Alarming, in our opinion, is the lack of knowledge about the signs of an optimal pre-launch state in the overwhelming number of respondents. Testing of the pre-start state has never been carried out in the majority of the athletes surveyed or was carried out using ineffective methods of suggestion and self-hypnosis, coach's settings and self-orders.

As for the ideas about the content of the psychological preparation of an athlete, the respondents agree on the usefulness of creating a positive emotional background in direct preparation for competitions, as well as a systematic analysis of competitive activity. However, in practice, coaches pay little attention to the issues of goal-setting, familiarization with the tasks and plan of the training cycle, pre-competitive preparation, the composition of the participants in the competition, seconding on the eve of the competition, analysis of the results of the competition. Moreover, for 40% of respondents, the very presence of a coach at competitions is disput-



able from the point of view of the effectiveness of competitive activity.

The results of the study actualize the development of a system of psychological preparation for all subjects of the training process, including coaches, athletes and their parents.

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# Structural and meaningful organization of coach's attitudes in the formation of operational thinking in young athletes

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Dr. Hab., Professor **T.K. Kim**<sup>1</sup>

Dr. Hab., Professor **G.A. Kuzmenko**<sup>1</sup>

**I.I. Rodkina**<sup>2</sup>

Associate Professor **A.V. Fedorov**<sup>2</sup>

<sup>1</sup> Moscow State University of Education, Moscow

<sup>2</sup> Moscow Polytechnic University, Moscow

Corresponding author: kim.tatiana@mail.ru

## Abstract

**Objective of the study** was to specify the content of the coach's attitudes to the young athlete with a focus on the development and full-fledged demonstration of operational thinking at a high pace of training activities.

**Methods and structure of the study.** In the course of scientific work, the following research methods were used: analysis of literary sources; content analysis of the trainer's attitudes; testing: psychomotor abilities, differentiation ability, cognitive functions, styles of activity, components of personality orientation. The study was conducted on the basis of the Chertanovo Sports Boarding School, Olympic Reserve Sports School No. 1, and the Moscow National Hockey Center in April 2021 with the participation of 10 coaches and 34 young athletes.

**Results and conclusions.** The factors revealed in the course of the study, reflecting the activity features of the implementation of operational thinking at a high pace of execution of a motor task in young athletes-players ("the number of precise, prompt actions in the format of the type of thinking"; "the ability to differentiate the parameters of actions with a constant concentration of sensory-perceptual attention"; "quantitative and temporal characteristics of activity"; "the number of correct decisions in a changing environment") made it possible to specify the coach's instructions for young athletes in the direction of development and full realization of the ability to operational thinking in conditions of a high pace of training and competitive activity.

**Keywords:** *coach's attitudes, operational thinking, young athletes, hockey, football, factors.*

**Introduction.** The constantly increasing pace of competitive activity in team sports makes high demands on the various components of the young athlete's fitness. At present, sports games are characterized by a high pace of the game, technical and tactical variability and unpredictability of competitive struggle, tough confrontation. Therefore, the player's ability to analyze the competitive situation, make prompt decisions, implement them in a specific tactical plan through technical actions and combinations, both independently and together with the players of his team, largely determines the outcome of the competition [1].

This circumstance initiates a substantive consideration of the components that systematically determine the basic basis for the implementation of operational thinking in action and activity at the early stages of sports improvement. Thus, D. Memmert

and S. Knig emphasize the importance of teaching "general playing skills at a high speed of its implementation" [5].

Along with this, experts pay attention to the relationship between "visual perception and visual attention and skills in sports", highlighting "blindness due to inattention when solving a real problem in sports games" and "rapid exhaustion by an athlete of adaptive capabilities (including mental ones)" [4]. At high volumes of given loads, the so-called "motor-energy stereotype of low speeds is formed, adaptation to training activity is underway, which does not correspond to competitive" [3].

Observation of the training process of young hockey players and football players revealed the problem of the lack of conjugation of the coach's attitudes with the tasks of improving technical and tactical actions and combinations in parallel with the formation



of high-speed strategies, tactics, models and styles of competitive struggle.

**Objective of the study** was to specify the content of the coach's attitudes to the young athlete with a focus on the development and full-fledged demonstration of operational thinking at a high pace of training activities.

**Methods and structure of the study.** In the course of scientific work, the following research methods were used: analysis of literary sources; content analysis of the trainer's attitudes; testing: psychomotor abilities, differentiation ability, cognitive functions, styles of activity (V.Ya. Anfimov, A.G. Ivanov-Smolensky; Allison, Hayes, 1996; I.P. Shkuratova, the Compass method; G.A. Kuzmenko [2, p. 205]); Test-training programs V. Sivitskii - noise immunity (A.V. Rodionov); components of personality orientation (A.V. Rodionov, A.V. Stambulov, Yu.L. Khanin, A. Mehrabian). The study was conducted on the basis of the Chertanovo Sports Boarding School, Olympic Reserve Sports School No. 1, and the Moscow National Hockey Center in April 2021 with the participation of 10 coaches and 34 young athletes.

### Results of the study and their discussion.

Based on pedagogical observations of the communicative interaction of coaches with young hockey players and football players aged 11-13 years in 30 training sessions, it was revealed that coaches do not focus on the special semantic organization of methodological recommendations that reflect the successive implementation of operational thinking components (14 variables, Table 1), it is noted non-coincidence of the localization of the meaningful accents of the methodological recommendations and the coach's attitudes to the actualization of the competitively significant manifestations of the young athlete's thinking in conditions of a high rate of activity implementation - 85% of the attitudes - in the zone 10, 12 and 14 of the quality requirements.

We present the co-organization of the studied variables and factors that reflect the complex characteristics of the speed and adequacy of the execution of the elements of training activity by young players.

With an increase in the sample size (more than 34 young athletes), an increase in the factor weight of three variables is likely: 1) "The number of correct de-

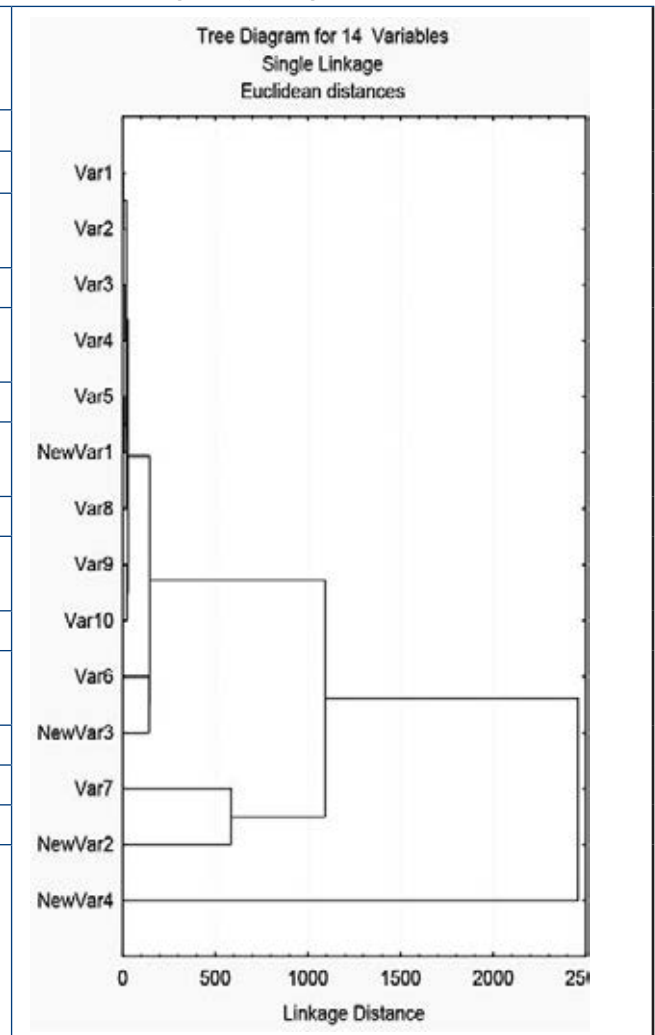
**Table 1.** Factors of effective high-speed implementation of training activity by a young athlete, characterizing the features of the development of operational thinking

Research variables	Factor loadings (Varimax raw) Extraction: Main components (Noted loads >70000)			
	Factor 1 The number of precise, operational actions depending on the type of thinking	Factor 2 The ability to differentiate actions with a constant concentration of sensory-perceptual attention	Factor 3 Quantitative- and temporal characteristics of activities	Factor 4 Number of correct decisions in a changing environment
1. TM*: Analyst, synthetic, formal combinator	<b>0,702857</b>	0,534129	0,010232	0,051505
2. TM: Rational, receptive, reflective	<b>0,871131</b>	0,274347	0,036934	-0,00927
3. SI, CAT: Game «5», the number of moves	0,056175	0,164888	<b>0,834628</b>	0,415413
4. SI, CAT: Game «5», task completion time	-0,127091	0,458193	0,334907	<b>0,676436</b>
5. PMA*: Reaction to a moving object, the number of precise clicks	<b>-0,933768</b>	-0,099291	-0,06234	0,039814
6. PMA: Tapping test, average of 6 attempts	0,168569	-0,455206	-0,11414	<b>-0,50396</b>
7. PMA: Reaction of Choice	<b>0,900630</b>	-0,005800	0,230442	0,004847
8. DA, SPA: Sense of time, (time acceleration trend), out of 10 attempts	-0,215683	<b>-0,823778</b>	-0,359184	0,091152
9. DA, SPA: Eye gauge	0,094219	<b>0,948057</b>	0,011611	0,107792
10. DA, SPA: Accuracy of muscle efforts, dynamometer, 50% max.	0,215944	<b>0,852034</b>	0,188351	0,105012
11. Personality orientation: Risk-taking	<b>-0,841561</b>	-0,070569	0,048743	0,179024
12. Regulatory A.: Noise Immunity	0,608900	0,600853	-0,12665	0,163253
13. Field independence, concentration of attention: «Compass», the number of correct answers	0,010761	-0,047189	-0,16930	<b>0,897671</b>
14. Field independence, concentration: «Compass», run time	0,115094	0,130730	<b>0,893610</b>	-0,33213

*Indicators:* Type of thinking (TM); Spatial imagination, combinatorial abilities of thinking (SI, CAT); psychomotor abilities (PMA); Differentiation ability, sensory-perceptual attention (DA, SPA); personality orientation; Regulatory abilities (A); Field independence in concentration.

**Table 2.** Cluster co-organization of attributes of operational thinking of a young athlete

Features of conjugation of the studied variables
1. TM: analyst, synthetic, formal combinator
2. TM: rational, receptive, reflective
3. Spatial imagination, combinatorial SM: Game «5» number of moves.
4. Spatial imagination, combinatorial SM: Game «5» time
5. PMA: Reaction to a moving object, the number of precise clicks
11. Personality orientation: risk-taking
8. DA, SPA: sense of timing, underestimation, out of 10 attempts
9. DA, SPA: Eye gauge
10. DA, SPA: muscle effort accuracy, dynamometer, 50% max.
6. PIMC: tapping test, average of 6
13. Field independence, concentration of attention: «Compass», the number of correct answers
7. PMA: reaction of choice
12. Regulatory A.: noise immunity
14. Field independence, concentration: «Compass», run time



cisions in a changing environment” - the time it takes to complete a task (when assessing spatial imagination, combinatorial thinking abilities) and a tapping test that reflects psychomotor abilities;

2) “The number of accurate, prompt actions in the format of the type of thinking” - “Noise immunity”. 14 variables under study are linked into a single correlation galaxy with a range of coefficients reflecting significant relationships (0.443855 - 0.880581), (Correlations (Spreadsheet9) Marked correlations are significant at  $p < 0.05$   $N = 34$ , and confirm the weight of those accepted for the study variables.

Cluster analysis data (Table 2) make it possible to specify the coach’s attitudes and form methodological recommendations in the context of the successive co-organization of the attributes of the young athlete’s operational thinking, focused on the quality of training activity.

The requirements of the coach to the athlete for noise-resistant and prompt performance of actions, taking into account the positions of partners and opponents, characterize the final stage of the associated

implementation of the abilities under consideration (No. 7, 12, 14) - to anticipatory operational thinking and effective (-th) quick action (activity at a high pace).

Considering the methodological sequence of constructing the content of methodological recommendations, one should pay attention to the basic clusters and successively form requirements based on them:

1) Think: analytically (quickly analyze all the parameters of the game situation); synthetically (perceive the situation as a whole: make operational decisions based on fixing the trajectory and speed of movement of all partners and opponents on the field (site); do not perform the action formally, without interest - concentrate, tune in and demonstrate maximum abilities. When teaching unusual styles - give instructions in their system of requirements.

2) Think: rationally (economically and quickly); receptively (instantly, based on one’s own feelings and decisions); reflexively (comparing, retracted analyzing).

3) Focus on the search and operational definition of a more economical, ergonomic action; search, com-



pare, compare, “what number of actions is better.”

4) Implement a technical and tactical technique, a combination at maximum speed, outstrip the opponent’s actions, demonstrate tempo interaction with partners.

5) Demonstrate the accuracy of projectile control, perform the final action accurately in free, defined zones.

6) Trust your sense of the moment of action, take risks, not be afraid of possible negative consequences, think in terms of possibilities.

7) Promptly, quickly, instantly, act, “do not delay” in making a decision, focus on working at the highest possible speed of the execution of the action.

8) Determine the distance to the partner, opponent, the dynamics of their movement, look for free zones, feints and strokes on the counter move to free the zones for hitting the ball, throwing the puck.

9) Invest so much effort to effectively control the trajectory of movement (links) of the body, the ball (puck), the speed of movement at the end point.

10) Demonstrate individually (over) the maximum rate of implementation of technical and tactical actions in the range of six-second work.

11) In training, playing, focus on multiple quick search for the right solutions, “do not fall out of the situation” (for example, in hockey - within one shift 45 s - 1 min 15 s; in football: from 45 s - up to 1.5 min.

12) Demonstrate a high speed of choosing a method of action, feel the right ways to solve the situation; make the right decisions promptly.

13) Demonstrate fault-tolerant, task-focused play behavior.

14) Field-independent, focused on the task to quickly perform a technical and tactical technique, a combination, carry out a shift, play a segment of competitive time.

**Conclusions.** In the course of the study, four factors were identified that reflect the activity features of the implementation of operational thinking at a high pace of execution of a motor task: “The number of precise, prompt actions in the format of the type of thinking”; “The ability to differentiate actions against the background of sensory-perceptual attention”; “Quantitative and temporal characteristics of activity”; “The number of correct decisions in a changing environment”.

The presented structural and content organization of the coach’s attitudes to the young athlete, which

ensures the successive development and full implementation of operational thinking in the high-speed component of training activity, will improve the professional competence of coaching staff and, as a result, the quality of training of the sports reserve.

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# Indicators of motor activity and physical fitness of university teachers

UDC 796.011.3



PhD, Associate Professor **A.A. Tretyakov**<sup>1,2</sup>

Dr. Hab., Professor **L.N. Akulova**<sup>3</sup>

PhD, Associate Professor **T.V. Nikulina**<sup>1</sup>

PhD, Associate Professor **V.K. Klimova**<sup>1</sup>

<sup>1</sup>Belgorod State National Research University, Belgorod

<sup>2</sup>Putilin Belgorod Law Institute of Ministry of the Interior of Russia, Belgorod

<sup>3</sup>Voronezh State Pedagogical University, Voronezh

Corresponding author: delphin87@inbox.ru

## Abstract

**Objective of the study** was to identify the level of physical fitness of university teachers based on the analysis of their physical activity.

**Methods and structure of the study.** The pedagogical experiment was carried out on the basis of the Belgorod State National Research University, which was attended by teachers of the humanities (general profile) and physical education. The sample consisted of participants aged 30 to 35 years. To assess motor activity, OMRON pedometers were used. To assess physical fitness, control exercises for men and women were proposed.

**Results and conclusions.** It has been established that teachers of humanitarian disciplines are characterized by low motor activity, which is associated with the peculiarities of their professional activities. This indicates a weak functional activity of the body systems and a violation in the activity of regulatory mechanisms. The authors proposed ways to increase motor activity and increase efficiency.

**Keywords:** motor activity, physical readiness, educational activity, physical culture, teacher, higher educational institution.

**Introduction.** At present, numerous studies have established that the professional activity of a teacher is accompanied by emotional, physical and mental overload. Factors that negatively affect the health of a teacher include workload, the use of information technology in the educational process, the maintenance of methodological and reporting documentation, and much more. In this regard, the organization and regulation of physical activity of teachers during the day is a topical area of research by scientists and practitioners.

**Objective of the study** was to identify the level of physical fitness of university teachers based on the analysis of their physical activity.

**Methods and structure of the study.** The pedagogical experiment was carried out on the basis of the Belgorod State National Research University, in which teachers of the humanities (general profile) and physical education took part. The sample consisted of participants aged 30 to 35 years. Each group consisted of 10 men and 5 women.

To assess motor activity, OMRON pedometers were used. Motor activity was measured during the week. To assess physical fitness, control exercises for men and women were proposed. Thus, women performed a 60-meter run, a tilt from a standing position, tilts from a prone position for 1 minute and a shuttle run of 10 × 10 m. Men performed 60 m run, tilt from standing position, flexion-extension of arms from prone position and shuttle run 4 × 20 m.

**Results of the study and their discussion.** The data obtained testify to the low physical activity of general teachers. On weekdays, the activity of both women and men does not exceed the conditional daily norm of 10,000 steps. And on weekends, the result of shagometry is halved (Table 1). Physical education teachers on weekdays take twice as many steps as in the group of general teachers. This trend is observed in both women and men. On weekends, physical activity exceeds the conditional daily norm of 10,000 steps. Comparison of the results is marked by a significant difference (ac-



**Table 1.** Average indicators of pedometer for teachers during the week

Days	General profile		Physical education profile	
	Women	Men	Women	Men
Weekdays	7358±467	8796±641	12175±658	14191±739
Weekend	4322±351	4178±512	10586±433	10893±541

**Table 2.** Results of control testing of teachers

Testing	General profile		Physical education profile	
	Women	Men	Women	Men
Run 60 m, s	13,2±0,8	12,4±0,7	10,5±0,6	8,7±0,4
Tilt, cm	9,5±0,6	-3,5±0,4	14,3±0,9	9,2±0,8
Shuttle run, s	34,1±2,7	18,2±1,5	31,2±2,1	16,5±1,7
Slopes for 1 min, times	21±1,7		35±2,4	
Push-ups, times		22±2,3		37±3,9

according to Student's t-test). Comparative assessment of the level of physical fitness in the control exercises of teachers demonstrates differences in indicators. Physical education teachers are faster in running 60 meters, they perform better the shuttle run test, as well as tests to determine strength abilities, than representatives of the humanitarian direction. The result of the tilt test from a standing position by male teachers of general disciplines was  $-3.5 \pm 0.4$  cm. The negative sign indicates the position of the fingertips above the floor. Comparison of the results is marked by a significant difference (according to Student's t-test).

**Conclusions.** As a result of the study, it was found that teachers of the discipline of the humanitarian profile are characterized by low motor activity, which is associated with the peculiarities of their professional activities. The only possible form of activity during the working day is moderate movement in a limited space, gestural movements and activity at the board or screen. While the activity of physical education teachers is full of various movements during practical classes.

In turn, low indicators of motor activity and physical fitness may indicate a weak functional activity of body systems and a violation in the activity of regulatory mechanisms. All this affects the efficiency and stability of teachers to professional and everyday workloads.

As part of the regulation of physical activity, general teachers are recommended to perform physical training minutes or mobile exercises during training sessions on weekdays. Daytime walks or light workouts are possible to switch activities. After a working day, get home on foot, and not by public transport. It is important to spend the weekend actively or to actively spend part of the day off. It is also important for teachers to be involved in the recreational and physical education activities of higher educational institutions. Take part in the preparation and delivery of the

All-Russian physical culture and sports complex GTO.

The proposed ways of motor activity regulation will allow not only to increase motor activity, but also to increase working capacity.

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# Online service "sportreserve" as an effective resource for monitoring the physical fitness of students

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PhD, Associate Professor **A.V. Fursov**<sup>1</sup>  
Dr. Hab., Professor **N.I. Sinyavsky**<sup>1</sup>  
<sup>1</sup>Surgut State Pedagogical University, Surgut

Corresponding author: fursovav@bk.ru

## Abstract

**Objective of the study** was to identify the functionality of the online service of the automated information system (AIS) "Sportreserve" in working with the sports reserve, selection and support of the most gifted children at the stages of sports training.

**Methods and structure of the study.** The tools for developing a software service were defined as the most universal cross-platform PHP Storm IDE solutions designed for writing interface programming text and implementing a database management system. More than 50,000 students from budgetary educational institutions of the city of Surgut were involved in testing the online service of the AIS "Sportreserve".

**Results and conclusions.** The AIS "Sportreserve" has automated the main algorithms, as well as created directories for recording the data of students passing the standards of the GTO complex at all stages of sports training with uploading an individual electronic passport of an athlete and relevant analytical data.

The program provides the following functions: automated recording of data on sports activities of athletes; generation of individual reports, creation of databases by sections of the athlete's digital passport.

**Keywords:** digitalization, GTO complex, physical fitness monitoring, online service, AIS "Sportreserve".

**Introduction.** To date, the implementation of scientific research and the introduction of new developments, taking into account the segments of the Sport-Net market and the Strategy for the Development of Physical Culture and Sports in the Russian Federation, updates the agenda for improving the mechanisms for information support of activities in the field of physical culture and sports, introducing modern online services for preparing a sports reserve, attracting the largest number of the population to regular physical culture and sports, the implementation of a unified statistical reporting. The digital transformation of physical culture and sports means not only the development and implementation of technical solutions, but also a huge amount of related work: conducting scientific research, eliminating legal barriers, training and developing user competencies [2].

An analysis of industry scientific and theoretical journals in the field of physical culture and sports

showed an increased interest of the scientific community in research on IT development, as well as the introduction of scientific and experimental developments that ensure the preparation of a sports reserve, automated data processing of basic health indicators and monitoring the physical fitness of students [1, 3-6].

**Objective of the study** was to identify the functionality of the online service of the automated information system (AIS) "Sportreserve" in working with the sports reserve, selection and support of the most gifted children at the stages of sports training.

**Methods and structure of the study.** The purpose of the AIS "Sportreserve" is to search for gifted children for selection in groups of sports sections. The tools for developing a software service were defined as the most universal cross-platform PHP Storm IDE solutions designed for writing interface program text and implementing a database management system. More than 50,000 students from budgetary educa-



tional institutions of the city of Surgut were involved in testing the online service of the AIS "Sportreserve".

#### Results of the study and their discussion.

The design of the AIS Sportreserve online service included three main stages:

- development of the concept and terms of reference, a module for analyzing data on the physical fitness of children for programming the main functions, a digital analytical service for searching and accompanying gifted children to form a sports reserve in the Ugra region;

- creation of a user's personal account on the site <https://rosinwebc.ru/>, through which it was possible for specialists to carry out search access to a database containing information on indicators of children's physical fitness and formed using the "AS FGC GTO" service. Also, the functions of analysis and data processing were adjusted according to the specified parameters to identify gifted children;

- integration of the online service "Sportreserve" with the "AS FGC GTO", which contains data on the conditional profile of the development of the main physical qualities of children, taking into account the results of fulfilling the standards of the GTO Complex.

The AIS "Sportreserve" has automated the main algorithms, as well as created directories for recording data at all stages of sports training with uploading an athlete's individual electronic passport and relevant analytical data. The online service allows you to support the sports reserve, as well as provide data for making important decisions aimed at developing the success of each talented child, and identifying breakthrough points for the development of their future sports career, demonstrating high sports results.

**Conclusions.** The online service AIS "Sportreserve" can be used in scientific, organizational and sports-methodical work of physical culture and sports organizations in working with a sports reserve, selection and support of gifted children at the stages of sports training. The program provides the following functions: automated recording of data on sports activities of athletes; generation of individual reports, creation of databases by sections of the athlete's digital passport.

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# Increasing the psychophysical state of children of primary school age by means of stretching with wushu elements

UDC 796.011.5



PhD, Associate Professor **A.V. Korichko**<sup>1</sup>

**A.V. Rotar**<sup>1</sup>

<sup>1</sup>Nizhnevartovsk State University, Nizhnevartovsk

Corresponding author: alexey.korichko@gmail.com

## Abstract

**Objective of the study** was to improvement of the psychophysical state of children of primary school age by means of stretching with wushu elements.

**Methods and structure of the study.** Children 9-10 years old took part in the pedagogical experiment. The initial level of physical fitness, the degree of workability and mental stability of children of primary school age were preliminarily determined, the features of their psycho-emotional state were revealed. In the course of the study, a program was developed based on the integration of elements of stretching and wushu. To prevent adverse effects on the health of younger schoolchildren (development of asymmetry in the sagittal plane, muscle imbalance), all developed complexes were designed for "mirror" stretching of all departments of the musculoskeletal system.

**Results and conclusions.** The use of stretching with wushu elements in the system of physical education of children of primary school age has a positive effect on the level of physical fitness, as evidenced by the positive dynamics in most of the proposed tests. The positive influence of stretching with wushu elements on the working capacity of those involved was traced. An increase in the efficiency of work and mental stability of children aged 9-10 was noted, which undoubtedly has a positive effect on the quality of classes.

**Keywords:** *stretching, psychophysical state, physical fitness, children aged 9-10.*

**Introduction.** Very often, increased cognitive load is the cause of the stressful state of schoolchildren. This is reinforced by the immobility of students - there is a tendency to increase in physical inactivity, the motivation for motor activity decreases in children, which implies a violation and destabilization of their psychophysical state [2,4].

The development of flexibility in children of primary school age is considered by experts to be one of the most effective methods of improving the body, contributing to normal physical development. Exercises for the development of flexibility help strengthen the musculoskeletal system and prevent injuries, contribute to the development of coordination of movements. It is complex coordination exercises that most positively affect the psychophysical state of children [1,3].

**Objective of the study** was to improvement of the psychophysical state of children of primary school age by means of stretching with wushu elements.

**Methods and structure of the study.** The pedagogical experiment, in which children aged 9-10 participated, was conducted on the basis of the Municipal budgetary educational institution "Secondary School No. 43" in Nizhnevartovsk. The initial level of physical fitness, the degree of workability and mental stability of children of primary school age were preliminarily determined, the features of their psycho-emotional state were revealed.

Based on the data of scientific and methodological literature, we have developed a program in which suitable exercises from two types of sports activities are integrated into a single system, their sequence and dosage are built, including elements of stretching and wushu [4,5].

The training program included a set of passive and active exercises, which were practiced in the context of a training session, where exercises aimed at increasing the range of motion were taken as the basis.



Experimental classes lasting 1 hour were held three times a week as part of extracurricular activities. The program of each lesson included 10-15 exercises that develop flexibility.

To prevent adverse effects on the health of younger schoolchildren (development of asymmetry in the sagittal plane, muscle imbalance), all developed complexes were designed for "mirror" stretching of all parts of the musculoskeletal system. During the classes, the basic elements of the sport of wushu-taolu were periodically learned and practiced. The main task at the same time was the awareness and implementation of the underlying principle of individual elements by younger students, without excessive requirements for technical performance.

**Results of the study and their discussion.** To evaluate the effectiveness of the proposed program, upon completion of the pedagogical experiment, a repeated testing of the level of physical fitness and psycho-emotional state of junior schoolchildren was carried out, and the following changes were revealed (Tables 1, 2, 3). Thus, positive changes were found in the level of physical fitness of children aged 9-10 years (Table 1), and the greatest changes were achieved in the tests of flexibility, coordination of movements, as well as in the manifestation of speed-strength qualities ( $p < 0.05$ ).

This fact is a consequence of the content of the applied experimental program, which was based on exercises for the development of joint mobility and coordination, evidence of compliance with all the main

criteria and principles during the experiment, in particular, the degree of dosing of the load and the direction of the exercises. In addition, the training program took into account the possible negative impact of flexibility with an excessive increase in the amplitude of passive movement on the development of speed-strength qualities.

To study the influence of the developed program on the properties of attention in children, we used the method of A.Yu. Kozyreva, where the main criteria are: work efficiency, degree of workability and mental stability.

The results presented in table 2, indicate an increase in work efficiency and mental stability of the studied contingent following the results of experimental classes, as evidenced by a decrease in the time for completing the proposed tasks.

The degree of workability has no statistics of significant changes, it is stable, is at a good level, which can be associated with the active attitude to work involved in all stages of the experiment. Minor fluctuations may be due to the psycho-emotional and physical state of children at the time of testing, which complicates an objective assessment.

In table 3 shows the results of diagnostics of the operational assessment of well-being, activity and mood of the control and experimental groups before and after the pedagogical experiment.

Criteria for evaluation:

1-4 points - low level - unfavorable degree of assessment of one's condition.

**Table 1.** The level of physical fitness of children 9-10 years old before and after the experiment

Tests	Experiment steps		
	Before	After	p
Flexion and extension of the arms in the lying position	9,25±3,79	10,5±3,41	>0,05
Standing long jump, cm	143,35±12,55	154,05±12,94	<0,05
Run 30m, s	5,86±0,45	5,52±0,42	>0,05
Shuttle run 3x10m, S	9,41±0,59	8,29±0,65	<0,05
Tilt forward from a standing position, cm	6,55±2,96	12,3±3,85	<0,05

**Table 2.** Levels of attention concentration according to the Schulte method in children 9-10 years old before and after the experiment

Tests	Experiment steps		
	Before	After	p
Efficiency	47,69±9,63	42,66±7,78	<0,05
Degree of workability	1,00±0,09	1,00±0,09	>0,05
Mental stability	1,01±0,08	0,96±0,07	<0,05



**Table 3.** *The level of psycho-emotional state of children 9-10 years old before and after the experiment*

Evaluated Criteria	Experiment steps	
	Before	After
Well-being	4,6	5,91
Activity	4,59	4,8
Mood	4,7	4,89

4-5 points - the minimum acceptable, sufficient level of assessment of one's condition.

5-5.5 - the optimal level of assessment of their condition.

5.5-6 - a high level of assessment of their condition.

6-7 - a very high level of assessment of their condition.

According to the results presented in table 3, it can be seen that the optimal state level was obtained by assessing one's own well-being, which, in our opinion, is a consequence of the increase in physical condition and psycho-emotional state of younger students upon completion of the proposed training program.

**Conclusions.** The use of stretching with wushu elements in the system of physical education of children of primary school age has a positive effect on the level of physical fitness, as evidenced by the positive dynamics in most of the proposed tests. The positive impact of stretching with wushu elements on the performance of those involved has been traced. An increase in the efficiency of work and mental stability of children aged 9-10 was noted, which undoubtedly has a positive effect on the quality of classes.

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# Historical development of domestic army hand-to-hand combat as a sport

UDC 796.85



Dr. Hab., Professor **V.N. Irkhin**<sup>1</sup>

Postgraduate student **R.F. Oldenburger**<sup>1</sup>

Associate Professor **M.S. Koreneva**<sup>1</sup>

**N.V. Repina**<sup>1</sup>

<sup>1</sup>Belgorod State National Research University, Belgorod

Corresponding author: v\_irkhin@list.ru

## Abstract

**Objective of the study** was to identify development trends in Russia of the military-applied sport "Army hand-to-hand combat".

**Methods and structure of the study.** The following were used in the work: analysis and generalization of scientific literature, statistical data, practice of organizing army hand-to-hand combat (AHHC); studying the best practices of the training process; observation; conversation; generalization; study of documentation; specific methods of the history of pedagogy: historiographic, determinant-genetic and problem-genetic analyzes of the problem.

**Results and conclusions.** The analysis of theoretical and empirical sources made it possible to identify the following features of the development of the AHHC as a military-applied sport in Russia from 1979 to the present: improvement of the organizational foundations and regulatory framework of the AHHC; geographical expansion of the AHHC in the regions of Russia; familiarizing pre-conscription and civilian youth with military hand-to-hand combat; improving tactics, increasing the speed and dynamics of the battle, increasing the entertainment of fights; increase in the number of competitions, athletes involved in AHHC (before 2010, positive dynamics, and after 2010 - negative); increased competition of AHHC from other types of martial arts; the outflow of children of school age 7-13 years old engaged in AHHC in the second or third years of training, improving the equipment of athletes.

**Keywords:** development trends, Russia, military-applied sport, army hand-to-hand combat.

**Introduction.** Currently, army hand-to-hand combat as a military-applied sport has become widespread and recognized not only in military units, but also among the "civilian population", adolescents and youth in Russia [1,2]. For more than 40 years of its existence, the AHHC gave impetus to the development of more than one type of martial arts in our country, contributed to the emergence of many schools of hand-to-hand combat, and continued to act as a determinant of the formation and development of new sports [1,2]. At the same time, the question of the development trends in Russia of the military-applied sport "army hand-to-hand combat" has not yet been reflected in the scientific literature.

**Objective of the study** was to identify development trends in Russia of the military-applied sport "Army hand-to-hand combat".

**Methods and structure of the study.** The following were used in the work: analysis and generalization of scientific literature, statistical data, practice of organizing army hand-to-hand combat (AHHC); studying the best practices of the training process; observation; conversation; generalization; study of documentation; specific methods of the history of pedagogy: historiographic, determinant-genetic and problem-genetic analyzes of the problem.

**Results of the study and their discussion.** The analysis of theoretical and empirical sources reflecting the peculiarities of the genesis of the army hand-to-hand combat (AHHC) as a military-applied sport made it possible to identify development trends in its organizational structure and regulatory framework (Tables 1, 2).



**Table 1.** *The development trend of the organizational bases of the AHHC*

The years	Organizational events
1985	AHHC is included in the ESC as an independent sport
1989	AHHC has been introduced into the Armed Forces of the Russian Federation as a military-applied sport
1991	The 1st AHHC Championship of the USSR Armed Forces was held in Leningrad
1992	The Federation of Army Hand-to-Hand Combat was created under the auspices of the Army Association of Contact Martial Arts
1994	Beginning of the championships of the Russian Federation among young men. At the Department of Overcoming Obstacles and Hand-to-Hand Combat of the Military Institute of Physical Training, active work began on the scientific and methodological substantiation of the system for training athletes and improving the rules of competitions (S.M. Ashkinazi)
1995	Creation of the all-Russian public organization «Federation of Army Hand-to-Hand Combat of Russia»
2007-2016	Organizational development of the children's and youth AHHC
2016	Creation of the «Sports Federation of Army Hand-to-Hand Combat of Russia»

**Table 2.** *Trends in the development of the regulatory framework for the AHHC*

The years	Regulations
1993-1996	Inclusion of the AHHC in the military sports classification
1997 -2000	Inclusion of the AHHC in the Unified All-Russian Sports Classification
1998	In accordance with Federal Law No. 53-FZ of March 28, 1998, as an element of voluntary training of young people for military service, AHHC was developed among civilian youth
2007	Law No. 329-FZ of December 4, 2007 "On Physical Culture and Sports in the Russian Federation" complicated the further development of AHHC in Russia by defining the departmental status of AHHC and the specifics of the functioning of sports federations
2009	In accordance with Decree of the Government of the Russian Federation of August 20, 2009 No. 695, AHHC is actively developing among military personnel
2012	Decree of the President of the Russian Federation No. 604 of May 5, 2012 contributed to the development of a set of measures to develop AHHC among citizens of military age
2013	Adoption of norm 27 of the order of the Minister of Defense No. 555 of 14.08. 2013 «On the clothing provision of the Armed Forces of the Russian Federation in peacetime» provided each conscript with a sports uniform
2015	Development, justification of category norms and requirements for the assignment of sports categories (titles), clarification of the conditions and rules for holding competitions in military-applied sports (exercises) of the Unified All-Russian Sports Classification 2018-2021.

An analysis of the trends in the geographical expansion of the AHHC in the regions of Russia shows: if in 2001, when the All-Russian Public Organization Federation of Hand-to-Hand Combat was registered, representatives of about 52 regions of Russia confirmed their participation in its work, today 63 regional federations have already been created in all federal districts of Russia.

At the same time, army hand-to-hand combat is gaining popularity among young men, pre-conscription and civilian youth. Until 1994, AHHC had the status of a military-applied sport, being part of the training program for military personnel in hand-to-hand combat classes. In this regard, it was cultivated only in army units. The wide popularity and increased in-

terest not only of athletes involved in various martial arts, but also of the younger generation led to the fact that since 1994 Russian championships in AHHC began to be held, in which young athletes took part, starting from 10 years old.

An analysis of such competitions makes it possible to talk about a trend towards improving tactics, increasing the speed and dynamics of the battle, increasing the spectacle of fights (due to the participation of athletes from various types of martial arts in competitions, their introduction of new techniques, increasing the functionality of athletes, increasing the number of shock and throwing techniques used in fights, knockouts and submissions).

Analysis of statistical data on the dynamics of



competitions, the number of athletes involved in this sport, allows us to speak about a contradictory trend towards the quantitative development of competitions and athletes representing AHHC in Russia. So, if until 2010 there was a steady increase in the number of athletes involved in AHHC in the country, reaching a peak of 500,000 people, then the opposite trend began to be traced towards a decrease in the number of athletes, who currently remain no more than 100,000 [1].

We are in solidarity with the point of view of S.M. Ashkinazi, A.I. Turkova, A.P. Chumlyakov, who believe that the negative dynamics emerged as a result of the 2007 Law No. 329-FZ "On Physical Culture and Sports in the Russian Federation", which determined the departmental status of the AHHC and the features of the functioning of sports federations.

All this led to a significant reduction in the number of athletes and organizations that developed AHHC, first of all, its "civilian" direction; to the concentration of the number of athletes and competitions mainly in the Armed Forces of the Russian Federation [1].

In our opinion, one of the significant reasons for the spread of the negative dynamics of the quantitative development of competitions and athletes representing AHHC in Russia is the influence of the trend towards increased competition for this sport from other types of martial arts, "pulling" potential athletes to themselves. Another reason, in our opinion, is the influence of the trend towards the outflow of schoolchildren of 7-13 years of age involved in AHHC in the second or third years of training, which is due to the inability to officially assign junior sports categories to athletes aged 7 to 14 years [3] (according to Unified All-Russian sports classification, the first sports categories in AHHC can be obtained from the age of 15). Since AHHC is one of the toughest martial arts, there is a lot of emphasis on equipment to protect fighters from injury. In this regard, from the beginning of the 80s of the last century until the 2020s, there has been a tendency to improve the equipment of athletes.

Connections. The conducted research allows us to state the inconsistency of the tendencies in the development of army hand-to-hand combat in Russia. On the one hand, there is a wide distribution and

recognition of AHHC in accordance with the development trends of the organizational, regulatory and legal framework of this sport; geographical expansion in the regions of Russia; development of AHHC among youths, pre-conscription and civilian youth; improving the equipment of athletes, tactics, increasing the speed and dynamics of the battle, increasing the entertainment of fights; quantitative development of competitions, athletes involved in AHHC; on the other hand, there are tendencies to increase the competition of AHHC from other types of martial arts and the outflow of children involved in AHHC.

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# Physical workability of students in the conditions of the mixed format of education in the discipline "physical culture and sport"

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Dr. Hab., Professor **Zh.B. Safonova**<sup>1</sup>  
PhD, Associate Professor **T.V. Koltoshova**<sup>1</sup>  
PhD, Associate Professor **I.N. Sheveleva**<sup>1</sup>  
PhD, Associate Professor **O.A. Melnikova**<sup>1</sup>  
<sup>1</sup>Omsk State Technical University, Omsk

Corresponding author: koltoshova@rambler.ru

## Abstract

**Objective of the study** was to identify the possibility of self-improvement of the physical performance of students during the period of the mixed format of mastering the discipline "Physical culture and sport".

**Methods and structure of the study.** 120 students (90 boys and 30 girls) of the 1st and 2nd courses took part in the experiment. The assessment of physical performance was carried out according to the step-test method modified by V.L. Karpman (1981), which makes it possible to use it in the "field" conditions.

During the period of the mixed mode of training (2020-2021), in order to increase physical performance during independent physical education, the maximum test was used, which includes eight physical exercises that ensure their consistent impact on all muscle groups.

**Results and conclusions.** The results of the experimental study made it possible to conclude that the maximum test, which includes eight physical exercises, provides a consistent effect on all muscle groups and allows you to optimize the load, according to the individual condition of the student.

During the period of the mixed format of mastering the discipline "Physical culture and sport" students at the university must include the most effective and accessible methods and means to improve physical performance.

**Keywords:** *students, physical performance, optimal load, self-study.*

**Introduction.** The study and evaluation of the physical performance of students are necessary, first of all, from the standpoint of a socio-hygienic approach based on medical and statistical indicators, pedagogical observations of philosophical and sociological understanding. The first is an assessment of physical condition; the second is an assessment of one's well-being, the desire to learn and be ready for work and the formation of healthy needs in life activity.

The issue proposed for discussion is not new, but this does not reduce its relevance, since, according to A.G. Shchedrina (2003), despite the positive social transformations, the problem of "health care, mass physical culture, and the health of the country's population is far from being resolved" [5].

The physical state is characterized by the degree of readiness of a person to perform muscular and labor

loads of a different nature in a given specific period of time, depending on the level of physical qualities and functional capabilities of individual body systems [3].

However, if we turn to the definition of the physical condition of a person, given by T.V. Khutiev et al. (1991), then its mandatory component, in addition to anthropometric indicators, are physiological parameters, including physical performance and exercise tolerance [4].

The definition of physical performance provides information about the "tolerant pulse", that is, the maximum heart rate allowed in the lesson. Without taking into account these fundamental provisions, motor activity is ineffective.

The transition to active individual design of physical activity, which increases the aerobic abilities of the individual, should be carried out through the optimi-



zation of students' motor activity with an emphasis on physical exercises of various directions in accordance with the functional capabilities of the individual.

**Objective of the study** was to identify the possibility of self-improvement of the physical performance of students during the period of the mixed format of mastering the discipline "Physical culture and sport".

**Methods and structure of the study.** 120 students (90 boys and 30 girls) of the 1st and 2nd courses took part in the experiment. The assessment of physical performance was carried out according to the

step-test method in the modification of Karpman V.L. (1981), which allows using it in "field" conditions [1].

During the period of the mixed mode of training (2020-2021), in order to increase physical performance during independent physical education, the maximum test was used, which includes eight physical exercises that ensure their consistent impact on all muscle groups [2].

The first exercise is for the shoulder girdle (jerk movements of the arms: 1 time bent at the elbows, 2 straight lines, counted at a time); the second - flexion-

**Table 1. Indicators of the maximum test among students**

Indicators	Youths (n-90) Girls (n-30)	The main medical group		
		I survey	II survey	p=0 (significance of differences)
Jerking hands	Y,	21±0,1	24±0,2	-
	G	18±0,8	21±1,1	< 0,05
Flexion and extension of the arms in the lying position	Y	18±0,8	21±0,6	< 0,05
	G	5±0,9	5±0,9	without change
Squats	Y	18±0,7	20±0,2	< 0,05
	G	16±0,6	17±0,6	without change
Bends back while sitting on a bench	Y	9±0,5	10±0,3	< 0,05
	G	9±0,5	9±0,4	without change
Raising straight legs in the starting position lying on your back	Y	12±0,9	14±0,7	< 0,05
	G	10±0,9	11±0,7	< 0,05
Step test (climbing the bench)	Y	17±0,6	21±1,2	< 0,05
	G	14±1,1	17±0,003	< 0,05
Raising the legs in the starting position lying on the stomach	Y	14±1,3	18±1,1	< 0,01
	G	15±1,1	17±0,03	< 0,05
Running in place heart rate difference	Y	48±0,5	48±0,7	without change
	G	42±0,5	46±0,7	> 0,05

**Table 2. Indicators of physical performance of students**

Indicators	1 2	Main group	
		Youths (n-90)	Girls (n-30)
Heart rate at rest, bpm	1	80±0,2	89±0,6
	2	78±0,4	80±0,4
	Po	<0,005	<0,005
Heart rate maximum, bpm	1	164±0,1	155±0,3
	2	148±0,3	140±0,6
	Po	<0,001	<0,005
PWC <sub>150</sub> , kgm/min	1	780±30	608±24
	2	969±24	720±15
	Po	<0,05	<0,05
VO <sub>2</sub> max absolute, l/min	1	3,4±0,2	2,8±0,1
	2	4±0,1	3,2±0,3
	Po	<0,005	<0,005
VO <sub>2</sub> max relative, ml/min/kg	1	41±8,2	40±14
	2	46±2,3	44±13
	Po	<0,05	<0,05
Heart rate at the 5th minute of recovery	1	102±0,4	110±0,4
	2	96±0,3	90±0,6
	Po	<0,001	<0,05

Note: 1 - before, 2 - after the experiment.



extension of the arms, in an emphasis lying down; the third - squats on the whole foot, arms forward; fourth - bending back, sitting on a bench, hands behind the head; fifth - raising the legs to a right angle from the ip. lying on your back; sixth - climbing on a bench 30 cm high; seventh - lifting straight legs from a prone position; eighth - running in place with a high hip lift. These are technically simple movements that do not require special training. Each exercise is performed the maximum number of times within 20 seconds with intervals between exercises of 30 seconds. The reaction to running is determined by the pulse before and after the load. The maximum number of exercises performed is divided by four and this determines the optimal number of repetitions individually for each student.

**Results of the study and their discussion.** Repeating this test after two weeks of regular classes will show their performance dynamics among students. In table. Figure 1 shows the results of the maximum test conducted by students after two weeks of its regular performance.

According to the WHO recommendations, physical culture and health-improving classes are held at the level of 70-85% of the maximum heart rate, which makes it possible to judge adaptation to the work performed (load) and the level of the functional state of the cardiovascular system.

Evidence of an increase in the functional capabilities of the cardiovascular system of students (boys and girls) who study independently according to the maximum test was a favorable and reliable ( $p < 0.05 - 0.001$ ) dynamics of physical performance indicators (Table 2). with a standard load (step test) indicates a reserve of the cardiorespiratory system, and hence the possibility of further increasing the number of repetitions of each of the eight exercises of the maximum test. adaptation of students to gradually increasing loads. At the same time, an increase in aerobic capacity should be noted, based on a significant ( $p < 0.05$ ) increase in the relative Maximum oxygen consumption ( $VO_2 \text{ max}$ ), which exceeded that before the start of classes.

**Conclusions.** The results of the experimental study made it possible to conclude that the maximum test, which includes eight physical exercises, provides a consistent effect on all muscle groups and allows you to optimize the load, according to the individual condition of the student.

During the period of the mixed format of mastering the discipline "Physical culture and sport" of students at the university, it is necessary to include the most effective and affordable methods and means to increase physical performance.

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# Prerequisites for the transition to the implementation of the blended learning model in the methodology of teaching physical culture in general educational organizations

UDC 377



Dr. Hab., Associate Professor **L.A. Akimova**<sup>1</sup>

PhD, Associate Professor **P.P. Thyssen**<sup>1</sup>

**R.R. Kalimullin**<sup>1</sup>

<sup>1</sup>Orenburg State Pedagogical University, Orenburg

Corresponding author: [lubovakimova@yandex.ru](mailto:lubovakimova@yandex.ru)

## Abstract

**Objective of the study** was to theoretically substantiate the socio-cultural, normative and pedagogical prerequisites for the introduction of the blended learning model into the methodology of teaching physical culture in educational institutions.

**Methods and structure of the study.** The work carried out: theoretical analysis of legal documents in the field of sports and health work and informatization of education; generalization of advanced pedagogical experience of safe implementation of offline and online tools in the practice of teaching physical culture; SWOT analysis.

**Results and conclusions.** Among the fundamental socio-cultural prerequisites for the transition to the implementation of the blended learning model in the teaching of physical culture in educational institutions, the phenomenon of technologization is singled out. The legal regulation of the protection of life and health of students with the use of a variable spectrum of the organization of physical culture and health work, physical education acts as normative prerequisites. The pedagogical prerequisites of the process under study are the renewal of the educational resources of physical culture based on innovative digital technologies, the development of variable forms of joint educational interaction for the development of the values of physical culture by the subjects of education.

**Keywords:** *blended learning, teaching methods, physical culture.*

**Introduction.** The relevance of the study is due to the impact of informatization of society on the education system, which significantly complements the realities of educational practices in raising a viable generation. In the context of a pandemic and the development of variable forms of organization of the educational process, it is necessary to update the methodology of teaching physical culture in a general educational organization based on blended learning as a significant factor in the improvement of children and youth, the formation of their life and educational success, optimal integration into society.

**Objective of the study** was to theoretically substantiate the socio-cultural, normative and pedagogical prerequisites for the introduction of the blended learning model into the methodology of teaching physical culture in educational institutions.

**Methods and structure of the study.** Within the framework of the study, the following was carried out: theoretical analysis of legal documents in the field of sports and recreation work and informatization of education; generalization of advanced pedagogical experience of safe implementation of offline and online means in the practice of teaching physical culture; SWOT analysis.

The study was carried out under the project "Methodology of teaching physical culture in a general education organization, taking into account the implementation of the blended learning model", which is implemented with the financial support of the Ministry of Education of the Russian Federation as part of the state assignment (additional agreements No. 073-0302021-044/1 dated 06.30. No. 073-0302021-044/2 dated July 21, 2021 to agree-



ment No. 073-0302021-044 dated January 18, 2021).

### **Results of the study and their discussion.**

Among the fundamental socio-cultural prerequisites for the transition to the implementation of the model of blended learning in the teaching of physical culture in educational institutions, the phenomenon of technologization is singled out, which is a trend in the lifestyle of modern society and a person, the leading means of implementing physical education in an unfavorable epidemiological situation, requiring a change in the content and organization of the educational process towards technology.

The content of the term "technologization" [3] most capaciously reflects the need of educational practice in building the educational process in physical culture in accordance with the technological cycle (within the academic year), which ensures completeness of the structural and content elements of blended learning. In this context, the technological chain of teaching physical culture can be represented as an algorithm of systemic actions of the teacher and students in the transition from one form of interaction to another.

Blended learning in the author's understanding can be the basic regulator of modern physical education of a person, providing a rational combination of information and educational resources of full-time (practice) and distance (theory) learning with elements of self-education. The phenomenon of technologization meaningfully focuses on determining the method of organizing interaction between the teacher, students and various sources of information, which in the semantic aspect is designed to minimize risks and increase the influence of positive factors of offline and online learning.

The normative prerequisites for the model of blended learning are the legal regulation of the protection of life and health of students using the variable spectrum of the organization of physical culture and health work, physical education.

The implementation of the blended learning model should be carried out in a safe combination of online (the theoretical aspect of expanding knowledge about the preservation and development of health, physical fitness in terms of physical, mental and social vectors) and offline (practical development of physical qualities, motor abilities, improvement of all types of physical culture and sports activities) formats that provide students with the acquisition of

skills and abilities of self-organization, self-management by physical improvement with an independent choice of the educational route, time, place and pace of learning to achieve academic and life success.

The pedagogical prerequisites of the process under study are the renewal of the educational resources of physical culture based on innovative digital technologies, the development of variable forms of joint educational interaction for the development of the values of physical culture by the subjects of education.

Updating the educational resources of physical culture based on innovative digital technologies enhances the range of strengths of the introduction and implementation of the blended learning model in the teaching of physical culture, which include the adequacy of the organization of physical education and upbringing to the realities of modern life; flexibility of the educational process; variability of traditional and innovative methods of pedagogical interaction; expanding the range of opportunities for professional development of teachers and communication of students; expansion of multimedia communication channels between the student and the teacher; implementation of individual educational trajectories of mastering physical culture (involvement of each student in the educational process); objectivity of control of educational results; stimulation of systematic independent work of students).

However, we should not forget about the weaknesses of the blended learning model, which include: the imperfection of the legislative framework for the implementation of electronic educational resources; insufficiency of electronic resources for teaching physical culture; low ICT competence of teachers.

The development of variable forms of pedagogical interaction in the context of blended learning focuses on minimizing the risks of its implementation in the teaching of physical culture, which involves:

- observance of the principles of consistency and synergy in the methodology of teaching physical culture, which are necessary for the digital transformation of physical education;
- the inclusion of new knowledge in the existing one and the construction of students' own knowledge;
- formation of long-term motivation of students for regular physical education;
- effective organization of the regime of work and rest;



- ensuring the safety and psychological comfort of the educational environment;
- increasing the satisfaction of students from remote forms of mastering the content of physical culture.

**Conclusions.** The effectiveness of blended learning in the methodology of teaching physical culture is possible on the basis of creative integration and the optimal ratio of offline realities of practical physical education classes and complementary online theoretical events of an educational nature with their focus on the safe transmission of physical culture values to students, raising their stable interest in regular classes physical culture and sports orientation.

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# Application of the blended learning model in teaching physical culture in school

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Dr. Hab., Associate Professor **E.M. Golikova**<sup>1</sup>  
PhD, Associate Professor **T.M. Pankratovich**<sup>1</sup>  
PhD, Associate Professor **V.Yu. Nefedova**<sup>1</sup>  
<sup>1</sup>Orenburg State Pedagogical University, Orenburg

Corresponding author: leon\_1205@mail.ru

## Abstract

**Objective of the study** was to scientifically substantiate the model of blended learning in teaching physical culture at school.

**Methods and structure of the study.** In the first part of the experiment, a questionnaire was developed and a survey of physical education teachers was conducted on the possibility of using information and telecommunication technologies for developing education. The survey involved 86 physical education teachers from 22 territories of the Orenburg region. The second part of the experimental work was connected with the selection of the most effective variants of physical education teaching models, taking into account the practice-oriented traditional education in combination with a self-organized distance format.

**Results and conclusions.** Studying the characteristics of digital platforms recommended for use in the educational process of the school, the most accessible and successive model is "blended learning". Based on the model characteristics of "blended learning" in the course of analysis and selection of effective tools that allow them to be introduced into the practice of teaching physical culture, a thematic plan for mastering the content of the program "Physical Education" was proposed, with consistent tracking of the result of mastering sections: knowledge component, independence and activity students.

**Keywords:** *blended learning model, characteristics of digital platforms, information and telecommunication technologies.*

**Introduction.** The modernization of general education is updated by the need to use information and telecommunication resources for developing education. At the same time, the models of "blended learning" are considered as a significant regulator in the education and training of school graduates for the formation of life and educational success, admission to professional educational institutions and optimal integration into society.

The introduction of information and telecommunication technologies of developing education into educational activities, as well as the modification of education itself, associated with inclusion, the emergence of a new coronavirus infection COVID-19, which broke into the lives of people around the world, has accelerated this process. New ap-

proaches to teaching schoolchildren involve the transition to independent work of students, including the subject of "Physical Education". Despite its positive aspects, the organization of independent physical activity is a complex pedagogical task that requires additional control by the teacher, since it is about maintaining and developing the health of students. Analysis of the proposed technologies for conducting physical education classes with the possibility of using blended learning models led to the search for the most effective educational resources and platforms. Using them in the practice of the lesson "Physical Education" will not reduce the practice-oriented content of the subject, but will strengthen it, freeing up time for the body-oriented development of students.



**Objective of the study** was to scientifically substantiate the model of blended learning in teaching physical culture at school.

**Methods and structure of the study.** Pedagogical development was carried out within the framework of the state task "Methodology of teaching physical culture in a general education organization, taking into account the implementation of the blended learning model", with the financial support of the Ministry of Education of the Russian Federation (additional agreements No. 0302021-044/2 dated July 21, 2021 to agreement No. 073-0302021-044 dated January 18, 2021).

In the first part of the experiment, a questionnaire was developed and a survey of physical education teachers was conducted on the possibility of using information and telecommunication technologies for developing education. The survey involved 86 physical education teachers from 22 territories of the Orenburg region. The questionnaire included 22 questions reflecting the following content: what information resources teachers use in their work, what material of the program "Physical Education" is offered to students for study, what pedagogical models and technologies are used in practice, etc.

The second part of the experimental work was connected with the selection of the most effective variants of physical education teaching models, taking into account the practice-oriented traditional education in combination with a self-organized distance format. Studying the characteristics of digital platforms recommended for use in the educational process of the school, the most accessible and successive model is "blended learning". Based on the model characteristics of "blended learning" in the course of analysis and selection of effective tools that allow them to be introduced into the practice of teaching physical culture, a thematic plan for mastering the content of the program "Physical Education" was proposed, with consistent tracking of the result of mastering sections: knowledge component, independence and activity students.

**Results of the study and their discussion.** The results of a survey of school teachers showed that 28% of teachers noted a weak material base (lack of a PC and software, video equipment), therefore, during the period of forced isolation and the use of distance learning, teachers mainly used the following educational information and telecommunication resources Zoom (84.4%), VKontakte (68.7%), E-mail

(97.2%) using telephone devices. Skype and Ya-class platforms (6.2%), Uchi.ru (12.5%), NES (1%), Classroom, Google-class, teacher's website, etc. were partially used [2]. It was revealed that (66%) note the poor development of software-content support (calendar-thematic and lesson planning) of the educational process in physical culture and the lack of educational and methodological materials on the use of blended learning and informative digital environment.

The second experimental block is connected with the introduction of the thematic plan into the practical work of educational organizations in the Orenburg region. The content of the plan includes sections of the program and topics in which the lesson is structurally specified, electronic educational resources are selected to help the teacher in preparing for the lesson, and the student to supplement and strengthen knowledge of physical education without reducing the time of the practical part of the lesson by the theoretical block.

The process of tracking the results achieved when introducing the blended learning model took into account the characteristics of universal competencies that are formed in students in the process of physical education classes when introducing the blended learning model. Additionally, indicators were developed (knowledge characteristics, independence and activity) of the formation of knowledge in the subject "Physical culture" and the development of the values of physical culture, which were checked in the frontal experiment. In the experiment, the model of blended learning "flipped classroom" was used. The results obtained before and after the experiment showed that in the main group the indicator of the knowledge component increased by 14%, while in the control group - by 4%; the results of independence and activity of students increased by 30% in the main group and by 4% in the control group.

**Conclusions.** The possibility and accessibility of using educational information resources in teaching the subject "Physical Education" allows you to present the material included in the thematic plan of the discipline in electronic form, which actualizes the creation of a model of blended learning "flipped classroom" in the practice of physical education of students.

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