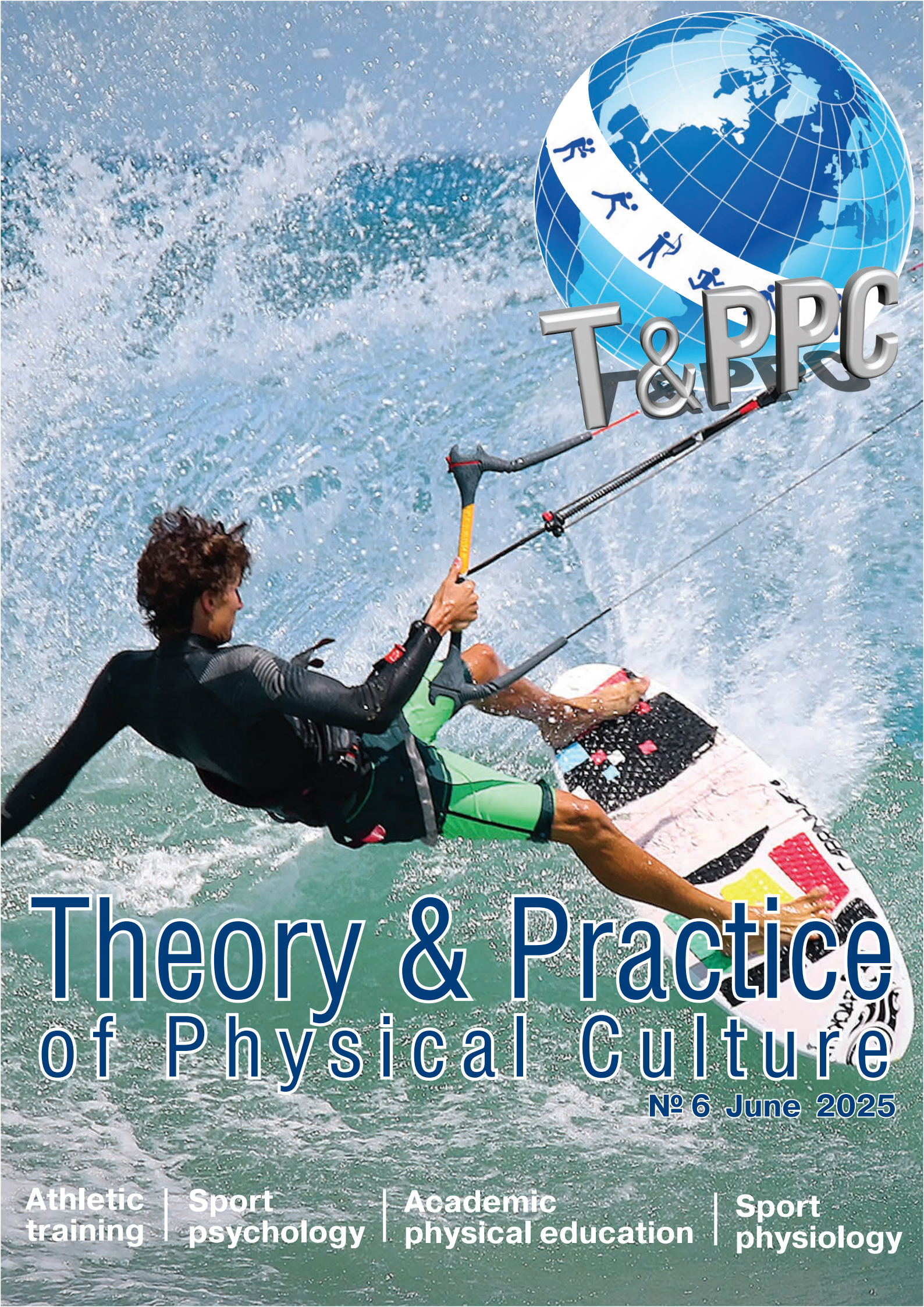

# Theory & Practice of Physical Culture

№ 6 June 2025

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

# Sports culture in the context of the category "National cultural code in sports"

At a meeting with journalists from the Moscow City News Agency, three–time Olympic champion Maria Kiselyova expressed the opinion that "sport is a national treasure, athletes are always representatives of their country, which should be reflected in all elements of sports life. For example, the colors of the national flag and the traditional ornaments in the national team's sports uniform are not just a design decision, but also an important marker, a demonstration of pride in their country. Thus, we are always a part of Russia. Sports shows and entertainment performances should also be a format where national cultures are manifested, reinterpreted in a creative form, and embodied by athletes." Summarizing what the Olympic champion said, we can conclude that sport and the related manifestation of culture should carry the national cultural code.

Currently, there is no generally accepted definition of "cultural code in sports." At the same time, referring to the philosophical understanding of this category, it is possible to form the boundaries of its conceptual field, combining values, traditions, rules and symbols that form the unique sports culture of the nation.

Sports culture, like no other, including physical culture, contains the greatest resource for personal reproduction. Physical culture has enough values that are vital for society and humans. However, its modern development is closely related to sports, and thus it is being rebuilt to a higher level, determined by the essence and dialectic of sports activities.

In our opinion, the sports culture of a personality is determined primarily by the degree of education, competence in the chosen sport, self-discipline and a sporty lifestyle, which determines the presence of a conscious need to use sports and physical training throughout life.

In the course of sports education, a young athlete develops a positive value attitude towards sports, he is an active participant in sports and competitive activities, during which he develops a special image of sports behavior, lifestyle, norms, symbols characteristic of the sports culture of the individual.

The basis of a person's sports culture is such a positive value attitude towards sports, in which the standards, values and cultural norms related to sports are internalized by a young athlete, i.e. they have become the property of his inner world.

The purposeful formation of sports culture consists of three fundamental processes: education, upbringing, and training, which are determined by the content of three components: cognitive, value-motivational, and operational.

Any code is primarily an informative system of conventional signs (symbols) organized according to the laws of its own syntax, therefore, code is a language. The code is a component unit of culture. According to the interpretation of modern scientists, culture is a hierarchically organized system of various codes that characterizes the worldview and the worldview of society.

Accordingly, the cultural code is a cultural language that has a certain meaning in a specific ethnic context in its chronotope. The national cultural code is the key to understanding the cultural worldview of a particular nation. According to this phenomenon, the cultural, the unconscious, that is, what is said and hidden from a person's understanding, manifests itself in his actions, norms, symbols, values.

Understanding sports culture in the context of the cultural code in sports implies considering sports activities not just as physical activity or competition, but as a complex system of values, norms and symbols that are shared and transmitted within a particular group or society. It is an important part of the cultural code that determines how people perceive, participate, and interact in a sporting environment.

Values are an important component of the cultural code. The cultural code in sports allows us to understand which values determine the socio-cultural role of sports in a particular country, and how they are expressed. A high level of sports culture is based on the team spirit, the athlete's desire for improvement, respect for the opponent, discipline and self-discipline, diligence, patriotism.

Deciphering the nation's sports cultural code makes it possible to determine society's attitude to sports: how does a nation treat victories and defeats, whether victory is valued at any cost or the process is important, the contribution of an athlete and fair play, and what standards of behavior are considered acceptable to athletes, coaches, and fans. The cultural approach allows sport to be considered as an instrument of national pride, a way of social integration.

Any national sports team has its own arsenal of logos, colors, and emblems identifying the country it represents. Sports culture values allow coaches, athletes, and fans to relate to a particular team, sport, nation, or community. Sports culture unites people of different ages, social strata and cultures, creating common interests and goals, and transmits values, norms and rules of conduct to other participants and future generations through sports symbols.

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

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

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Theory and Practice of Physical Culture

# Contents

# Formation of physical qualities in young basketball players

UDC 796.323:796.011.3

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**Abstract**

**Objective of the study** is to increase the physical fitness of basketball players aged 13-14 years at the initial stage of the general education training cycle.

**Methods and structure of the study.** The research involved 40 basketball players from the Dynamo Sports School in Moscow, who trained four times a week for 90 minutes. The pedagogical experiment, designed for the period from September 3 to December 3, 2024, included an assessment of physical qualities according to the following criteria: 30-meter run, 3x10-meter shuttle run, long jump, pull-ups, 6-minute distance run and forward tilt.

**Results and conclusions.** In the control group, after completion of the experiment, an increase in all tests was observed by 4-7%, but only in the 6-minute running test the increase reached a statistically significant level (1126±16 to 1182±14, $p<0.05$). The experimental group showed more significant progress, with an average increase in the range of 8-16% over the entire study period. Although the indicators in the forward bending and crossbar pull-up test increased (from 6.1±0.8 to 6.8±0.6 and from 9.1±1.8 to 9.8±1.5, respectively), no statistically significant differences could be identified ($p>0.05$).
If you perform a set of physical exercises aimed at developing physical qualities during basketball training sessions at the general preparatory stage of training with athletes aged 13-14, their performance will significantly improve. The solution of the hypothesis is confirmed by the results of scientific research.

***Keywords:*** *Keywords: physical fitness, basketball players, age 13-14 years, preparatory cycle, pedagogical experiment, assessment of physical qualities, growth of indicators, statistically significant level.*

**Introduction.** A current topic of our time is the low level of health of schoolchildren, this is due to many factors, but above all to the lack of physical activity, which causes spinal diseases and others [8, 9]. One of the effective means of physical inactivity is physical education or sports games, in particular basketball, which is one of the popular and exciting sports. Basketball helps to improve the physical fitness of children, develop strength, speed, endurance, flexibility and coordination skills [5, 7].

The level of development of physical qualities of basketball players is one of the most important factors on which the effectiveness of team and individual technical and tactical actions depends. No matter how technically and tactically competent a basketball player is, he will never achieve success without a good level of comprehensive physical fitness. A team in which the physical development of even one player does not meet modern basketball standards will not achieve success either [2, 6].

A favorable period for the development of most physical qualities is the age of 13-14 years [4, 10]. In this case, the main attention in developing strength should be focused on strengthening the muscle groups of the entire muscular system. It should be noted that children's strength should be developed by carefully using short-term dynamic strength stress. To develop speed, strive to maximize the pace of movement. To develop general endurance, use aerobic running for up to 30 minutes. Developing coordination of movement and flexibility at the stages of preliminary training creates the basis for successfully mastering

the technique of the sport [4, 10].

The annual training cycle assumes the presence of general and special preparatory stages of training. As a rule, at the general preparatory stage of training, exercises from general physical training prevail, however, in the standard basketball program at this stage, special basketball exercises are also present to an insignificant extent [2, 5-7].

Thus, in modern basketball, the requirements for the level of development of the physical qualities of athletes are constantly growing, so it is necessary to lay and develop these qualities from childhood and continue in adolescence.

**Objective of the study** is to increase the physical fitness of basketball players aged 13-14 years at the initial stage of the general education training cycle.

**Methods and structure of the study.** The pedagogical experiment involved 40 children aged 13-14 who attended the Dynamo basketball section. The pedagogical experiment was held from September 3 to December 3, 2024. After the primary data on the tests determining the level of development of the physical qualities of athletes were obtained, the athletes were differentiated into two groups of 20 people in such a way that the difference between the groups in all indicators of the studied physical qualities was not reliable. Both groups trained four times a week for 90 minutes. Children from the control group – CG trained according to the usual program for basketball players of sports schools, which provides for both the development of physical qualities and the performance of specific work in basketball [3]. Children in the experimental group EG performed different sets of physical exercises aimed at developing physical qualities. The sequence of performing sets of exercises during training was regulated by the recommendations of leading experts in the field of physical training of athletes [1]. At the beginning of the lesson, a warm-up of 10 minutes. Then, within 75 minutes, it was necessary to perform a set of exercises in a certain sequence:

1) development of speed of movement (repeated running on short segments of 10-15 m, shuttle run 2x10 m or 3x8 m, running in place for 10-15 sec, jerks from different starting positions);

2) coordination skills (forward and backward somersaults, jumping over a gymnastic goat, running between the posts, jumping over medicine balls, dribbling a ball between the posts);

3) strength qualities (there should be three approaches to each exercise. The exercises must be performed “to failure”, and rest between approaches is 60-100 sec. Bending and unbending the torso from a supine position, pull-ups from a hang on the bar, bending and unbending the arms in a prone position, bending with a partner on the shoulders, lying on the chest raising the arms and legs up, the plank exercise, squats);

4) general endurance (long but slow running without a ball or with a ball, alternating running and walking depending on how the athlete feels, recommended heart rate 130-155 beats/min);

5) flexibility (slowly perform exercises to stretch all muscle groups and increase the mobility potential of joints. Perform exercises from top to bottom from the neck muscles to the ankle joint).

After completing all exercises, sum up the results of the session (5 min).

At the beginning and end of the study, to determine the effectiveness of the technique, all athletes passed control tests: 30 m run, 3x10 m shuttle run, long jump, pull-ups on a horizontal bar, 6-minute test, forward bend [1, 11].

**Results and conclusions.** After the initial testing of all physical qualities, two training groups were formed in such a way that there were no reliable differences between them in all tests ($p>0.05$) (Table 1).

Table 1 shows that at the beginning of the pedagogical experiment, all the athletes’ indicators for all tests did not have reliable differences. However, after the end of the pedagogical experiment, changes occurred. The average results of children in the CG from the beginning to the end of the study are presented in Table 2.

*Table 1. Average results of both groups before the start of the study*

| Standard | KG (n=20) | EG (n=20) | p |
|---|---|---|---|
| 30m sprint (sec) | 5,6±0,5 | 5,8±0,6 | >0,05 |
| Shuttle run 3x10 m (s) | 9,0±0,8 | 9,1±0,6 | >0,05 |
| Standing long jump (cm) | 188±5,2 | 192±6,3 | >0,05 |
| Pull-ups on the bar (number of times) | 5,9±1,1 | 6,1±0,8 | >0,05 |
| 6 minute run (m) | 1126±16 | 1117±13 | >0,05 |
| Forward bend (cm) | 8,6±1,6 | 9,1±1,8 | >0,05 |

*Table 2. Comparison of results for the study period in the control group*

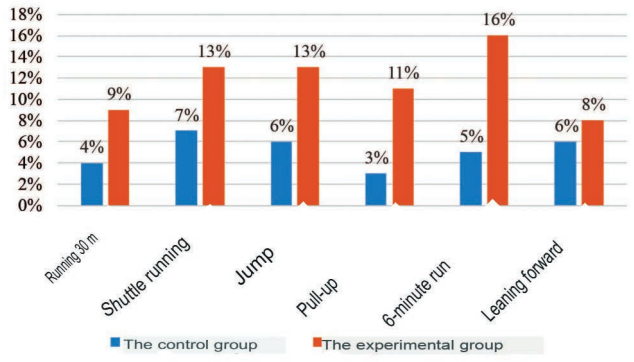
| Standard | Before the study | After research | p |
|---|---|---|---|
| 30 m sprint (sec) | 5,6±0,5 | 5,4±0,6 | >0,05 |
| Shuttle run 3x10 m (s) | 9,0±0,8 | 8,4±0,9 | >0,05 |
| Standing long jump (cm) | 188±5,2 | 199±7,3 | >0,05 |
| Pull-ups on the bar (number of times) | 5,9±1,1 | 6,1±0,9 | >0,05 |
| 6 minute run (m) | 1126±16 | 1182±14 | **<0,05** |
| Forward bend (cm) | 8,6±1,6 | 9,1±1,3 | >0,05 |

*Table 3. Comparison of results for the study period in the experimental group*

| Standard | Before the study | After research | p |
|---|---|---|---|
| 30 m sprint (sec) | 5,8±0,6 | 5,3±0,7 | <0,05 |
| Shuttle run 3x10 m (s) | 9,1±0,6 | 7,9±0,5 | <0,05 |
| Standing long jump (cm) | 192±6,3 | 216±7,1 | <0,05 |
| Pull-ups on the bar (number of times) | 6,1±0,8 | 6,8±0,6 | >0,05 |
| 6 minute run (m) | 1117±13 | 1295±16 | **<0,05** |
| Forward bend (cm) | 9,1±1,8 | 9,8±1,5 | >0,05 |

Table 2 shows that all average indicators of athletes from the control group improved during the study period, but reliable differences were observed only in the six-minute run test. In all likelihood, the traditional methodology of conducting classes in the basketball section contributes to the growth of endurance to a greater extent than other physical qualities. It is also possible that in this case the duration of the pedagogical experiment was insufficient. At the same time, the average data in the experimental group from the beginning to the end of the study are presented in Table 3.

Table 3 shows that almost all physical fitness indicators in the EG improved significantly from the beginning to the end of the pedagogical experiment. The increase in indicators was statistically insignificant only in the pull-up and forward bend tests. The increase in indicators in percentages for both groups from the beginning to the end of the study is shown in the figure.




*Increase in indicators of both groups during the experimental period*

The figure clearly shows the advantage of the EG over the CG in terms of the main physical qualities during the training period of three months. Such data allow us to assert that the use of the proposed means and methods for developing physical qualities at this age is effective for developing the physical qualities of 13-14 year old basketball players.

***Discussion.*** Having analyzed the state of the issue according to literary sources, it should be concluded that the content of the educational and training process of basketball players at the general preparatory stage in the preparatory period of the annual training cycle should be aimed less at the technique of performing a competitive exercise and tactics, and more at developing physical qualities [5, 6]. It has been proven that the age of 13-14 years is for the development of most physical qualities [4, 10]. Based on the analysis of the relevant literature, exercise complexes were compiled aimed at developing physical qualities, which were experimentally tested in previously conducted studies [2, 5-7].

The final testing showed that in the control group, the athletes did not achieve reliable changes ($p > 0.05$) in most indicators (except for the 6-minute run test). This may be due to the peculiarity of the standard program, the period of the study. As for the EG, the average indicator for each test significantly improved during the experiment, however, despite the high percentage increase in all indicators, the increase in indicators in the pull-up and forward bend test was still statistically insignificant. Thus, it can be argued that the selected means and methods have proven their

effectiveness in developing the physical fitness of 13-14-year-old basketball players at the general preparatory stage of training.

**Conclusion.** The effectiveness of using the standard program in the preparatory period of the annual training cycle for 13-14-year-old basketball players is confirmed by the research results obtained in the CG. On the other hand, when athletes from the EG performed a special set of physical exercises aimed at developing physical qualities, their indicators significantly and reliably improved in almost all tests. This speaks to the effectiveness of the developed means and methods for developing physical qualities.

**Conflict of interest.** *The authors declare that they have no conflict of interest.*

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# The specifics of the components of physical fitness in student wrestlers specializing in freestyle and Greco-Roman styles

UDC 796.82

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**Abstract**

**Objective of the study** is a comparative analysis of the physical fitness of student wrestlers engaged in freestyle and Greco-Roman wrestling.

**Methods and structure of the study.** The study involved 81 university-trained athletes specializing in wrestling. The group consisted of 47 Greco-Roman wrestlers (average age 17.5±2.4 years) and 34 freestyle wrestlers (average age 17.5±1.6 years). All participants were students studying at physical education and sports colleges and universities. The following methods were used to conduct the study: anthropometric measurements and bioimpedance analysis, as well as ergometric tests. In addition, the strength indicators of the muscles of the upper and lower extremities were assessed.

**Results and conclusions.** The analysis of anthropometric data and body composition revealed no significant differences between wrestlers of different styles. However, when assessing the anaerobic power of the arm muscles, Greco-Roman wrestlers showed significantly better results compared to freestyle wrestlers. This is due to the fact that in Greco-Roman wrestling, hand actions are more important, which affects the characteristics of their physical fitness and tactics. At the same time, despite the concession in the anaerobic power of the arm muscles, freestyle wrestlers demonstrate an advantage in most speed and strength characteristics. This reflects a wider range of techniques and a balanced development of physical qualities in athletes of this style.

***Keywords:*** *Greco-Roman wrestling, freestyle wrestling, physical condition, anaerobic and aerobic capabilities, strength, wrestlers, significant differences, anthropometry.*

**Introduction.** Wrestling places extremely high demands on the physical fitness of athletes. At the Olympic Games, men compete in two types of wrestling: freestyle and Greco-Roman. Freestyle wrestling allows techniques using both the upper and lower extremities, including leg holds, throws, and ground fighting. In Greco-Roman wrestling, leg holds and footwork are prohibited, and the emphasis is on throws and holds of the opponent's upper body. Wrestlers' bouts are characterized by short-term, high-intensity, and intermittent actions [4].

The specificity of the performance evaluation system, which involves the use of power techniques that can lead to an early end to the fight, makes anaerobic endurance a priority factor for success. The level of an athlete's physical fitness is highly correlated with the results of tests assessing endurance, arm strength, and trunk muscles, which play an important role in wrestling. Strength of both the upper and lower extremities is necessary for successful execution of offensive actions and countering the opponent's attacks in defense [3].

In the existing scientific literature, there is a shortage of studies devoted to comparing the level of physical fitness of athletes involved in different types of wrestling [1, 2].

**Objective of the study** is a comparative analysis of the physical fitness of student wrestlers engaged in freestyle and Greco-Roman wrestling. The study was based on the hypothesis that the features of these wrestling styles determine the differences in the physical fitness of wrestlers associated with the specifics of

the technique of performing techniques.

**Methods and structure of the study.** The experiment involved 81 student-athletes specializing in wrestling: 47 Greco-Roman wrestlers (average age 17.5±2.4 years) and 34 freestyle wrestlers (average age 17.5±1.6 years). All participants were students of physical education and sports colleges and universities. The athletes were tested after a day of rest. The testing procedure was carried out for all participants under the same conditions.

The following methods were used in the study: anthropometry (assessment of body length and weight) and bioimpedancemetry (determination of body composition, InBody analyzer), ergometric studies: determination of anaerobic power of the muscles of the upper and lower extremities (Wingat tests) on a hand and foot bicycle ergometer; determination of aerobic performance when working with arms and legs using a Cortex gas analyzer. To assess the strength capabilities of the upper and lower extremities, a Biodex System 4 Pro multi-joint dynamometer and a wrist dynamometer were used to determine the strength of the wrist. The speed-strength capabilities of the wrestlers' lower extremities were determined using jump tests: "from a squat (SJ)" and "with a squat (CMJ)", the ratio of the results of these jumps (CMJ/SJ) was calculated.

**Results and conclusions.** A comparative analysis of the morphological indicators and sports experience of wrestlers engaged in freestyle and Greco-Roman wrestling is presented in Table 1. The results of the data obtained did not allow us to identify statistically significant differences in the characteristics of wrestlers representing both wrestling styles.

When analyzing the data, it was found that at the statistical significance level of $p>0.05$, no reliable differences in the values of the indicators were found.

To assess the anaerobic performance of wrestlers, the Wingate test was used in the study for both the upper and lower extremities, with the resistance value for the upper extremities being 5.0% of body weight, and for the lower extremities – 7.5% of body weight.

*Table 1. Morphological indicators and experience of wrestlers in the studied samples by wrestling styles (X±δ)*

| Indicators | Freestyle wrestling | Greco-Roman Wrestling | p-value |
|---|---|---|---|
| Age | 17,5±2,4 | 17,5±1,6 | 0,93 |
| Body length (cm) | 169±9,5 | 170±8,8 | 0,42 |
| Body weight (kg) | 66,7±12,4 | 70,2±14,9 | 0,38 |
| % Fat mass | 13,2±3,5 | 14,3±4,6 | 0,15 |
| % Lean Mass | 61,3±9,6 | 60,5±11,2 | 0,59 |
| Body mass index | 24,7±1,8 | 25,8±3,7 | 0,12 |
| Training experience (years) | 6,3±1,8 | 6,4±1,5 | 0,36 |

*Table 2. Comparison of the performance of the muscles of the upper and lower extremities of wrestlers of different wrestling styles in the anaerobic mode (x±δ)*

| Indicators | Freestyle wrestling | Greco-Roman Wrestling | p-value |
|---|---|---|---|
| Lower limb muscle performance in anaerobic mode | | | |
| Maximum power of legs (W) | 606±50 | 712±70 | 0,77 |
| Maximum relative power of legs (W/kg) | 9,9±1,0 | 10,8±1,1 | 0,63 |
| Average leg power (W) | 522±62 | 573±56 | 0,23 |
| Average relative power of legs (W/kg) | 8,5±0,8 | 8,6±0,6 | 0,88 |
| Time to reach max.power (s) | 9,2±2,1 | 7,8±2,1 | 0,21 |
| % power drop, % | 29,2±7,8 | 37,6±14,0 | 0,11 |
| Upper limb muscle performance in anaerobic mode | | | |
| Maximum Hand Power (W) | 366±112 | 437±125 | 0,39 |
| Maximum relative power of arms (W/kg) | 6,0±0,9 | 6,5±0,7 | 0,02* |
| Average hand power (W) | 312±80 | 360±79 | 0,01* |
| Average relative power of arms (W/kg) | 5,1±0,7 | 5,4±0,6 | 0,51 |
| Time to reach max.power (s) | 15,0±3,8 | 12,4±4,2 | 0,05* |
| % power drop, % | 18,4±7,4 | 24,5±8,6 | 0,03* |

** - presence of reliable differences in indicators between groups of wrestlers by wrestling style (at p< 0.05).*

*Table 3. Comparison of the performance of the muscles of the upper and lower limbs of wrestlers of different wrestling styles in aerobic mode (x ± δ)*

| Indicators | Freestyle wrestling | Greco-Roman Wrestling | p-value |
|---|---|---|---|
| Lower limb muscle performance in aerobic mode | | | |
| Power on AnP (W) | 187,5±30,6 | 200,5±33,8 | 0,48 |
| Relative power on AnP (W/kg) | 2,7±0,2 | 2,4±0,4 | 0,30 |
| HR on AnP (bpm) | 150,6±14,4 | 158,5±17,6 | 0,31 |
| Relative oxygen consumption at AP (ml/min/kg) | 36,1±4,8 | 35,9±4,7 | 0,93 |
| Power per MPC (W) | 281,3±48,4 | 263,1±43,8 | 0,52 |
| Relative power at MPC (W/kg) | 4,0±0,6 | 3,4±0,6 | 0,08 |
| HR at $VO_{2max}$ (bpm) | 174,6±16,6 | 181,8±12,3 | 0,40 |
| Relative oxygen consumption at failure (ml/min/kg) | 47,4±3,2 | 47,7±7,7 | 0,85 |
| Lower limb muscle performance in aerobic mode | | | |
| Power on AnP (W) | 108,3±18,3 | 117,8±19,7 | 0,30 |
| Relative power on AnP (W/kg) | 1,7±0,2 | 1,7±0,3 | 0,97 |
| HR on AnP (bpm) | 160,5±10,8 | 159,0±9,2 | 0,77 |
| Relative oxygen consumption at AP (ml/min/kg) | 32,1±0,7 | 33,3±0,6 | 0,64 |
| Power per MPC (W) | 150,0±27,6 | 165,7±23,9 | 0,24 |
| Relative power at MPC (Вт/кг) | 2,5±0,4 | 2,5±0,2 | 0,95 |
| HR at $VO_{2max}$ (bpm) | 181,5±10,5 | 183,4±10,1 | 0,69 |
| Relative oxygen consumption at failure (ml/min/kg) | 40,5±7,5 | 43,8±5,4 | 0,07 |

*Table 4. Comparison of indicators characterizing the speed-strength abilities of wrestlers of different styles (x±δ)*

| Indicators | | Freestyle wrestling | Greco-Roman Wrestling | p-value |
|---|---|---|---|---|
| Assessment of cardiovascular system using a multi-joint dynamometer | | | | |
| Muscles of the anterior thigh | Mmax (Н*м) | 302,0 ± 78,5 | 318,8 ± 91,5 | 0,42 |
| | Motn. (N*m/kg) | 3,74 ± 0,49 | 3,91 ± 0,64 | 0,69 |
| | K | 0,98 ± 0,58 | 0,72 ± 0,26 | 0,22 |
| muscles of the anterior thigh | Mmax (Н*м) | 77,0 ± 16,3 | 85,9 ± 26,2 | 0,29 |
| | Motn. (N*m/kg) | 0,98 ± 0,13 | 1,05 ± 0,19 | 0,16 |
| | K | 1,08 ± 0,31 | 0,88 ± 0,26 | 0,04* |
| Jump test | | | | |
| SJ squat jump height m | | 0,26 ± 0,03 | 0,28 ± 0,04 | 0,43 |
| CMJ squat jump height m | | 0,27 ± 0,03 | 0,30 ± 0,04 | 0,12 |
| CMJ/SJ ratio | | 1,06 ± 0,10 | 1,07 ± 0,07 | 0,88 |
| Hand dynamometry | right | 44, 9± 7,9 | 52,1 ± 7,4 | 0,34 |
| left | 40,4 ± 6,2 | 45,5 ± 6,6 | 0,27 | |
| 10 m dash (sec) | | 1,85 ± 0,1 | 1,74 ± 0,1 | 0,01* |
| 30 m sprint (sec) | | 4,30 ± 0,3 | 4,39 ± 0,2 | 0,05* |
| Seated Forward Bend (cm) | | 31,3±6,8 | 26±5,3 | 0,01* |

** – presence of reliable differences in indicators between groups of wrestlers by wrestling styles (at p<0.05).*

The results of the comparative analysis of the performance indicators of the upper and lower extremities in athletes in the anaerobic mode, engaged in freestyle and Greco-Roman wrestling, are presented in Table 2.

The results of the statistical analysis presented in Table 2 indicate the presence of reliable differences (p<0.05) in favor of Greco-Roman wrestlers in terms of maximum relative arm power (W/kg), average arm power (W), time to reach maximum power (s), and the percentage of power drop (W/kg).

At the same time, the data analysis revealed statistically significant differences in the anaerobic performance of the arms of Greco-Roman and freestyle wrestlers. At the same time, the anaerobic performance of the legs was approximately equal (Table 2).

The study showed that athletes involved in Greco-Roman wrestling demonstrate a higher level of anaerobic performance of the upper limbs compared to freestyle wrestlers. The difference is 19.4% in the maximum glycolytic power of the arm muscles (W),

8.3% in the relative maximum glycolytic power of the arm muscles, and 33.1% drop in power during the test. This is probably due to the specifics of the training process and competitive conditions in Greco-Roman wrestling, which involves performing dynamic movements (lifts, throws, resistance to the opponent) with the active use of the strength of the upper limbs. Thus, the obtained results allow us to conclude that a higher level of physical fitness of the upper limbs in Greco-Roman wrestlers is not just a necessary condition, but also the result of many years of practicing technical and tactical elements during the training process.

A high level of aerobic indicators can play a key role in the successful performance of wrestlers, since it allows the athlete to maintain a high intensity of wrestling throughout the entire match and effectively recover during the break between periods.

Table 3 presents the results of a comparative analysis of the aerobic performance of the muscles of the lower and upper limbs of wrestlers of different styles.

The obtained data characterizing the performance of the muscles of the upper and lower extremities of wrestlers of different wrestling styles in the aerobic mode did not show reliable differences between the groups, only one trend was recorded for the indicator of relative power when refusing to perform leg work during the test and the indicator of maximum oxygen consumption when working with the hands.

The assessment of speed-strength indicators was carried out using a wrist dynamometer and a multi-joint dynamometer from a static position. The indicators of maximum strength of the muscles of the anterior thigh and muscles of the anterior shoulder were assessed (Table 4). Pedagogical tests in 10 and 30 m running and a jump test were also carried out using the AMTI strain gauge platform. The results of the study (Table 4) show that athletes specializing in Greco-Roman wrestling demonstrate statistically significant superiority in terms of 10-meter running time, the coefficient "K", which characterizes the ratio of the gradient of the moment of force to the maximum manifested moment of force and flexibility compared to representatives of freestyle ($p<0.05$).

Significant differences were found in such parameters as 10 and 30 m running time and flexibility indices (Table 4). Statistical analysis showed that Greco-Roman wrestlers have a higher speed (by 6.3%) of the studied index in the 10 m run test than freestyle wrestlers. At the same time, freestyle wrestlers demonstrate higher flexibility (by 11.8%). The results of the analysis indicate that the most significant differences between the styles are observed in the indices of relative maximum glycolytic performance of arm muscles (W/kg), 10 and 30 m running time and flexibility.

**Conclusions.** Freestyle and Greco-Roman wrestlers have similar anthropometric characteristics, including body length, body weight, percentage of fat tissue, muscle mass and body mass index. Their level of athletic skill is also equal. However, Greco-Roman wrestlers have a more developed upper limb performance in the anaerobic mode than freestyle wrestlers. This is due to the specifics of the Greco-Roman wrestling technique, which involves performing dynamic movements: lifting, throwing and countering the opponent. Such actions require significant efforts from the upper limbs. It is important to note that all techniques in Greco-Roman wrestling are performed mainly with the help of the upper limbs both during competitions and during the training process. The data obtained should be used when planning the training process, taking into account the features of the limiting factors of the physical fitness structures of wrestlers of different wrestling styles when implementing a model-target approach to training athletes. This approach can also be used in other types of martial arts.

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# The results of a pedagogical experiment aimed at improving overall endurance in football during the training period

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**Abstract**

**Objective of the study** is to improve the methodology for developing the general endurance of football players using high-intensity interval training.

**Methods and structure of the study.** The experimental study was carried out on the basis of the State Budgetary Institution of Additional Education "Sports School of Olympic Reserve No. 19 named after B. Kabargin" in the conditions of the training process. Direct participants of the pedagogical experiment were 20 young football players aged 13-14 years at the training stage of preparation in the sports school, 10 of whom were included in the experimental group and 10 players in the control group. Complexes of high-intensity interval training were developed, aimed at increasing the aerobic performance of the athletes' body and in their content represented high-intensity exercises that alternated with various variations of rest.

**Results and conclusions.** It was established that the use of the proposed sets of exercises in the training sessions of football players led to positive changes in a number of endurance indicators in the experimental group. The positive dynamics of the parameters of general endurance was especially clearly observed in specific tests for football players of this age period.

***Keywords:*** *football, physical training, endurance development, high-intensity interval training.*

**Introduction.** In modern world football, which is characterized by a high density and intensity of play with a large number of single combats, the success of competitive activity is determined by the high level of comprehensive training of athletes. During the match, a football player performs a variety of technical and tactical actions, the quality of which depends on the level of special performance. Often in the game, goals are scored in the last minutes of the match or in extra time, which indicates a loss of concentration and the onset of premature fatigue. In these circumstances, one of the important qualities in football should include general endurance, which is the foundation for the successful implementation of technical actions of players.

However, it should be noted that in sports schools, for the development and improvement of aerobic endurance, coaches mainly use methods of continuous exposure in moderate-intensity exercises, which does not fully reveal and optimize the adaptive mechanisms of the body.

In these circumstances, the search for new variable ways to improve the effectiveness of the methodology for developing general endurance in football is an urgent problem. The gaps that have arisen at present can be resolved only with a qualitative transformation of the structure and content of the training process and its intensification. The most promising direction, in our opinion, in this aspect is the technology of constructing the training process for football players using high-intensity interval training, which is characterized by short repetitive series of intensive tasks alternating with recovery periods of low intensity or passive rest, contributing to the diversity and variability of the load.

**Objective of the study** is to improve the methodology for developing the general endurance of football players using high-intensity interval training.

**Methods and structure of the study.** The experimental study was carried out from September 2023 to May 2024 at the State Budgetary Institution of Additional Education of the Rostov Region "Olympic Reserve Sports School No. 19 named after B. Kabargin".

The experiment was aimed at testing the effectiveness of the developed high-intensity exercise complexes aimed at improving the overall endurance of 13-14 year old football players. In order to determine the content of training sessions for the football players participating in the study, pedagogical observations were conducted. A total of 8 training sessions were analyzed in groups of young athletes at the State Budgetary Institution of Additional Education "Olympic Reserve Sports School No. 19 named after B. Kabargin".

During the observation, it was established that to solve the problems of physical training, the sports school coaches use traditional means with an emphasis on technical and tactical training, which is allocated about 70% of the total training time. Basically, this is the improvement of technical elements in football using specially preparatory and selected competitive exercises (passes, "squares", shots on goal, game combinations, etc.). The rest of the time (20%) was allocated to other types of training.

It was revealed that the content of general physical training includes strength exercises using the repeated method (push-ups, squats, bending and unbending the body, etc.). In the training process as part of special physical training, tasks on the coordination ladder, jerks, accelerations, shuttle running are used.

As a result of observations, it was also established that only long-term running exercises of moderate intensity at the beginning of training along the perimeter of the field (10-15 minutes) are used to develop general (aerobic) endurance.

In addition, the results of testing the level of general endurance according to the main parameters in groups of young football players aged 13-14 years showed a low level of its development (Table 1).

Based on the analysis of scientific and methodological literature, state educational programs and the standard for the sport of "Football", we have developed complexes of high-intensity interval training aimed at improving the overall endurance of young football players. When compiling microcycles, the preparation period, age and anatomical and physiological characteristics of those involved were taken into account.

Experimental training was aimed at increasing the aerobic performance of the athletes' body and, in terms of its content, represented high-intensity exercises that alternated with various variations of rest. The increased intensity of the tasks ensured the work of physiological systems to work above the threshold values of a submaximal and maximum nature.

In addition, the presented complexes provided for the modeling of game situations of football players, in which there are alternating short-term stresses. The tasks were planned with an increase in the volume of impacts at a higher intensity due to the partial restoration of metabolic mechanisms in adjustable intervals of passive or active rest. The developed high-intensity interval training complexes used exercises with and without a ball, as well as strength-oriented tasks with the global participation of all muscle groups. The exercises were included in the preparatory and main parts of the classes, depending on the focus.

To test the effectiveness of the developed tools, a pedagogical experiment was carried out over a six-month period, during which the control group (n=10) studied according to the generally accepted training program approved in the sports school, and the content of the training sessions of the experimental group (n=10) included specially developed complexes of high-intensity interval exercises aimed at improving the overall endurance of 13-14 year old football players.

Specially selected physical training tools in the training sessions in the experimental group were used in the main part of the classes. As a result of the final

***Table 1.*** *Level of development of general endurance of football players aged 13-14 in specific and non-specific tests*

| Tests | Unit of measurement | Average result in the group (n=20) | State of the art |
|---|---|---|---|
| Cooper test | м | 2155,3 | short |
| Harvard Step Test | ИГСТ | 58,8 | short |
| «Bansgbo» | м | 2263,4 | average |
| «Yo-yo» | м | 1778,9 | short |
| «Hoff» | м | 1567,2 | short |

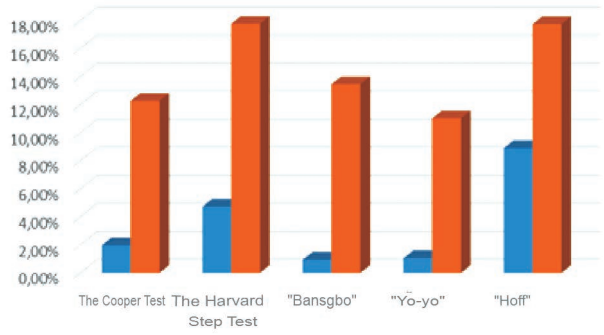
***Table 2.*** *Indicators of the level of development of general endurance in groups of football players aged 13-14 years during the pedagogical experiment*

| Тест | КГ до эксп. (n=10) | КГ после эксп. (n=10) | КГ прирост показателей (%) | ЭГ до эксп. (n=10) | ЭГ после эксп. (n=10) | ЭГ прирост показателей (%) |
|---|---|---|---|---|---|---|
| Неспецифические тесты | | | | | | |
| Тест Купера (м) | 2055,7 | 2096,6 | 1,98% | 2106,7 | 2365,2 | 12,27% |
| Гарвардский степ-тест | 57,1 | 59,8 | 4,72% | 60,8 | 71,6 | 17,76% |
| Специфические тесты | | | | | | |
| «Бансгбо» (м) | 2121,2 | 2141, 5 | 0,95% | 2214,4 | 2512,5 | 13,46% |
| «Йо-йо» (м) | 1738,3 | 1756,6 | 1,05% | 1698,3 | 1885,5 | 11,02% |
| «Хофф» (м) | 1507,1 | 1641,3 | 8,9% | 1567,5 | 1845,6 | 17,74% |

testing at the end of the pedagogical experiment, data were obtained that were processed using mathematical and statistical methods.

**Results and conclusions.** It was found that the use of the proposed exercise complexes in the training sessions of football players led to positive changes in a number of endurance indicators in the experimental group. The positive dynamics of the parameters of general endurance was especially clearly observed in specific tests for football players of this age period (Table 2).

As a result of the final testing, the advantage of young football players from the experimental group over their classmates from the control group was seen in all indicators of overall endurance, which confirmed the hypothesis of the study (see figure).




*Increase in indicators (%) of general endurance in football players aged 13-14 years at the end of the experiment*

**Conclusions.** In the presented study, based on the data obtained at the end of the experiment, the effectiveness of the developed means in the process of physical training of young football players was proven. It was found that the use of high-intensity exercises and special game tasks in the training process had a positive effect on endurance indicators. The results of the final testing showed a significant increase in the level of endurance development in 13-14 year old players of the experimental group, both in specific and non-specific tests.

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# High-performance sports and women's health in cyclical sports

UDC 796

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**Abstract**

**Objective of study** was to explore the health status of women in cyclical sports (short and long-distance running, cross-country skiing, speed skating, swimming), highly qualified athletes – "master of sports" and "master of sports of international class", who regularly participate in competitions in the Republic of Bashkortostan and Russia and have no income other than wages a member of a sports club, a scholarship from the Federal Agency for Physical Culture and Sports of the Russian Federation or the Ministry of Physical Culture and Sports of the Republic of Bashkortostan.

**Methods and structure of the study.** An in-depth medical and clinical and functional examination of 33 women of the main and 49 women of the control groups was conducted on the basis of the Republican Medical and Physical Education Dispensary of the Republic of Bashkortostan. The health status of women aged 19-28 years, with 3-5 years of experience in the national team of the Republic of Bashkortostan, was studied.

**Results and conclusions.** There were no statistically significant differences in the overall prevalence of chronic noncommunicable diseases in 33 high–class athletes and 49 women in the control group, 87.8 cases per 100 examined were among cyclical sports athletes, and 55.1 cases per 100 examined in the control group.

***Keywords:*** *professional sports, women's sports, increased training loads, gender role stereotype.*

**Introduction.** Since ancient times, there has been a gender stereotype about the "limited capabilities of the weaker sex". Today, there is no doubt that modern life has determined the need for women to increase their level of self-importance and free self-realization. Accordingly, modern women have a need to change their social status, which ultimately led to women's participation in various types of professional sports. The development of professional women's sports has brought women to the most typically "male" sports. Hockey, football, various types of martial arts – women have achieved great success in all of these sports. In Russian billiards, women compete very successfully in the fight with men. The beautiful half of humanity is engaged in those sports in which they have an interest and natural abilities. All this reflects the changes in modern society towards gender equality [1].

Many authors cite data on the positive effect of high sports loads on the body of women, if their health is monitored in a timely manner. According to M.G. Tkachuk, physical activity contributes to comprehensive development, improves performance and well-being. Regular training improves the psychological state, reduces the possibility of developing depressive states and anxiety levels, increases self-esteem and tolerance to stressful effects [6].

Research by M. Aberg has shown a relationship between the cardiovascular system and a high level of intelligence, good academic performance in educational institutions [7]. E.N. Kurganova and M. Klonovskaya note that systematic physical exercise

can improve not only a person's physical abilities, but also his intellectual abilities, making him more successful in his profession. Thus, physical exercise has a multifunctional effect on the body and is a trigger that mobilizes positive reactions of all organs and systems of the body [2, 4].

Sociological studies by L.I. Lubysheva allow us to assert that "sports, regardless of their focus, cultivate such personality traits in sportswomen as confidence, discipline, responsibility, persistence, which enrich their life experience without distorting the expression and feeling of their femininity, which serves as an additional argument in favor of awareness and overcoming gender stereotypes in society" [5].

There are many examples of women athletes who successfully built their sports careers, and their subsequent fate turned out well. Nevertheless, everything depends on whether a woman does sports for pleasure and maintaining an ideal shape, or whether we are talking about professional sports with its grueling training and injuries. Any, even the most feminine sport, in its professional version, cannot always be considered healthy [3].

Women's professional sports are actively developing, training loads are steadily increasing, competition among women athletes is growing. The article presents scientific research on the negative impact of high-performance sports on the female body, figure, psyche, behavior, reproductive function, family relationships and personal life.

Objective of study is to assess the health of women involved in cyclic sports.

**Methods and structure of the study.** An in-depth medical and clinical-functional examination of 33 women in the main group and 49 women in the control group was conducted at the Republican Medical and Physical Culture Dispensary of the Republic of Bashkortostan. The health of women aged 18-28 years, with 3-5 years of experience in the national team of the Republic of Bashkortostan, was studied. The comparison group, consisting of 49 women of the same age (18-28 years), was formed from amateur athletes who do not have high sports titles, students and graduates of the coaching and teaching faculty of the State Educational Institution of Higher Professional Education "Bashkir Institute of Physical Culture", professionally working in the field of physical culture.

**Results and conclusions.** Based on the results of the in-depth medical examination, 87.8 cases of chronic non-communicable diseases were identified in elite female athletes in cyclic sports per 100 examined, and 55.1 cases per 100 examined in the control group (see table).

Musculoskeletal diseases in women in cyclic sports occurred in 30.3% (10 out of 33) of those examined and were mainly represented by chronic inflammatory-degenerative processes of muscle, bone tissue and ligamentous apparatus due to overexertion, arthrosis and arthritis of the knee joint - in 9.1% (3 people) of athletes; tendovaginitis - 3.0% (1 person) of athletes; Osgood-Schlatter syndrome (osteochondropathy of the tibial tuberosity) was determined in 3.0% (1 person) of athletes.

9.1% of athletes had osteochondrosis in the form of degenerative-dystrophic lesions of the thoracic and lumbar spine. Peripheral nervous system diseases were found in 3.0% of athletes and were represented by lumbosacral radiculitis and lumbago.

The same place among all chronic diseases in female athletes was occupied by deviations from the central nervous system, represented by neurocirculatory dystonia, neuroses and neurasthenia, the share of which was 30.3% (10 people). Neurocirculatory dystonia of the hypertensive type was determined in 6 athletes (18.2 cases per 100 osm.). In the comparison group among women amateur athletes of the same age category, similar changes were found in 6 out of 49 people (12.2 cases per 100 osm.). Comparison of the obtained results of chronic morbidity of high-class athletes with the control

*Prevalence of chronic non-communicable diseases in elite female athletes in cyclic sports, cases per 100 examined*

| Sports | Number of surveyed | Morbidity (total) | CMS and PNS | CNS | OD | MPS | OP | Others |
|---|---|---|---|---|---|---|---|---|
| Cyclic | 33 | 87,8 | 30,3 | 30,3 | 9,1 | 9,1 | 3,0 | 6,0 |

*Disease designations: musculoskeletal (MBS), peripheral nervous system (PNS), central nervous system (CNS), respiratory system (RS), genitourinary system (UGS).*

group did not reveal statistically significant differences.

No pronounced clinical forms of circulatory system diseases were found during the in-depth medical examination, however, 6 athletes (18.2 cases per 100 osm.) had such changes in the electrocardiogram (ECG) as signs of autonomic instability in the form of sinus arrhythmia, incomplete right bundle branch block, intraventricular and intraatrial conduction disorders, repolarization processes, and metabolic processes in the myocardium. In the control group, such changes were found in 7 out of 49 people (14.3 cases per 100 osm.). These indicators did not show statistically significant differences when compared with the group of elite athletes. The studies did not reveal any significant difference in the health of elite athletes in cyclic sports with 3-5 years of experience in high-performance sports and women in the control group of the same age. Nevertheless, based on the results of the in-depth medical examination, four athletes of the main group were released from sports due to their health conditions and sent for further recovery and rehabilitation in order to prevent more serious pathologies of the central nervous system, peripheral nervous system and cardiovascular system.

The obtained research results indicate, first of all, the ambiguous influence of professional sports activities on the general health and body of women, which necessitates further research in this area.

**Conclusions.** Increased training loads in women of cyclic sports with 3-5 years of experience in high-performance sports can cause functional disorders of the nervous and cardiovascular systems. At the same time, moderate physical activity can improve not only a person's physical abilities, but also his intellectual abilities. Sports, regardless of its focus, cultivate such personality traits in athletes as confidence, discipline, responsibility, perseverance, which enrich their life experience. Women who have high physical and mental capabilities can engage in sports activities, but must undergo mandatory monitoring of the physical condition of the body.

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# A study of the relationship between physical fitness, physical and psychological development and their impact on the level of special training among seven-year-old hockey players

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**Abstract**

**Objective of the study** is to identify the relationship between indicators of physical fitness, physical and psychological development and manifestations of special fitness in hockey players aged seven.

**Methods and structure of the study.** 27 young hockey players took part in the experiment: the average age was 7.1±0.22 years; the training experience was 2.3±0.22 years; the average weekly training volume was 11.6±2.5 hours. The following body sizes and proportions were studied; variable components of body weight; abilities: psychomotor, cognitive and motor (30 m sprint; 3x10 m shuttle run; 3x10 m alternating running (regular, side-by-side, back-to-back); long jump from a standing position; grip strength) in conjunction with the results of standardized tests. tests evaluating special training in hockey, using Spearman correlation analysis.

**Results and conclusions.** It has been established that the formation of special sports skills among hockey players in the second year of training at the sports and recreation stage of training at a medium-low level of correlation mainly depends on the degree of physical fitness, to a lesser extent on the development of psychomotor skills, morphofunctional and cognitive characteristics. In athletes aged seven, the level of special training is mainly determined by the ability to resist interference, the speed and strength characteristics of the legs, the state of autonomic regulation and the formation of a specific muscular balance of the body.

***Keywords:*** *hockey, morphofunctional and psychological features, body proportions, physical fitness, special fitness, age seven years.*

**Introduction.** Early initiation of organized sports practice has become a paradigm of modern society. The main problem in sports activities for young children is the insufficient development of physiological and psychological capabilities, which limit the body's adaptation to physical activity and the proper acquisition of special technical skills [11].

The discrepancy between the level of development of the child's body and the requirements of the content of training in an additional sports training program can manifest itself in functional disorders, muscle imbalances and injuries, including craniocerebral injuries, early psychological burnout, provoking not only withdrawal from sports, but prolonging the disturbances in the processes of further growth and development [6].

The sports and health stage as a promising and prognostic one in the process of long-term sports training is aimed at forming the readiness of the child's body to meet the requirements for enrollment in the initial training stage [7]. In one of the popular sports for children, “hockey” (ice hockey), classes at the sports and health stage begin at five and continue until seven years of age with the need to achieve the standards for enrollment in the stage of initial sports training at the age of 8 in general, including the development of speed, speed-strength, strength qualities, and special training, assessing the technical skill of moving on skates [8].

The development of a seven-year-old child is determined by the variable passage of a half-height jump

and the transition to active differentiation processes against the background of a change in social status and the volume of motor activity at the beginning of school education, which is manifested in morpho-functional, functional, cognitive and motor development and is determined by standardized tests [9]. The simultaneous criticality of the ontogenesis period and the transition period in long-term sports training actualizes the search for growth and development indicators, including morphofunctional and cognitive development, influencing the achievement of special training standards in young hockey players aged seven years, including due to the practical absence of systematic research on this topic [12].

Objective of the study is to identify the relationship between indicators of physical fitness, physical and psychological development and manifestations of special fitness in hockey players aged seven.

Methods and structure of the study. Subjects: 27 young hockey players: age - 7.1±0.22 years; training experience - 2.3±0.22 years; number of classes per week - 11.6±2.5 hours. The following methods were used to assess the comprehensive development of the child's body, taking into account the total dimensions and proportions of the body and limbs; labile components of body weight (anthropometry, caliperometry); cognitive abilities (visual- and verbal-logical, visual-spatial and analytical-synthetic (Raven's color progressive matrices) thinking, attention in the Bourdon test, mediated memory), manifestations of fine and gross motor skills, including the tapping test, simple and complex visual-motor reactions (SVMR, RDO and noise immunity); 30 m run; shuttle run, 3x10 m; alternating running (T-test: smooth, 10 m; side step with leg change, 5 m x 2; backwards, 10 m); grip strength, kg, % (wrist dynamometry, DK-25), standing jump [1-4].

The functional state of the cardiovascular and autonomic nervous system was assessed by the indicators of heart rate, systolic and diastolic blood pressure, heart rate variability (lying and standing) [10]. Posture was assessed using the method of computer optical topography according to the integral indices of disorders in the frontal, horizontal and sagittal planes (APC "Metos").

The assessment of special training (SP), including coordination abilities, speed qualities, movement technique, braking and maneuverable skating was carried out in standard tests: skating 36 m facing and backwards; shuttle run 6x9 m; slalom running with and without a puck, "eight" face forward, backward forward [5]. For the integrated assessment (IA) of the SP, the average values and standard deviation were determined based on the results of each test for further calculation of the assessment on a five-point scale: X±0.5σ – 3 points; X+ (-) 1.0σ – 4 (2) points; > X+ (-)1.0σ – 5 (1) points. The examinations were conducted in the morning with the informed consent of the parents.

Results and conclusions. It was found that the volume of training load, as a modeling effect, does not show any connection with the SP indicators, but weakly (r=0.38–0.48) correlates with a number of growth and development indicators of seven-year-old hockey players. The greatest volume of training correlates with the least time (r=-0.40 and -0.43) in tests requiring coordination of movements of the whole body (alternating running and running with a side step with a change of legs), and, on the contrary, with the least manifestation of speed-strength abilities of the legs (r=-0.42), strength of the left hand (r=-0.48), reactivity in simple and complex visual-motor tests (VMT, attention, r=0.38–0.39).

This indicates that the positive effect of the volume of training on the formation of motor skills does not exclude the need for individual dosing of the training load. On the contrary, the IO SP is associated with a unidirectional increase in motor and psychological indicators, which include noise immunity (r=-0.70), speed-strength abilities of the legs (r=0.67), strength of the left hand, kg, % (r=0.47–0.51), spatial thinking and reaction accuracy (r=0.43–0.45), indicating the most important signs of a child's growth and development for the formation of special sports skills when playing hockey.

SP indicators are most often interconnected with physical fitness indicators (47% of all relationships), less often – psychomotor abilities (29%), body build (16%) and cognitive function (8%). The greatest significance in determining SP from the side of growth and development indicators at this age belongs to two indicators – the ability to noise immunity and speed-strength abilities of the legs (average r=0.51 and -0.52). Noise immunity is associated with the results in each of the SP tests (r=0.40–0.62) with a priority effect on the results in backward skating and shuttle skating (r=0.61–0.62); the value of the long jump with two legs is inversely proportional to the time in skating in five out of six tests (r=0.40–0.61) with the greatest connection with the time in backward skating and small figure eight (r=0.60–0.61), without revealing a reliable effect on the time of the shuttle run.

The most complex conditionality, including body shape indicators (pelvis width/shoulder width), physical fitness (standing long jump, left hand strength in kg and %), cognitive (analytical and spatial thinking) and psychomotor (reaction accuracy, attention and noise immunity) properties are found in the results of 36 m backward skating (r=0.39–0.62). The complication of technical actions in figure-eight skating with puck dribbling is largely associated with the development of speed-strength abilities of the legs (r=-0.61), noise immunity (r=-0.52) and left hand strength (r=-0.47), and to a lesser extent – with the reaction accuracy in the RDO test (r=0.39).

The results of the SP tests are also associated with the functional state of the body at rest, which is especially clearly manifested in the results of the 36 m forward skating and figure-eight skating tests. Hockey players with higher HR values (r= 0.38 – 0.57), shorter RR intervals (r= -0.41 – -0.53), prevalence of sympathetic regulatory influences LF/HF (r= 0.39 – 0.51) and a smaller contribution of respiratory waves HF% (r=-0.40 – -0.43) to the overall spectrum of HRV, i.e. greater tension of the mechanisms of vegetative regulation, are distinguished by lower SP.

Significant relationships between SP indicators of seven-year-old hockey players and the state of posture, as a "mirror" of the established muscle balance, vary from 0.44 to 0.50. The time in the most difficult SP tests (slalom) improves, the IO increases as the index of impairment in three planes increases, mainly due to the sagittal plane (torso tilt back, flattening of the thoracic kyphosis, increased lumbar lordosis), which is combined with a decrease in results with an increase in frontal impairments (distortions).

**Conclusions.** The development of special sports skills in hockey players in the second year of training at the sports and health stage of training at a medium-weak level of communication is determined mainly by the level of physical fitness, to a lesser extent by the development of psychomotor, morphofunctional and cognitive properties. The level of special training in seven-year-old hockey players is primarily approximated by the ability to noise immunity and the speed-strength qualities of the legs, the functional state of the mechanisms of vegetative regulation, the formation of a specific muscle balance of the body.

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# The relationship of leg explosive power with the performance efficiency of ski racers aged 18-20 years old in competitions at various distances

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**Abstract**

**Objective of the study** is to investigate the relationship between the explosive leg strength indices of 18-20 years old cross-country skiers with the performance efficiency at the main starts at different distances of cross-country ski races in the sports season 2023-2024.

**Methods and structure of the study.** Eleven cross-country skiers aged 18-20 years old with qualifications from KMS to MS took part in the research work. The study of explosive leg strength indicators included the performance on a strain gauge platform of jumping exercises from two legs with arm swing with maximum power from a static position at an angle of inclination in the knee joint of 120°. In the course of the study we recorded: the strength of the support reaction, the time of reaching the maximum force, which provided the calculation of the force gradient value (absolute and relative values) characterizing the level of explosive force of leg muscles. The obtained indicators were included in the program of correlation analysis with the results at the main starts of the sports season.

**Results and conclusions.** It has been established that the efficiency of performances at goal-oriented starts turned out to be significantly dependent on the degree of maximum strength and the time of its achievement, forming the "strength gradient", the level of which differentiates the final result in races with separate starts (individual sprint and individual races, relatively "short" distances) by absolute and with a common start (skiathlon and massstarts, relatively "long" distances) by relative value, depending on body weight.

***Keywords:*** *cross-country skiing, athletes aged 18-20, explosive leg strength, athletic performance, ski racing distances, correlation relationship.*

**Introduction.** The results of the conducted studies [4, 5] showed that the effectiveness of competitive activity for both adults and young athletes significantly depends on the formation of the main components of physical fitness, among which the level of development of explosive leg strength is of great importance, the differentiated significance of the structural components of which is determined by the requirements of the specifics of training and competitive activities [6, 7].

One of the possible directions for improving the training process is the study of correlation relationships and the establishment of the significance of indicators reflecting the influence of explosive leg strength on the achievement of a high sports result, taking into account the specifics of muscle activity. In this regard, for scientifically based management of the training of young athletes, specialists need to have information not only about the level of development of the structural components of explosive leg strength, but also about the degree of relationship of the selected indicators with the sports result at various distances of cross-country skiing [6, 8].

**Objective of the study** was to evaluate the relationship between the explosive leg strength of ski racers aged 18-20 years and the effectiveness of per-

formance at the main starts at various ski racing distances of the 2023-2024 sports season.

**Methods and structure of the study.** The set goal was achieved through the use of the following research methods: pedagogical (collection, processing and analysis of competition activity documentation); ergometric methods (performing jumping exercises on the PD-2, VISTI strain gauge platform); mathematical and statistical methods [3].

To assess the level of development of explosive leg strength, cross-country skiers were asked to undergo testing on a strain gauge platform in accordance with the developed test procedures [1]. The test procedure consisted of performing jumping exercises from two legs (with arm swings) from a static position corresponding to the beginning of the push-off in an alternating two-step stroke (knee joint angle 120˚), while recording and calculating the following indicators included in the nomenclature of the 2022 Olympian model characteristics [2]: maximum strength, time to reach maximum strength, "force gradient" (absolute and relative values).

During the 2023-2024 sports season. 11 athletes of the Russian junior national cross-country skiing team aged 18 to 20 years, with qualifications from CMS to MS, were observed. To achieve the stated goal and the tasks of the study, the magnitude (closeness of the relationship) and direction ("+/-") of the correlation coefficients were considered through the dynamics of the relationship "selected indicator" – "goal-setting significance of the competition".

That is why, in order to identify the relationship between the indicators of explosive leg strength and sports results, the dynamics of the correlation coefficients of maximum leg strength (support reaction force), time to reach maximum strength, strength gradient with the results of performance at various distances of individual sprint (qualifying races), individual races, skiathlon and mass starts were studied at the following stages of the 2023-2024 annual cycle: at the end of the snowless stage of the preparatory period, including the All-Russian Competitions (VS) and the Summer Championship of Russia (SCR, September), the middle and the end of the competitive period, including the II All-Russian Spartakiad of the strongest athletes of Russia (VUSSR, February), the Russian Championship for athletes aged 19-20 (PR19-20, mid-February), the Russian Championship aged 21-23 (PR21-23, end of February), the Russian Championship (CR, mid-March), the Final Russian Cup (RKF, April) and Russian Championship 19-20 years (PR19-20, mid-April). The dates of the goal-setting starts (February, March) are associated with reaching the peak level (February, March) at the main starts of the season (VUSSR, PR19-20, PR21-23, CR), as well as the LCR races (September) at the end of the snowless stage of the preparatory period and the RKF and PR19-20 years (April) at the end of the competitive period.

**Results and conclusions.** The following recorded and calculated indicators were used to conduct the correlation analysis: maximum leg strength (Fmax), time to reach maximum strength (tmax), absolute and relative values of the force gradient (Jabs. and Jrel., respectively) and sports results at the main starts of the season. The average group data of the studied indicators of explosive leg strength (at the end of the snowless stage of the preparatory period, CP) and average speed at various distances, taking into account the specifics of muscle activity by types of races and

*Table 1. The level of explosive strength of the leg muscles in the checkpoint and average speed in 18-20 year old cross-country skiers at various distances of the main starts of the 2023-2024 season (average group data, n=11)*

| The indicator under study | Level achieved |
|---|---|
| EXPLOSIVE POWER OF THE LEGS | |
| Maximum leg strength (Fmax), kg | 172,6±17,8 |
| Time to reach maximum leg strength (tmax), s | 0,209±0,002 |
| Absolute value of the gradient of the leg force (Jabs), kg/s | 826,6±90,7 |
| Relative value of the gradient of leg strength (Jrel.), kg/s/kg | 11,50±0,86 |
| SPORTS PERFORMANCE (speed of overcoming the distance) | |
| Individual sprint (qualifying race), m/s | 7,166±0,187 |
| Individual race (races with separate start), m/s | 6,646±0,162 |
| Skiathlon (race with changing movement styles), m/s | 6,267±0,186 |
| Mass Start (races with a general start), m/s | 5,982±0,105 |

the dynamics of the correlation coefficients are presented in Tables 1 and 2.

To achieve this goal, we will analyze the dynamics of the correlation coefficients for each of the selected indicators. The dynamics of the relationship between the maximum leg strength indicator ($F_{max}$), which is a characteristic of both the absolute strength itself and the strength component of the strength gradient, is characterized by a unidirectional change in the tightness (strength) of the relationship in the range from 0.297 to 0.586 in individual sprint, from 0.252 to 0.724 in individual races, from 0.467 to 0.565 in skiathlon and from 0.353 to 0.725 in mass start (see Table 2).

The peak level of correlation coefficients (Rtk), assessed by direction ("+/-" and strength of the relationship), is achieved with the "+" sign in sprint races at the All-Union Soviet Union competitions (Rtk=0.586, February) and the winter Russian Championship (Rtk=0.490, March), in individual races at the race in the Russian Championship (Rtk=0.724, April) and the Russian Championship for 19-20 years (Rtk=0.714, February), in skiathlon the highest level is set at the Russian Championship race (Rtk=0.565, March) and in mass start at the race in the Russian Championship (Rtk=0.725, April) and the Russian Championship for 21-23 years (Rtk=0.588, March) and the lowest in the 50 km race at the Russian Championship for 19-20 years (Rtk=0.353, April). In general, the positive direction of the relationship is maintained for peak values at the "medium-strong" level and the lowest values at the "moderate-weak" level throughout the entire period of the main starts.

The dynamics of the relationship between the indicator and the time to reach maximum leg strength (tmax), on the one hand, reflecting the speed of the push-off, and on the other hand, the level of the speed component of the strength gradient, is characterized by a unidirectional (by the "-" sign) change in the tightness of the relationship in the range from -0.177 to -0.743 in the individual sprint, from -0.304 to -0.642 in individual races, from -0.254 to -0.382 in the skiathlon and from -0.204 to -0.351 in the mass start (see Table 2).

In this case, the peak level of the correlation coefficients is achieved at the main starts of the sports season: in sprint races at the competitions of the win-

*Table 2. The level of correlation coefficients of the indicators of explosive leg strength with the performance efficiency at various distances of the main starts in the 2023-2024 sports season*

| The type of competitive activity under study | The studied indicator of explosive leg strength | | | |
|---|---|---|---|---|
| | Fmax | tmax | Jabs. | Jotn. |
| INDIVIDUAL SPRINT | | | | |
| 1.97 KL, 09/16/2023 – LCR, Arkhangelsk region | 0,343 | -0,264 | 0,345 | 0,244 |
| 1.70 KL, 02/09/2024 – VUSSR, Tyumen | 0,586* | -0,580* | 0,620* | 0,561* |
| 1.71 KL, 02/21/2024 – PR19-20, K-Chepetsk | 0,363 | -0,233 | 0,430 | 0,343 |
| 1,39 KL, 02/28/2024 – PR21-23, Syktyvkar | 0,380 | -0,177 | 0,519 | 0,390 |
| 1.52 St., 03/16/2024 – Czech Republic, Arkhangelsk region. | 0,490 | -0,743* | 0,555* | 0,426 |
| 1.50 SV, 04/02/2024 – FKR, Kirovsk | 0,297 | -0,323 | 0,308 | 0,381 |
| INDIVIDUAL RACE | | | | |
| September 20, 09/15/2023 – LHR, Arkhangelsk region | 0,252 | -0,305 | 0,265 | 0,539 |
| CLASS 20, 09/18/2023 – LHR, Arkhangelsk region. | 0,516 | -0,561* | 0,518 | 0,373 |
| 10 SV, 12.02.2024 – VSSSR, Tyumen | 0,637* | -0,420 | 0,639* | 0,434 |
| 10 SV, 02/22/2024 – PR19-20, K-Chepetsk | 0,714* | -0,642* | 0,737* | 0,609* |
| 10 SV, 02/29/2024 – PR21-23, Syktyvkar | 0,529 | -0,321 | 0,667* | 0,545* |
| CLASS 10, 03/19/2024 – Czech Republic, Arkhangelsk region. | 0,556* | -0,318 | 0,564* | 0,484 |
| 15 SV, 04/03/2024 – FKR, Kirovsk | 0,724* | -0,304 | 0,646* | 0,416 |
| KL 15, 04/05/2024 – FKR, Kirovsk | 0,488 | -0,314 | 0,498 | 0,358 |
| SKIATHLON (race with a change of course) | | | | |
| 20 02/17/2024 – VSSSR, Tyumen | 0,467 | -0,254 | 0,370 | 0,421 |
| 20 03/17/2024 – The Czech Republic, Arkhangelsk region. | 0,565* | -0,382 | 0,462 | 0,463 |
| MASS START (race with a shared start) | | | | |
| 20 KL, 02/25/2024 – PR19-20, K-Chepetsk | 0,436 | -0,244 | 0,295 | 0,362 |
| 20 KL, 03.03.2024 – PR21-23, Syktyvkar | 0,588* | -0,280 | 0,385 | 0,475 |
| 10 SV, 04/07/2024 – FKR, Kirovsk | 0,725* | -0,351 | 0,697* | 0,656* |
| 50 KL, 04/12/2024 – PR19-20, Monchegorsk | 0,353 | -0,204 | 0,446 | 0,406 |

** – correlation coefficients corresponding to the significance level of p<0.05.*

ter Russian Championship (Rtk=-0.743) and the All-Union Soviet Union (Rtk=-0.580), in individual races the highest level is at the PR19-20 race (Rtk=-0.642) and in the summer Russian Championship race (Rtk=-0.561, when moving in the classic style), in skiathlon the highest level is achieved in the Russian Championship race (Rtk=-0.382) and in the mass start in the FKR race (Rtk=-0.351) and PR21-23 (Rtk=-0.280) and the lowest is set in the 50 km race at PR19-20 (Rtk=-0.204, April).

In general, the dynamics presented in the table. 2 reflects the tendency of the highest correlation relationship of the indicator of the time to reach maximum strength with sprint races and individual races in the entire studied range from 10 to 20 km and a decrease in significance (tmax) in distance races depending on the duration of muscle activity.

The dynamics of the correlation coefficients of the indicator of the absolute value of the strength gradient (Jabs.) is characterized by a unidirectional change in the sign ("+") of the relationship in the range from 0.308 to 0.620 in individual sprint, from 0.265 to 0.737 in individual races, from 0.370 to 0.462 in skiathlon and from 0.295 to 0.697 in mass start (see Table 2). The peak level of the correlation coefficients is reached at the main starts: in sprint races at the All-Union Soviet Union competitions (Rtk=0.620) and the winter Russian Championship (Rtk=0.555, March), in individual races at the race for the PR19-20 years (Rtk=0.737, February), PR21-23 (Rtk=0.667, February) and the All-Union Soviet Union (Rtk=0.639, February), in skiathlon the highest level is set at the Russian Championship race (Rtk=0.462, March) and in the mass start at the Russian Federation of Cross-Country Skiing (Rtk=0.697, April) and the lowest in the race for the PR19-20 years (Rtk=0.295), reflecting a decrease in the significance of the strength gradient indicator (Jabs.) in relatively long races with a mass start (skiathlon and mass start in a 50 km race).

The dynamics of the correlation coefficients of the relative magnitude of the force gradient (Jrel.) is characterized by a unidirectional change in the sign ("+") of the relationship in the range from 0.244 to 0.561 in the individual sprint, from 0.358 to 0.609 in individual races, from 0.421 to 0.463 in the skiathlon and from 0.362 to 0.656 in the mass start (see Table 2).

The peak level of the correlation coefficients is reached at the main starts: in sprint races at the All-Union Soviet Union competitions (Rtk=0.561, early February) and the winter Russian Championship (Rtk=0.426, March), in individual races the highest level is reached at the race for the PR19-20 years (Rtk=0.609, February), PR21-23 (Rtk=0.545, February) and the winter Russian Championship (Rtk=0.484, March), in skiathlon the highest level is set at the Russian Championship race (Rtk=0.463, March) and in the mass start at the Russian Championship race (Rtk=0.656, April) and the lowest in the race for the PR19-20 years (Rtk=0.362, February), reflecting, on the one hand, the tendency to equalize the peak level of the correlation coefficients in the entire range of competitive activity (from sprint to marathon), and on the other hand, the absolute values of the correlation coefficients are inferior to the indicators that are directly dependent on body weight.

**Conclusions.** The results of the analysis made it possible to establish that a characteristic feature of the dynamics of the correlation relationships between the indicators of explosive leg strength and the results in races at the main starts is the differentiated significance of the ratio of maximum strength and push-off speed, which form a strength gradient that prevails in races with a separate start (individual sprint and individual races) in relation to races with a common start (skiathlon and mass starts), in which the final result is largely determined by the influence of endurance qualities associated with the development of body weight.

The results of the study allowed us to formulate the main patterns of manifestation of indicators of explosive leg strength depending on the specifics of the competitive activity of athletes aged 18-20:

- in individual sprint races, the effectiveness of competitive activity (average distance speed in the race) is determined by the balance of the development of the strength and speed components of the strength gradient with the dominant significance of absolute values in relation to relative ones, having a correlation relationship with the result at a level of at least "average" - "strong";

- in individual races, the success of the performance is determined, first of all, by the development of the strength component of the explosive leg strength (the maximum strength and strength gradient), reflecting the influence of the incompleteness of the process of formation of strength qualities that depend on body weight, which determines the high relationship with the absolute value of the strength gradient;

- in skiathlon, the success of the performance is determined, first of all, by the priority development of

the power component (maximum strength) in relation to the speed component (push-off time) of the force gradient, with an emerging tendency for the correlation coefficients of the relative value to prevail in relation to the absolute force gradient;

- in mass start (races with a mass start), the success of the performance is determined by the priority development of the power component (maximum strength) of the force gradient in relation to the speed, with a balanced significance (by the value of the correlation coefficients) of the absolute and relative values of the force gradient, which may be associated with the specifics of competitive activity, which imposes increased requirements both for maintaining mid-distance speed and finishing acceleration.

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# Physical fitness and skiing technique in elite biathletes with different efficiency of performance

UDC 796.92

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**Abstract**

**Objective of the study.** To identify the values of a morphology, physical fitness and skiing technique in high-class biathletes with a different efficiency of performance (PE).

**Methods and structure of the study.** The PE criterion was the average points in one race during the competitive period among 46 leading Russian biathletes, "purified" from the influence of the shooting accuracy and the differences in physical fitness.

**Results and conclusions.** Athletes with high PE had shorter gliding phase, lower push-off activity with higher vertical oscillations of the BCM, but lower losses of horizontal speed in the cycle. Such athletes had higher body and muscle mass, as well as better aerobic power, especially of upper body.

***Keywords:*** *biathlon, skiing technique, biathlete's physical fitness.*

**Introduction.** The greatest difficulty in studying skiing technique is the lack of a clear criterion for "good technique". This is due to the high variability of external conditions of competitive activity, technical difficulties in recording running parameters on snow, a large number of ski moves and their variations associated with variable terrain, the influence of sliding conditions, equipment, lubricants, etc. There is also a second problem. The main running parameters are not only influenced by the above factors and are associated with the speed of movement, but are also interconnected with the level and profile of physical fitness of athletes [2]. As a result, it is often difficult to determine which features of the biomechanical running parameters are determined by the level of "technicality" of the athlete, and which are simply determined by the features of the structure of his body, the properties of the neuromuscular apparatus, the power of the supporting systems, etc.

One of the ways to solve the problem of the "technicality criterion", including when studying the relationship between the biomechanical parameters of running and the physical fitness of athletes, may be to use the coefficient of "implementation efficiency of competitive activity" (RE) of an athlete [1]. Indeed, if of the two most significant factors of a sports result – physical fitness and technique – we exclude the influence of one of them (for example, physical fitness), then the remaining inter-individual dispersion of the sports result will be associated mainly with the second factor – in this case with technique, and the RE itself will serve as the desired assessment of the technical fitness of the athlete. The RE can be calculated by calculating the regression residuals of the dependence "sports result" – "physical fitness".

**Objective of the study** is to identify indicators of morphological status, physical fitness and skiing technique in high-class biathletes with different levels of competitive activity (CAT) implementation efficiency.

**Methods and structure of the study.** Based on video recordings of 43 high-class biathletes during races at the World Cup, IBU Cup and major Russian competitions in the 2018/19–2024/25 seasons, 20 kinematic parameters of the simultaneous one-step

skating stroke (SOSKS) were calculated. A total of 644 video recordings were processed. For each athlete, the technique parameters were averaged over all laps of the distances of all races and reduced to the same speed (5.89 m/s) to eliminate its influence on the parameter values. The physical fitness and morphological status of the same athletes (hereinafter referred to as "physics") were determined based on 24 indicators obtained during the stage-by-stage comprehensive examinations (SCCE) conducted in August-October for the same athletes in the corresponding seasons. For more details on the methodology, see [2].

The athletes' RE was calculated as follows. First, the influence of shooting accuracy on the sports result was eliminated using the regression residual method for the dependence of "average performance in a race for the season" – "average shooting accuracy for the season" (according to the Russian Biathlon Union website). The resulting regression residual served as an estimate of the average distance speed of an athlete in a given season (hereinafter referred to as "speed") in the logic presented above in the "Introduction". Then, the regression residual of the dependence "speed" – "integral index of physical fitness" was calculated in a similar way, which, in turn, was calculated in a standard way based on the athletes' IVF data [2].

This regression residual was used as the PE coefficient. All athletes were divided into two groups according to the PE criterion: a group of "effective" biathletes and a group of "ineffective" biathletes. The reliability of differences between the groups in the average indicators of "technique" and "physics" was determined using the Mann-Whitney criterion in MSExcel.

*Table 1. Values and standard deviations (SD) of kinematic indicators in athletes with high (Eff, n=21) and low (NEff, n=22) implementation efficiency of competitive activity*

| Indicator | Eff | SD | NEff | SD |
|---|---|---|---|---|
| Sales Performance Index | 31,2 | 13,3 | 10,5# | 4,7 |
| Length of steps, m | 5,54 | 0,18 | 5,60 | 0,14 |
| Ratio of rolling length to step length | 0,47 | 0,02 | 0,50# | 0,02 |
| Ratio of arm push-off duration to leg push-off duration | 1,73 | 0,21 | 1,80 | 0,18 |
| The ratio of the duration of free sliding (rolling) to the duration of pushing off with hands | 2,48 | 0,31 | 2,89# | 0,39 |
| The ratio of the duration of free sliding (rolling) to the duration of the push-off with the foot | 1,45 | 0,07 | 1,60# | 0,13 |
| Distance traveled during pushing off with hands, m | 1,79 | 0,09 | 1,75* | 0,08 |
| Distance traveled during foot push-off, m | 1,17 | 0,11 | 1,08# | 0,10 |
| Distance during the active push-off phase (arms and legs), m | 2,96 | 0,10 | 2,82# | 0,14 |
| Distance during free sliding, m | 2,58 | 0,14 | 2,77# | 0,16 |
| Angle of the pole at the end of the push-off, degrees | 26,4 | 1,21 | 26,5 | 1,05 |
| Time between the start of pushing off with the arms and the start of knee extension, s | 0,22 | 0,03 | 0,23 | 0,03 |
| Hip joint angle at the moment of placing the poles (HJ1) | 129 | 3,27 | 129 | 3,76 |
| Hip joint angle at the lowest point of flexion (HJ2) | 100 | 4,93 | 102 | 5,04 |
| Change in the angle in the hip joint (difference HB1-HB2) | 29,1 | 4,02 | 27,2 | 4,62 |
| Angle at the knee joint when placing the poles (KS1) | 148 | 3,27 | 145* | 3,21 |
| Angle of the knee joint at the moment of the lowest point of flexion (KS2) | 126 | 3,17 | 126 | 3,28 |
| Change in angle in KS (difference KS1-KS2) | 21,9 | 3,38 | 19,1* | 3,64 |
| Angle at the shoulder joint at the moment of placing the poles (PS1) | 59,4 | 8,30 | 63,3 | 9,15 |
| Angle in PS at the moment of breaking away of poles from support (PS2) | 13,3 | 4,57 | 13,1 | 4,70 |
| Angle of change of angle in PS (sum of PS1+PS2) | 72,6 | 7,04 | 76,7 | 10,2 |

*Note: * – differences are significant at α=0.05; # – differences are significant at α=0.01.*

**Results and conclusions.** Table 1 presents the data on the kinematic indicators of running OOKH in athletes with different implementation efficiency. More "effective" athletes with α=0.06 had a shorter step length. With α=0.05 and lower, they had a shorter free roll length, but greater values of the roll length during the push-off with arms and legs. Accordingly, "effective" biathletes had lower ratios of the roll length to the step length and the roll time to the push-off with arms and legs. They had a larger angle in the knee joint at the moment of placing the poles on the support and a greater amplitude of movement in the knee joint during the push-off with the leg.

Table 2 presents data on the physical fitness indicators of athletes with different implementation efficiency. More "effective" athletes had a larger body mass due to a larger mass and volume of muscles with a tendency (p=0.06) of a lower proportion of fat mass in the body. Of the physical fitness indicators, they only had a higher anaerobic threshold power (AnT) when working with arms on a ski ergometer and a higher heart rate at the AnT level when running. However, it should be noted that with a fairly high probability (p<0.1) they had a higher index of "oxidative muscle fiber power" of the shoulder girdle muscles, but a lower index of stroke volume of the heart when running on a treadmill.

**Discussion.** This is the first study to identify the physical fitness and skiing technique indicators of elite athletes with different ER, which in this context could

*Table 2. Indicators of physical fitness and anthropometric indices in athletes with high (EFF, n=21) and low (NEFF, n=22) implementation efficiency of competitive activity*

| Indicator | Eff | SD | NEff | SD |
|---|---|---|---|---|
| Body weight, kg | 77,6 | 7,00 | 73,1* | 4,70 |
| Body mass index (modified) | 41,0 | 1,50 | 43,2# | 2,1 |
| Muscle component, % | 52,0 | 1,62 | 50,6* | 1,33 |
| Muscle mass, kg | 40,3 | 3,9 | 37,0# | 2,7 |
| Fat component, % | 9,38 | 1,65 | 9,99 | 1,31 |
| Upper Body Lean Mass/Body Mass | 16,5 | 1,26 | 15,7* | 1,11 |
| Lean Lower Body Mass/Body Mass | 21,0 | 1,82 | 19,8* | 1,35 |
| Maximum leg muscle strength, N*m/kg | 2,67 | 0,23 | 2,73 | 0,35 |
| Speed-strength abilities of leg extensors, W/kg | 22,9 | 1,27 | 22,5 | 2,00 |
| Maximum strength of the muscles of the shoulder girdle and arms, W/kg | 3,91 | 0,60 | 3,66 | 0,49 |
| Maximum alactic power when working with hands, W/kg | 8,26 | 0,62 | 8,25 | 0,77 |
| Maximum alactic power during leg work, W/kg | 13,4 | 0,85 | 14,0 | 0,90 |
| Maximum impulse force when working with hands, W*s/kg | 9,36 | 1,03 | 9,46 | 1,16 |
| Power of slow fibers of the shoulder girdle muscles, c.u. | 44,2 | 6,4 | 41,7 | 5,8 |
| Index (assessment) of stroke volume of the heart, c.u. | 184 | 15 | 191 | 14 |
| Index (assessment) of maximum cardiac output, c.u. | 31,6 | 2,0 | 32,2 | 2,0 |
| $VO_2$ max when running with poles on a treadmill, ml/min/kg | 72,7 | 5,0 | 71,6 | 5,4 |
| Oxygen pulse on the AnP during hand work, ml/beat | 30,3 | 2,12 | 29,9 | 1,80 |
| Oxygen pulse on AnP during treadmill running, ml/beat | 33,8 | 2,7 | 34,5 | 1,9 |
| Oxygen consumption at the level of AnP during hand work, ml/kg/min | 51,9 | 2,9 | 50,5 | 3,4 |
| Power at the AnP level when working with hands, W/kg | 3,46 | 0,31 | 3,27* | 0,21 |
| Oxygen consumption at the level of AnP in treadmill running, ml/kg/min | 61,4 | 4,8 | 60,7 | 3,6 |
| Power at the level of AnP in running with poles on a treadmill, W/kg | 3,11 | 0,24 | 3,13 | 0,37 |
| Heart rate at anaerobic threshold during treadmill running, bpm | 181 | 7,0 | 176* | 6,1 |

*Note: * – differences are significant at α=0.05; # – differences are significant at α=0.01.*

serve as an integral assessment of sports and technical skill in the racing portion of the competitive exercise of biathletes.

The study revealed (Table 1) that athletes with higher ER had shorter stride lengths and, accordingly, higher step frequency solely due to shorter free sliding (rolling) lengths. At the same time, the rolling length in the active phases of the cycle, on the contrary, was longer. The ratio of shorter rolling but longer active phases resulted in lower rhythm coefficients, which, by analogy with the results of studies of runners, can be interpreted as lower "push-off activity" [2].

This allows us to make an unambiguous conclusion that "effective" athletes used a "non-active", "non-impulsive", but "economical" running style with less tension and concentration of muscle effort during push-off. In addition, a short roll reflects lower losses of horizontal velocity in the step cycle.

The third sign of "economization" of running can be considered a higher position of the body's center of mass during the roll, as follows from a larger angle in the knee joint and, accordingly, a smaller torque that the muscles counteract in the passive phase of the cycle. However, saving on losses of horizontal velocity, "effective" athletes did not save on vertical oscillations of the CMT, "squatting" more strongly when pushing off with the leg. It is possible that in this case the mechanism of recuperation of elastic deformation energy was used better.

When identifying the features of the morphological status and physical fitness characteristic of "effective" athletes (Table 2), a rather unexpected result was obtained. It was found that with a high probability ($p<0.01$), heavier biathletes with greater mass and muscle volume have an "economical" running style. At the same time, they are characterized by better aerobic indicators, especially when working with their arms. The explanation for such features of the "physics" of "effective" athletes can be as follows. To compensate for the greater body and muscle mass, especially when running uphill, when this is critical, one must be able to run "economically" to ensure one's competitiveness among the best biathletes in the world, especially considering the additional mass of the rifle. However, to compensate for the higher step frequency characteristic of "economical running" and the additional energy demand that arises with it, athletes must have better aerobic performance.

**Conclusions.** There are kinematic parameters of skiing that distinguish athletes with high and low ER. These are less rolling, low push-off activity with high vertical oscillations of the CMT, but low losses of horizontal speed in the step cycle. The development of an "economical running style" is facilitated by a relatively high body and muscle mass. "Economical style" assumes a high step frequency. This increases the energy demand, so "effective" athletes must have relatively high aerobic abilities.

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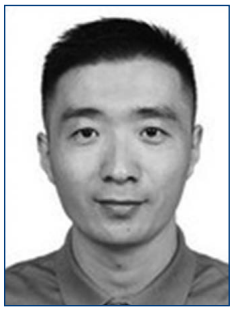
# Evaluation technology and methodology for improving hammer throwing technique using vertical elastic coupling

UDC 796.325



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**Abstract**

**Purpose of the study.** To describe the evaluation technology and methodology of improving the hammer throwing technique using vertical elastic coupling.

**Methodology and organization of the study.** Experimental studies were conducted in China on the basis of the sports team of Shaanxi province. We evaluated a number of kinematic parameters of athletes' movements.

**Results of the study and conclusions.** The use of aids with vertical elastic links has a positive effect on the technical movements of hammer throwers, which is reflected not only in the improvement of hammer movement parameters, its throwing speed and angular velocity of rotation, but also in the improvement of biomechanical parameters and indicators of physical fitness of athletes.

***Keywords:*** *hammer throwing evaluation technology, hammer throwing technique, improvement methodology, vertical elastic coupling.*

**Relevance.** Hammer throwing is the most complex of athletics sports with a rotating trajectory and intense action of many different forces. Researcher Pavlovic R. used 28 male hammer throwers who were finalists of World Championships (Berlin, 2009, Daegu, 2011, London, 2017) as a sample. Multiple regression analysis was applied to determine the influence of certain kinematic parameters on throwing performance. The aim was to determine the influence of spatial and temporal biomechanical parameters on hammer throw performance. The results of a study of male finalists confirmed a direct relationship between hammer throw initial velocity, hammer release velocity, hammer first round velocity and performance [3].

Chinese male athletes [2] in hammer throw need to improve their technical level due to poor performance in international competitions. Researchers Jia Chao and Li Chengde used three-dimensional cameras to capture and analyze the technical movements of three top male hammer throw athletes (Wang Shizhu, Guo Kun, and Xiao Feng) at the Chinese Open Championships. The main technical parameters were: quantitative analysis, including pre-swing stage, rotation stage and final tension stage, to find reasonable factors and internal relationships to improve performance. By comparing some technical parameters of outstanding foreign male hammer throwers, we can identify the shortcomings and gaps in the hammer movements of Chinese athletes. Compared with outstanding overseas athletes, the pre-swing time of Chinese male athletes is too long, resulting in lower hammer speed during the pre-swing phase, which puts more stress on the rotation process. Compared with elite athletes in the world, the three hammer throw athletes still have the following deficiencies in the rotation phase: total rotation time is too long, unreasonable distribution of single and double support time - single support time is longer and hammer; throwing velocity increase time

*Table 1. Kinematic parameters of hammer throwing technique*

| Parameters | Description |
|---|---|
| The speed at which the hammer leaves the hand | The velocity of the hammer as the handle leaves the hand |
| The angle at which the hammer leaves the arm | The angle between the hammer and the horizontal plane at which the hammer handle leaves the hand. |
| The time to support one leg. | Time to land on one foot |
| The time for both feet to rest on the ground. | The time it takes for both feet to stay on the ground. |
| The angular velocity of rotation of the ball of the mallet | The angular velocity of the line connecting the hammer and handle rotating about a vertical axis |
| The angular velocity of rotation of the two shoulders | Angular velocity of both arms rotating about a vertical axis |
| The angular velocity of rotation of the pelvis | Angular velocity of the pelvis rotating about a vertical axis |
| The angle of the knee joint | Angle between the thigh and the calf |
| The data of the center of the human body.(velocity, acceleration) | Velocity and acceleration of the center of mass of the human body. |

is shorter, which is not conducive to rotational acceleration; poor continuous acceleration ability; insufficient center of gravity drop, different degrees of upper body backward tilt, chest flexion and compensatory actions Chest and elbow flexion are not conducive to maintaining balance and performing subsequent technical movements. The final power stage of the three Chinese athletes is relatively long and should be shortened, especially the time from the lowest point of the hammer throw to its completion. Judging from the speed of hammer throw, the speed in the final force stage has increased significantly, but there is a large gap between the speed of the final throw of Chinese athletes and outstanding foreign athletes [1].

Methodology and organization of the study. Experimental studies were conducted in China on the basis of the sports team of Shaanxi province. We evaluated a number of kinematic parameters of athletes' movements.

Results of the study and conclusions. The use of aids with vertical elastic links has a positive effect on the technical movements of hammer throwers, which is reflected not only in the improvement of hammer movement parameters, its throwing speed and angular velocity of rotation, but also in the improvement of biomechanical parameters and indicators of physical fitness of athletes.

Results of the study and their discussion. The main method for determining the kinematic parameters of the hammer throwing technique was video analysis using a CASIO camera shooting at 120 frames per minute. Table 1 shows the description of kinematic parameters of hammer throwing technique used in the research work.

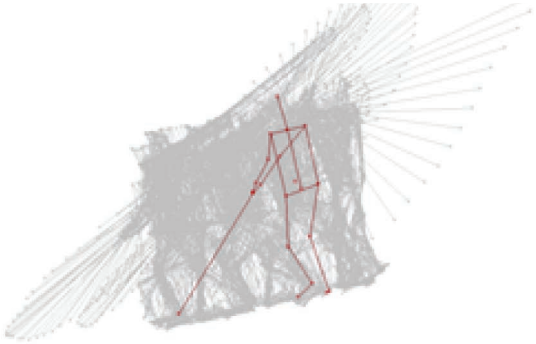

*Figure 1 shows the sports video data processed by the APAS software.*

Figure 1. Video data of sport competitions processed by APAS software

We have developed a methodology to improve the technique of hammer throwing, the essence of which was that if the body of the hammer thrower to apply a vertical traction force, it is possible to achieve a reduction in the yaw of the axis of rotation and relieve the musculoskeletal apparatus of the thrower from part of the vertical work, redistributing the saved mechanical energy to increase the rotational motion of the body of the thrower (Figure).

Venue and equipment:

-over the cage, over the throwing circle from one edge to the other, a steel non-deformable rod is stretched and attached to the walls of the cage,

-to this rod is attached a rubber cord (vertical elastic connection) with a diameter of at least 1 centimeter. The other end of the cord will be attached to a belt around the thrower's waist (Figure 2).

*Figure 2 Schematic diagram of the vertical elastic coupling equipment*

On the example of the experimental group, each experimental session was divided into three parts: preparatory, main and final part.

Preparatory part: The main tasks are to warm up and activate the body.

Basic part: includes technical exercises, quick low-load strength exercises, as well as stretching and relaxation. The specific content is as follows:

1) Hammer throwing exercise under vertical elastic linkage;

2) High leg raise exercise with a barbell;

3) Weighted barbell pulling exercises;

4) Grasp the barbell and simulate a rotational motion as in a hammer throw;

5) Stretch and relax.

Final: The main objectives are to get organized and relax.

There is only one vertical elastic connection. While one athlete performs the throwing exercises, other athletes perform other exercises. The main part of the exercises is based on the circuit training method. Each of the five athletes performed the above five exercises that made up one cycle, totaling 10 cycles, with a 3-minute rest between each cycle.

The difference between the experimental and control groups: the experimental group performed hammer throwing exercises under vertical elastic ties, whereas the control group performed hammer throwing exercises in the natural state. The rest of the training content was exactly the same. We developed the

*Table 2. Micro-cycle of training on the example of the team of Shaanxi Province in China*

| Day of the week Content | Day of the week Content | Day of the week Content | Day of the week Content |
|---|---|---|---|
| Monday | 1. 800 meter run, warm-up exercise<br>2. teaching experiment, throwing the ball 30 times<br>3. Stretching, relaxation exercises | 1. 800 meter run, warm-up exercise<br>2. technical exercises, throws 35 times<br>3. Stretching, relaxation exercises | Medium intensity with emphasis on technical movements |
| Tuesday | 1. 800 meter run, warm-up exercises<br>2. technical exercises, throwing 35 times<br>3. stretching, relaxation exercises | Physical preparation | Focus on technical movements and muscle coordination of the upper and lower extremities. |
| Wednesday | 1. Running 800 meters and warm-up exercises.<br>2. Teaching experiment: throw the ball 40 times.<br>3. Stretching and relaxation exercises | Watch the technical video, rest | Physical recovery |
| Thursday | 1. Running 800 meters and warm-up.<br>2. Technical practice, serve 40 times<br>3. Stretching and relaxation exercises | Physical preparation | Focus on technical movements and maintain fitness level. |
| Friday | 1. Running 800 meters and warm-up.<br>2. Teaching experiment: throw the ball 40 times.<br>3. Stretching and relaxation exercises | 1. Run 800 meters and warm up.<br>2. Technical practice, 45 throws<br>3. Stretching and relaxation exercises | Focus on developing neuromuscular coordination |
| Saturday | 1. Run 800 meters and warm-up.<br>2. Technical practice, 45 throws<br>3. Stretching and relaxation exercises | Jogging 3000 meters | Focus on technical movements and do aerobic training |
| Sunday | vacation | | |

*Table 3: Physical training plan for hammer throwers*

| Part | Content | Scope and intensity |
|---|---|---|
| Warm-up | Jogging 800 meters<br>Whole body muscle activation | Heart rate 120-140 beats/minute |
| Special preparatory exercises | Running with small steps, jumping with steps, imitation of exercises from hand, rotation of a bar weighing 40 kg | Heart rate 130-150 beats/minute |
| Strength training | Squat 150 kg, 160 kg, 170 kg, 180 kg, 190 kg | 4 times each * 4 approaches<br>70-90% |
| | Small lunge squat jump 140, 150, 160 kg | Alternating left and right leg<br>3 times each * 4 approaches<br>70-90% |
| | Bench press 160, 170, 180, 190 kg | 4 times each * 4 approaches<br>70-90% |
| | Jerk 80, 90, 100 kg | 4 times each * 4 approaches<br>70-90% |
| | Bench press 140, 150, 160 kg<br>4 times each * 4 approaches<br>70-90% | |
| Recovery | Relax and run 800 meters.<br>Muscle stretching | |

content of the training microcycle considering two training sessions per day (Table 2).

We developed a physical training plan for hammer throwers, including the content of different logical structures: warm-up, special preparatory exercises, strength part, and recovery (Table 3).

**Conclusion.** To summarize the above, it can be concluded that in order to determine the kinematic parameters of movements it is necessary to use a special camera and a 3D video motion analysis system APAS (Ariel Performance Analysis System) for video analysis and processing. Vertical elasticity allows the hammer thrower to engage additional contractions of the FR motor units because the S motor units contract faster during training. Training with vertical elastic links can effectively improve hammer throwers' biomechanical test scores and help improve competition performance. The training helps hammer throwers achieve directional changes in speed and speed-force performance, and the speed index is significantly increased. Hammer throwers should incorporate explosive strength exercises such as weighted squat jumps and multi-level jumps into their training. After training, hammer throwing velocity and rotational angular velocity increased significantly, while throwing angle remained stable.

Thus, as a result of this study, it can be concluded that the use of aids with vertical elastic links has a positive effect on the technical movements of hammer throwers, which is reflected not only in the improvement of hammer motion parameters, throwing speed and angular velocity of rotation, but also in the improvement of biomechanical parameters and indicators of physical fitness of athletes.

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# A method for tracking and evaluating students' physical activity using wearable devices

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**Abstract**

**Objective of the study** is to scientifically substantiate a system of pedagogical control of motor activity based on data from wearable devices.

**Methods and structure of the study.** The work involved: theoretical analysis, generalization of data from scientific publications, statistical and rank analysis.

**Results and conclusions.** The system, developed for monitoring and assessing the motor activity (MA) of those engaged in health-improving physical culture (HPE), is closely integrated with the process of setting physical activity standards. The key component is the information and analytical complex (IACOM), which includes a heart rate (HR) database, tools for analysis and visualization, and a user interface. Elements of the system of pedagogical control of motor activity (SPKDA) are built into each stage of standardization. The main activities for monitoring and assessing MA are shown in the figure. This system of pedagogical control expands the possibilities of personalized standardization of physical activity, providing the feedback necessary for effective management of the motor activity of those engaged in HPE.

***Keywords:*** *monitoring, assessment, physical activity, health-improving physical culture, heart rate, HR, pedagogical control system, physical activity regulation, feedback, physical activity management.*

**Introduction.** The realities of scientific and technological progress determine the modernization of all spheres of society, including the sphere of health-improving physical education (HPE) [1]. Pedagogical control (PC) is an important part of HPE, which is understood as the process of obtaining information about the physical condition of those involved in HPE in order to improve the effectiveness of physical education and health-improving activities (PEH). It is based on monitoring the volume and intensity of physical activity in accordance with the physical and functional state of the person involved. It is carried out in the form of preliminary, current, operational, stage-by-stage and final control of the DA of those involved in HPE. It can be carried out both with the help of a teacher and independently through self-control.

**Objective of the study** is to scientifically substantiate a system of pedagogical control of motor activity based on data from wearable devices.

**Methods and structure of the study.** The work involved: theoretical analysis, generalization of data from scientific publications, statistical and rank analysis.

**Results and conclusions.** In order to improve the systematicity, individualization and digitalization of physical education, a system of pedagogical control of motor activity (SPKDA) was developed, which represents a set of measures for monitoring and assessing the activity of those involved in general physical education, as well as an information and analytical complex (IACOM), which includes a heart rate (HR) database, calculation and graphic modules and a user interface. Elements of the SPKDA are integrated into each stage of the physical activity standardization technology. The main PC activities for monitoring and assessing the activity of those involved are shown in Figure 1 [2-4].

The first stage of the technology includes comprehensive diagnostics, collecting heart rate data using smart

watches [1, 5] and preliminary PC. Preliminary control extends to the first three stages of the technology: diagnostic, standardization and design. At the second stage of the technology, a system of daily heart rate measurement data is formed, components of the standardization methodology are implemented [2, 3], procedures for ranking heart rate data analysis are carried out, personalized physical activity standards are developed, and indices of optimal physical activity for those involved in general physical fitness are calculated (Table 1) [6].

The third design stage should help those involved in general physical fitness develop a physical fitness strategy that allows them to fulfill the developed personalized physical activity standards [1, 4].

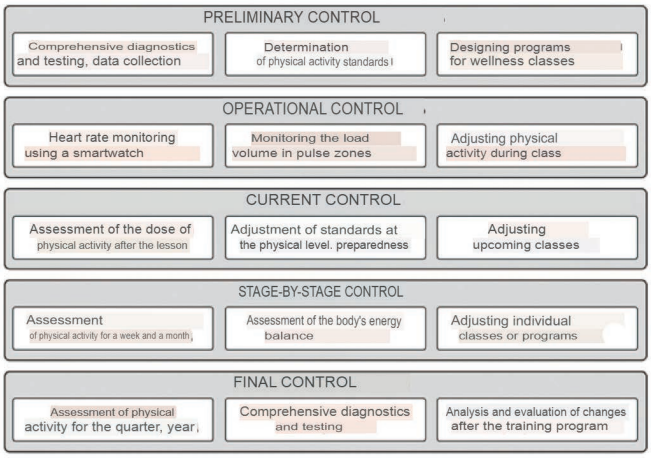


***Fig. 1.*** *Complex of pedagogical control measures for monitoring and assessing the physical activity of those involved*

At the fourth stage, in which the designed physical fitness program is implemented, operational, current and staged PC is carried out. Within the framework of the methodology [2, 3], operational control is carried out according to the indicator of temporary stay in the heart rate training zones. The operational control data allow regulating the dynamics of the load in the process of physical fitness, as well as assessing the received dose by comparing it with personalized standards (Fig. 2) [5].

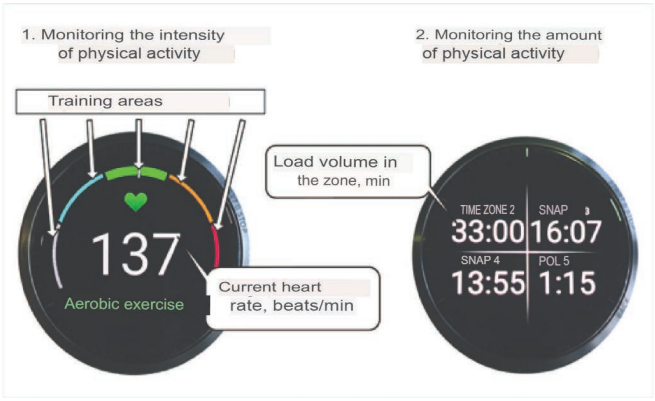


***Fig. 2.*** *Monitoring the intensity and volume of physical activity*

Current monitoring is carried out to determine the reaction of the body of those involved in the load after the physical training program, as well as to assess the fulfillment of the personalized norm of physical activity. For this, the time volume of being in the training zones of the heart rate is compared with the planned for the fulfillment of a certain personalized norm (Table 2).

Stage-by-stage control is carried out to obtain information on the cumulative (total) training effect that has arisen over the period under consideration (week, month). Within the framework of the developed standardization methodology [2, 3], this information is formed in the form of an index of optimal physical activity [6], which allows monitoring and evaluation of daily and weekly and DA (Table 3) [6].

The fifth stage includes checking and evaluating the effectiveness of the physical activity program, as well as the implementation of the final PC. The purpose of the final control is to evaluate the degree of implementation of the physical activity program, identify the results of the completed physical activity program. An example of accounting for the optimal physical activity index for the year is shown in Table 4 [6].

The SPKDA complements the IACOM, which includes a heart rate database, calculation and

*Table 1. Personalized norm of physical activity and index of optimal physical activity for one of the involved*

| Heart rate zone name | Zone range, bpm | Time spent in zones depending on the level of physical fitness, min | | |
|---|---|---|---|---|
| | | Short | Average | High |
| Maximum | 166 – 184 | 0 | 3 | 8 |
| Anaerobic | 147 – 165 | 1 | 4 | 9 |
| Aerobic | 129 – 146 | 4 | 9 | 13 |
| Fitness zone | 110 – 128 | 10 | 19 | 25 |
| Total time, min | – | 15 | 35 | 55 |
| Index value (low, optimal, high), points | – | 27 | 64 | 100 |

*Table 2. Examples of assessing the dose of physical activity after the session*

| Example number | Example 1 | | Example 2 | | Example 3 | |
|---|---|---|---|---|---|---|
| Zone ranges, bpm | Lower limit norm | Received dose | Average limit norm | Received dose | Upper limit norm | Received dose |
| 168 – 185 | 1 | 0 | 4 | 1 | 8 | 6 |
| 149 – 167 | 1 | 0 | 4 | 3 | 7 | 25 |
| 131 – 148 | 4 | 3 | 7 | 10 | 12 | 33 |
| 111 – 130 | 9 | 10 | 22 | 26 | 31 | 25 |
| Time, min | 15 | 13 | 37 | 40 | 58 | 89 |
| Grade | Low dose | | Optimal dose | | Increased dose | |

*Note: The intensity ranges of the zones are calculated for a 35-year-old subject.*

*Table 3. Accounting for the index of optimal physical activity for a month*

| Indicator | Week of the month | | | | Average value of the index and its assessment |
|---|---|---|---|---|---|
| | 1st | 2st | 3st | 4st | |
| Index value | 30 | 17 | 35 | 72 | 38,5 |
| Rating YES | Optimal | Low | Optimal | Increased | Optimal |

*Note: The optimal activity values in this example range from 26 to 64 points.*

*Table 4. Accounting for the optimal physical activity index for the year*

| Indicator | Month of the year | | | | | | | | | | | | Average value of the index and its assessment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| Index value | 7 | 12 | 17 | 27 | 43 | 67 | 30 | 22 | 70 | 35 | 20 | 10 | 30 |
| Rating YES | L | L | L | O | O | P | O | L | P | O | L | L | Optimal |

*Note: The values of optimal activity in this example range from 26 to 64 points, where L is low activity, O is optimal, and P is high.*

graphic modules, and a user interface. Fig. 3 shows the structure of the information and analytical complex of the SPKDA. Within the framework of the creation of the information and analytical complex of the SPKDA, a database [7] and computer programs [8-11] were developed. Thus, the SPKDA was developed, which performs the main function – the implementation of feedback in the management of the activity of those engaged in OFC. In this case, the means of preliminary, operational and current control is a personalized norm, and the stage and control - an index of optimal physical activity. The SPKDA includes two complexes: a set of measures for monitoring and assessing the activity of those engaged in OFC and the IACOM.

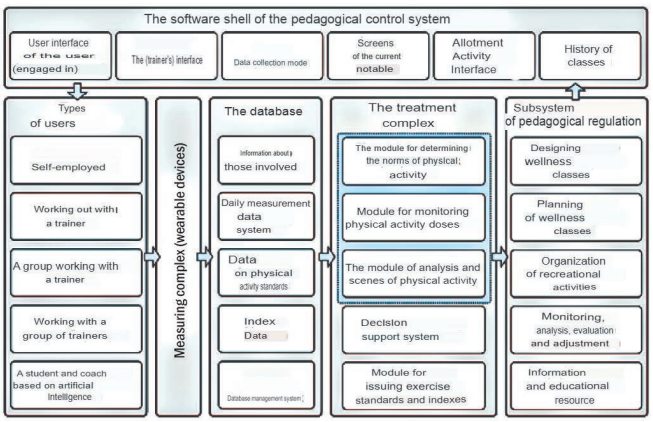


*Fig. 3. Information and analytical complex of the system of pedagogical control of motor activity*

**Conclusion.** The need of society to increase the level of systematicity, individualization and digitalization of health-improving activities for those involved requires the improvement of the PC system in OFK. The proposed SPKDA of those involved in OFK will ensure the proper implementation of personalized standards of physical activity, improve the indicators of the psychophysical state of those involved, increase their level of motivation and actualize the need for systematic physical exercise.

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# Using gamification techniques in digital sports marketing

UDC 339.138

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**Abstract**

**Objective of the study** is to develop algorithms for the effective use of digital gamification tools in the marketing strategies of sports organizations.

**Methods and structure of the study.** The following scientific methods were used in the course of the work: the method of system analysis, the method of comparative characteristics, generalization, systematization, structural and functional method.

**Results and conclusions.** A reasonable conclusion is made that the effectiveness and efficiency of competitive marketing strategies in sports is determined by the degree of integration of elements of innovative, creative interaction of organizations with the target audience. The involvement of fans and consumers of sporting goods and services in marketing communications through gamification tools provides conditions for long-term cooperation and, consequently, strengthening the company's image and brand in the external environment of sports marketing. Gamification as a set of effective ways and methods of interactive digital marketing finds successful application in various segments of the sports industry, optimizing the solution of operational tasks related primarily to employee motivation and training, multi-channel customer engagement, as well as improving marketing results in the context of long-term strategic decisions. By means of such innovative solutions, not only the competitive advantages of individual business entities are formed, but also the investment attractiveness of the sports industry as a whole is increased.

***Keywords:*** *sports industry, gamification, digitalization, marketing strategies, innovations in sports, competition, digital transformation, collaboration, creative approaches.*

**Introduction.** Currently, the drivers and trends of the digital transformation of the sports industry have actualized new methods of communication between key participants in the sports market, which has largely predetermined the change in existing marketing strategies [8]. In this regard, gamification in sports can be characterized as a strategy that, using the principles and mechanics of games, ensures the involvement of individual segments of the target audience and increases the motivation of participants in the sports business (sports industry) for continuous cooperation and interaction.

Research in this area of scientific knowledge [2, 4, 7] show that for commercial and other purposes, game mechanics contribute to deeper communication of a company, a sports brand with its potential and / or permanent target audience. At the same time, the effectiveness of this element of a marketing campaign in the sports industry largely depends on the sequence of strategic decisions, as well as the competencies of sports marketers. In this regard, further scientific research on the potential of gamification in sports is of great practical importance.

**Objective of the study** is to develop algorithms for the effective use of digital gamification tools in the marketing strategies of sports organizations.

**Methods and structure of the study.** The following scientific methods were used in the course of the work: the method of systems analysis, the method of comparative characteristics, generalization, systematization, and the structural-functional method.

Results and conclusions. In the context of the rapid development of innovative technologies in sports and the structure and methods of marketing communications with consumers that have changed as a result of this process, gamification is becoming a relevant and effective tool that helps entities from various segments of the sports industry stand out from the competition [3].

For example, in collaboration with professional sports, gamification contributes to the creation of independent interactive fantasy leagues based on existing sports competitions, events and teams (clubs) in real sports. “The National Basketball Association, as part of its marketing strategies and the actualization of gamification, offered fans digital tools and formats that allow fans to create virtual teams based on the real performances of players. This solution not only increased the number of spectators, but also deepened the fans' understanding of sports, as they became more interested in player statistics and team strategies” [6].

In amateur and mass sports, multifunctional and easy-to-use mobile applications and digital devices make it possible to track the health indicators and current fitness of people leading an active lifestyle. Feedback generated and available in real time thanks to the Internet of Things (IoT) motivates sports fans to achieve new goals, solve current problems, which is identical to increasing the complexity and moving to new levels in a video game [9].

The use of gamification in such segments of the sports industry as student and youth sports also has a number of features. Here, gamification acts as an effective and efficient tool for increasing the motivation of young athletes and students to play sports, improve their own (individual) sports results, and develop team spirit in game disciplines. Leaderboards, badges and awards as elements of digital gamification stimulate representatives of this target group to regularly train in sports sections, participate in student and school competitions, and meet sports standards [1].

Effective implementation and application of gamification as an element of marketing strategy in various segments of the sports industry involves the consistent implementation of the following actions:

• deep analysis of the target audience to determine and identify its priority interests, current requests and preferences, formed incentives and motivation (it is obvious that in student sports and high-performance sports the portrait of the consumer will be significantly different);

• definition of the strategic goal that the sports organization plans to achieve using gamification tools (increase in ticket and souvenir sales, attract new spectators and participants, increase customer loyalty, etc.);

• development of technological tools, that is, such game mechanics that will meet the expectations of the target audience and contribute to the achievement of the goals of the marketing campaign (use of a rating system, bonus and rewards programs, holding thematic competitions, solving tasks and cases) [3];

• practical implementation of a marketing strategy with gamification elements and monitoring the effectiveness of its application.

It should be noted that the practical use of gaming strategies in marketing communications processes not only optimizes interactions between participants in the sports market [5], but also opens up additional opportunities for content monetization and, in general, expansion of income sources (see figure).

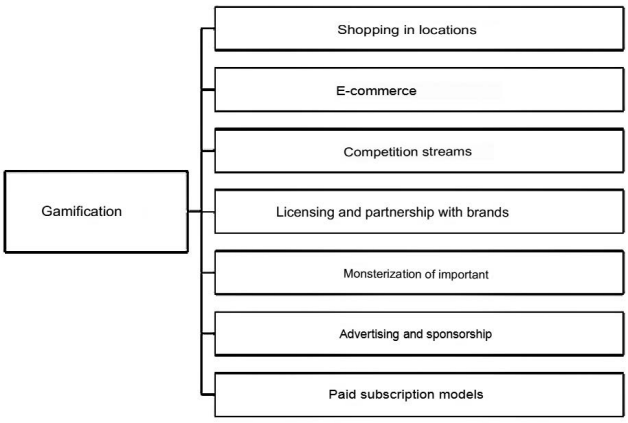


*Fig. 1. Commercial potential of gamification in the sports industry*

When creating and promoting game content in the sports industry, it is necessary to take into account the fact that maintaining the game process (engagement) and stimulating various categories of communication participants to further activity should be of a strategic nature. The interest of the target audience in the offers of a sports brand, generated by gamification tools and technologies, should have positive economic consequences for the organizers and initiators of promoting goods and services in this kind of creative format [10].

**Conclusions.** The comprehensive formation of consistent actions at the stage of developing and implementing the principles and technologies of gamification in the digital environment of sports marketing actualizes a multi-level approach, within the framework of which it is necessary to take into account both the specific features of the functioning of individual segments and entities of the sports industry, and the strategic goals of specific sports organizations. In this regard, the practical industry implementation of a marketing strategy with integrated elements of gaming techniques in the offline and online environment allows not only to attract the attention of certain categories of the target audience to an event, sports event, product or service, but also to create, using a creative approach, a long-term basis for promoting and positioning the positive reputation of a sports organization.

Thus, marketing communications, implemented including by means and methods of gamification, significantly strengthen the loyalty of the sports audience to the company, ensuring the creation of conditions under which consumers quickly move from the category of potential user to the status of "brand advocate".

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# Optimization of operational control in physical education using digital technologies based on heart rate indicators

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**Abstract**

**Objective of the study** is to substantiate the capabilities of digital tools in improving the operational control of physical activity during physical education classes.

**Methods and structure of the study.** The study involved girls and boys aged 15-16, who were students of the 10th grade, school GBOU No. 1505 "Preobrazhenskaya". The experiment took place within 5 months within the framework of the Athletics and Skiing blocks. The students were divided into control and experimental groups, in which the contents of the warm-up and the main part of the lesson differed. With the help of a fitness bracelet, the pulse of students was recorded, and using the formulas for the pulse value of exercises, the level of optimal load for each student was calculated.

**Results and conclusions.** The content of the exercises in the experimental group were more optimal and effective than in the control group. Fitness gadgets are an effective tool for teachers to optimize operational control in physical education lessons.

***Keywords:*** *operational control, fitness gadget, heart rate.*

**Introduction.** Pulse plays an important role in physical exercises, as it allows to determine the level of load in a timely manner, analyze the recovery time of the body of the person engaged [9]. In this regard, it is extremely important to keep a pulse chart during a physical education lesson. A pulse chart, which is determined by pulse diagnostics, is a method of operational control in physical education lessons in comprehensive schools [4]. Today, a fitness gadget is a relevant tool for measuring pulse.

**Objective of the study** is to substantiate the capabilities of digital tools in improving the operational control of physical activity during physical education classes.

**Methods and structure of the study.** The educational experiment was conducted at the State Budgetary Educational Institution of Moscow, School No. 1505 Preobrazhenskaya, as part of physical education lessons. The study involved 60 10th-grade students, divided into control (CG) and experimental (EG) groups using the randomization method while maintaining sample homogeneity by key parameters: age (15-16 years), level of physical fitness (based on the results of preliminary testing), gender composition (15 girls and 15 boys in each group). Both groups studied according to the standard program of V.I. Lyakh, corresponding to the current Federal State Educational Standard.

During the lesson, the following indicators were recorded using the Huawei band 6 fitness bracelet:

- Heart rate (HR) – at 5-second intervals.
- Duration of the exercise (active work time, pauses).
- Distance traveled (taking into account GPS data).
- Intensity of physical activity (calculated using the metabolic equivalent – MET).

Classes in the CG were conducted according to a standard plan without using data from fitness bracelets. In the EG, the teacher adjusted the load based on the analysis of data from the devices, which consisted of the following:

- individualization of tasks (selection of exercises taking into account the students' heart rate zones).

• optimization of the duration of lesson stages (warm-up, main part, recovery) based on the average values of the group's heart rate.

The pulse cost of the exercise (PCE) was calculated using the formula:

$$\frac{\text{PSU} = \text{Average heart rate} \times \text{Execution time (min)}}{1000}$$

For example:

A student ran for 10 minutes with an average heart rate of 140 bpm → PSU = 1.4. The standard for tenth-graders: 1.2–1.6 PSU per lesson. Corrective measures were taken: students with PSU<1.2 were given additional homework (e.g., a 15-minute warm-up monitored via a bracelet). Students with PSU>1.6 had their intensity reduced in the next lesson. Students received visualized reports (HR graphs, distance traveled, intensity zones achieved) to understand their results. The teacher also analyzed the rate of heart rate decrease after exercise (according to the pulse chart). If the heart rate dropped to the norm (>3 minutes), the proportion of aerobic exercise was reduced in the next lesson. Rapid recovery (<2 minutes) served as a signal to increase intensity.

The PSU results were used to assess energy expenditure and plan subsequent lessons. An example of a pulse chart for one of the students is shown in the figure.


*Pulsegram of student 1*

In the main part of the lesson, the EG and CG performed the Cooper test - running, after which they studied according to the curriculum - track and field.

As part of the operational control, testing of the participants in the pedagogical experiment was conducted. The Student t-test (or t-test) was chosen as the method for testing the hypothesis. The results of the initial testing of the participants in the pedagogical experiment showed that the differences in all parameters between the groups are insignificant, which indicates the same level of physical development, therefore, confirms the homogeneity of the sample. All students completed the track and field block for one and a half months. The control group studied mainly short-distance running: 30, 100, 200, and 500 meters.

**Results and conclusions.** The results of the experiment showed that the CG program had little effect on the work of the heart muscle.

At the same time, the EG revealed that the average pulse of the participants decreased significantly, the average indicator of the distance covered did not in-

*Table 1. Test results (Cooper Run Test) of the control group at the beginning and end of the experiment*

| Indicator | Results at the beginning of PE | Results at the end of the PE | Student's t-test | Reliability of differences, p |
|---|---|---|---|---|
| Pulse, bpm | 137 ± 7 | 136 ± 8 | 1,9 | > 0,05 |
| Distance, m (Cooper test, running) | 2508 ± 286 | 2541 ± 667 | 2,6 | > 0,05 |
| Pulse value | 666 ± 41 | 646 ± 33 | 0,4 | > 0,05 |

*Table 2. Results of the experimental group at the beginning and end of the experiment*

| Indicator | Results at the beginning of PE | Results at the end of the PE | Student's t-test | Reliability of differences, p |
|---|---|---|---|---|
| Pulse, bpm | 135 ± 9 | 130 ± 8 | 8,4 | > 0,05 |
| Distance, m (Cooper test, running) | 2481 ± 252 | 2548 ± 325 | 1,9 | > 0,05 |
| Pulse value | 660 ± 27 | 618 ± 50 | 2,8 | > 0,05 |

crease significantly (Table 2). Both of these indicators significantly affected the pulse cost parameter of the exercise, therefore, it can be concluded that the program of the experimental group had a positive effect on the level of endurance, as well as mild hypertrophy of the cardiac ventricles, since the stroke volume became higher.

**Conclusion.** The use of a digital device designed to assess pulse rates during physical activity helps to increase the efficiency of operational monitoring of the physical condition of those involved, and to correct the volume of the load and its intensity.

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# Multifunctional technology of the "Blurring Borders" project as a driving force for the growth of mass adaptive physical culture and sports

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**Abstract**

**Objective of the study.** The research aims to experimentally confirm the impact of the "Blurring the Lines" Festival on the development of adaptive physical education and improving the quality of life of students in the regions of Russia.

**Methods and structure of the study.** A scientific study was conducted at Plekhanov Russian University of Economics, which included the study of specialized literature, a comparison of the first and second "Blurring the Lines" festivals (2023 and 2024), the definition and explanation of their socio-cultural impact, as well as the development of conclusions and recommendations on the development of adaptive physical culture (AFC) in the regions of Russia.

**Results and conclusions.** Based on the quantitative and qualitative data obtained during the First and Second "Blurring the Lines" festivals, the positive socio-cultural impact of the project on the higher education system in Russia was scientifically substantiated. The festival promotes the development of mass adaptive physical culture by uniting the academic community and improving the socialization of students with special needs. The participation of military veterans, Paralympians and public figures expands the scope and significance of the project. The creation of a digital educational ecosystem provides a platform for the exchange of knowledge and experience. The expert community of the festival proposed scientifically sound measures for the further development of the AFC, including regular scientific and practical conferences and the Universiade "Blurring the Lines", as well as the organization of the III All-Russian Student Festival to promote the health and social adaptation of students.

***Keywords:*** *students with disabilities, adaptive physical education, socio-cultural processes, multi-sport technologies.*

**Introduction.** According to the results of the 1st All-Russian Student Festival of Adaptive Physical Culture and Sports "Erasing the Boundaries" (hereinafter referred to as the Festival), held in 2023, a great interest was revealed among students with disabilities and university coaching and teaching staff in various events of the Festival (27 universities from 18 constituent entities of the Russian Federation) [1].

At the panel discussions and working platforms of the scientific and practical conference "Erasing the Boundaries. Adaptive Physical Education and Adaptive Student Sports: New Development Trends" (June 2023), issues of involving students with various psychophysical limitations (with somatic diseases, disabilities and disabilities), the number of which is constantly increasing, in systematic adaptive physical education (APE) classes were discussed for successful adaptation to the modern educational space of the university. Students from 60 universities in 46 constituent entities of the Russian Federation (RF) took part in the II All-Russian Student Festival of Adaptive Physical Culture and Sports "Erasing the Edges" for higher education institutions (2024), which confirms the active and effective work of the Festival organizers and the expert inter-university community of teachers and coaches for the development of mass APC in universities (created within the framework of the 1st Festival) in promoting the mission of the Festival "Erasing the Edges" (development of mass physical culture in Russian universities) to other regions of the country to

attract new participants (students, teachers, coaches, volunteers, interested parties). There is a need to substantiate the significant socio-cultural effects of the Festival "Erasing the Edges" in the development of mass adaptive physical culture in the regions of the country for further replication of the experience of effective methodological and pedagogical practices in other constituent entities of the Russian Federation and other countries to improve the quality of life of young people with health problems and successful self-realization.

**Objective of the study** is to provide scientific and experimental substantiation of the significant socio-cultural effects of the Festival “Erasing the Boundaries” in the development of mass adaptive physical culture in the regions of the country and improving the quality of life of young people with health problems.

**Methods and structure of the study.** The study conducted at the Plekhanov Russian University of Economics included the following stages: analysis of special documentation; comparative analysis of the implemented Erasing the Edges Festivals (I Festival-2023 and II Festival-2024), identification and substantiation of the socio-cultural effects of the Erasing the Edges Festival, formulation of conclusions and proposals for the further development of mass AFC in the constituent entities of the Russian Federation. The conclusions were formulated on the basis of the presented events (video and photo reports, scientific, methodological and practical developments) from 60 universities in Russia.

**Results and conclusions.** At the first stage of the study, a scientific substantiation of the target groups of students participating in the Festival was conducted.

Initially, the term "persons with health problems" was introduced by the developers of the Federal State Educational Standard as a generalized concept (all those who have persistent health problems) [3].

In the Festival regulations, we use the following unification of students into the concept of "students with health problems" (Federal Law No. 273; Federal Law No. 181; Order of the Ministry of Health No. 514): students with disabilities (based on the PMPK); students with disabilities (based on the forensic medical examination); students assigned to a special medical group for physical exercise (SMG "A") due to their health condition (with temporary or permanent somatic diseases) [4].

The regulations and competition tasks of the Festival "Erasing the Boundaries" stipulate that students with health problems need adaptation of physical education (PE) and APE methods and means taking into account their interests, needs, psychophysical limitations and capabilities, as well as special conditions for quality education.

Accordingly, the competition tasks of the Festival for Russian universities are compiled taking into account the various capabilities of this category of students: a competition for the best health cases for students with somatic diseases (SMG "A"); a competition of successful practices in preparing students with disabilities and disabilities to pass the standards (tests) of the All-Russian Physical Culture and Sports Complex "GTO"; a competition of effective methods for preparing students with disabilities and disabilities to participate in competitions in adaptive sports and phygital sports, including in inclusive settings [1].

The culmination of both the 1st and 2nd Festivals, by tradition, is a multi-sport event that includes a summary of the methodological and practical experience in AFC in universities (reports with presentations); awarding of the winning universities; master classes in types of AFC, master classes in types of phygital sports (at the 1st Festival – phygital martial arts and phygital mini-golf, at the 2nd Festival – phygital basketball); expert platforms; competitions in phygital

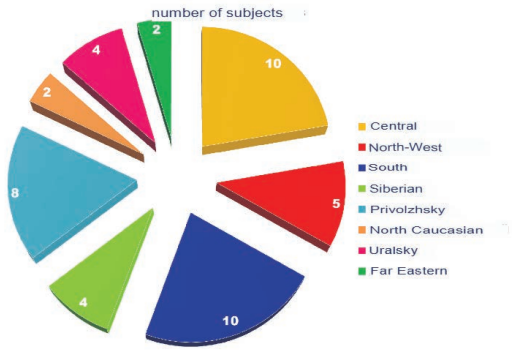
*Quantitative indicators of participation of Russian regions in the events of the All-Russian student festival "Erasing the Edges"*

| Quantitative indicators | I Festival 2023 | II Festival 2024 |
|---|---|---|
| Participants universities | 27 | 60 |
| Participants subjects of the Russian Federation | 18 | 46 |
| Participants: students with disabilities and special needs (students) | 15 412 | 27 169 |
| Participants students with disabilities (students) | 4 385 | 3 681 |
| Participants are students with disabilities (Paralympians) | - | 32 |
| Participants: students with disabilities (SVO participants) | - | 533 |
| Refresher courses | 8 | 12 |
| Number of issued certificates for the CPC (72 hours) | 234 | 257 |

mini-golf among students with health problems). One of the priority tasks of the "Erasing the Boundaries" Festival is the task of training qualified coaching and teaching staff to work with students with health problems, taking into account their psychophysiological and physical limitations and capabilities. Therefore, within the framework of the 1st Festival, 8 educational courses for advanced training (AAC) were presented to the pedagogical community; within the framework of the II Festival, 4 more educational additional professional courses were added to the existing CPC [2].

The development of mass physical culture in Russia through the prism of the main quantitative indicators of the Festival "Erasing the Edges" (a comparative analysis of the participants of the I Festival and II Festival) are presented in the table.

At the II Festival, 60 higher education institutions located in 50% of the constituent entities of the Russian Federation by federal districts presented their results on the development of adaptive physical education in the university space (see figure).




Festival participants by federal districts

Based on the results, we highlight the main qualitative results as socio-cultural effects of the Festival "Erasing the Edges" in the development of mass AFC in the constituent entities of the Russian Federation:

- Conducting master classes (on adaptive physical recreation and creative body-oriented practices, adaptive games (mini-volley), types of aqua fitness) allowed us to consider and summarize various directions for the further development of all types of mass AFC.

- Summarizing the results of the regional events of the Festival (presentations by university representatives) on the best practices for including students with health problems in AFC classes, the All-Russian Physical Culture and Sports Complex "GTO" events and competitions in adaptive sports showed the great potential of this category of student youth, both in the sports life of the university and the region, and in the socio-economic development of the country.

- Demonstration of phygital competitions organized in the space of universities in various types of phygital sports for students with disabilities, including in inclusive conditions, reveals enormous opportunities for the development of phygital sports in the physical education and sports environment of the university, both in mandatory physical education classes and in educational and training classes of the student sports club.

- Creation of a digital educational ecosystem (database) of effective scientific and methodological developments and pedagogical practices in AFC and adaptive sports, including types of phygital sports adapted to this category of students, creates opportunities to use data for the development of mass AFC in their regions and the replication of advanced pedagogical experience in other constituent entities of the Russian Federation.

- Expanding the panel of advanced training courses for Festival participants provides an opportunity: for coaches and teachers to improve the level of professional competencies; supplement the digital database of the CPC.

- The work of the academic community at the expert platform "Functional and digital development of mass adaptive physical education and sports in Russian universities" and the panel discussion "Digital educational ecosystem for adaptive physical education and sports" demonstrated a high level of involvement of teachers and coaches in the development of mass AFC in the country's universities (scientifically based proposals for organizing the III Festival "Erasing the Boundaries" were developed).

- Holding regional and final competitions in phygital mini-golf "Erasing the Boundaries" for students with health problems showed the possibility of scaling up competitions in adaptive sports and phygital sports, including technological sports, within the framework of the Festival.

- Participation in the events of the Festival of students and coaches (participants of the SVO) transfers the project "All-Russian student festival of adaptive physical education and sports "Erasing the boundaries" for educational institutions of higher education of various departmental subordination of the Russian Federation" to a higher social level of involvement of students and the pedagogical community of differ-

ent age and social strata in strengthening the health of the nation for the socio-economic development of the country.

**Conclusions.** Quantitative and qualitative indicators, as well as socio-cultural effects of the implementation of the 1st Festival and the 2nd Festival "Erasing the boundaries" in the constituent entities of the Russian Federation demonstrate the high efficiency of involving student youth with health deviations in adaptive physical education and adaptive sports events.

The expert inter-university community of the Festival (165 specialists and public figures) presented scientifically based proposals for the development of mass APC for the specified category of students:

- holding a scientific and practical conference "Erasing the boundaries" on a regular basis. Adaptive physical education and adaptive student sports: new development trends" in order to promote advanced scientific and practical pedagogical experience in higher education institutions;

- organizing and holding the Universiade in APC and sports "Erasing the Boundaries" as a necessary resource for recruiting national teams in Paralympic sports and participating in international competitions;

- organizing and holding on a regular basis the All-Russian student festival of adaptive physical education and sports "Erasing the Boundaries" to improve the quality of life of students and successful self-realization in modern society.

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# The use of adaptive physical culture in the comprehensive rehabilitation of children with cerebral palsy

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**Abstract**

**Objective of the study** is to identify the effectiveness of a comprehensive rehabilitation program for primary school children with cerebral palsy using adaptive physical education (APE) tools.

**Methods and structure of the study.** As part of an experiment conducted at Kursk boarding school No. 3, sixteen children (equally boys and girls) aged 7-9 years with a diagnosis of cerebral palsy (spastic diplegia, GMFCS level 1) were engaged in a special adaptive physical education program. This program consisted of three blocks: general development exercises, fitball exercises and water exercises, and was aimed at correcting motor disorders, developing coordination and forming correct posture.

**Results and conclusions.** The experiment, which included goniometry and pedagogical testing, demonstrated the positive effect of the developed program of comprehensive rehabilitation with AFC on the motor functions of the lower extremities. The subjects showed an increase in the angle of flexion in the hip joints and dorsal flexion in the ankle joint. In addition, the indicators of balance and performance of dynamic exercises (squats and walking) improved. The study confirms the effectiveness and expediency of using this AFC program in the comprehensive rehabilitation of primary school students with cerebral palsy, which is reflected in an increase in the time of balance, the number of steps and squats, as well as the amplitude of movements in the joints.

***Keywords:*** *disability, primary school students, adaptive physical education, cerebral palsy, comprehensive rehabilitation program, goniometry, pedagogical testing, fitball exercises, swimming.*

**Introduction.** According to the World Health Organization, the number of children with various forms of disabilities continues to grow, and one of the leading positions among diseases causing childhood disability is occupied by cerebral palsy (CP). CP unites a group of non-progressive neurological syndromes that arise as a result of damage or underdevelopment of the brain in the early stages of ontogenesis, which leads to persistent movement disorders such as paralysis and paresis, less often hyperkinesis, ataxia, as well as various speech and mental disorders and, as a consequence, to limitation of the child's life [2].

Despite the key role of medical rehabilitation in matters of restoring impaired body functions, the modern practice of rehabilitation of people with CP emphasizes the importance of an integrated approach that includes medical, psychological, social and pedagogical components. At the same time, a significant role is given to adaptive physical education (APE) – an area aimed at the use of specially selected physical exercises taking into account the health characteristics of the child [1].

That is why the Government of the Russian Federation approved the "Concept for the Development of a System of Comprehensive Rehabilitation and Habilitation of Disabled Persons, Including Disabled Children, in the Russian Federation for the Period up to 2025" [6].

The problem of rehabilitation of disabled persons with cerebral palsy is reflected in numerous medical

and pedagogical studies, which present the means of adaptive physical education [3, 4].

At the same time, the issue of using adaptive physical education in the comprehensive rehabilitation of patients with cerebral palsy remains insufficiently studied.

**Objective of the study** is to identify the effectiveness of a comprehensive rehabilitation program for primary school children with cerebral palsy using adaptive physical education (APE) tools.

**Methods and structure of the study.** The research was carried out at the Kursk Regional State Educational Institution Boarding School No. 3. The study involved 16 children (8 girls and 8 boys) aged 7-9 years with a diagnosis of cerebral palsy, spastic diplegia. The parents of the participants, in accordance with the Helsinki Declaration of the World Medical Association, which regulates the conduct of scientific research, signed an informed consent form for the examination [5].

The children belonged to level 1 according to the gross motor function classification system (GMFCS). Children walk at home, at school, outdoors and in public places. They are able to go up and down curbs without the physical assistance of another person, and can climb stairs without using handrails. They are able to run and jump, but their speed, balance and coordination of movements are limited. They can participate in sports games of their own choice and depending on environmental factors.

The subjects were divided into two groups (8 people each). The experimental group (EG) followed the developed program. The control group (CG) used traditional methods of exercise therapy.

The comprehensive rehabilitation program for patients with cerebral palsy includes three sessions per week using three groups of tools:

1. General development exercises (twice a week, in the gym): correction of support ability and feet (flexion and extension of toes, rolling from heel to toe, walking on a narrow support, etc.); development of balance (standing on one leg, walking along a line, an inclined plane, etc.).

2. Exercises with a fitball (as part of indoor classes): familiarization and basic elements (simple rolls, hand rests, sitting on a fitball). Formation of correct posture (keeping the back straight, control of the position of the feet). Special exercises (lying rests with support on the ball, "boat", "half-bridge", etc.).

3. Water exercises (once a week, in a pool): mastering water (walking and running along the bottom, breathing exercises). Game tasks ("crossing", "tag", "fishermen and fish", etc.), which stimulate the work of the muscles of the whole body and develop coordination.

**Results and conclusions.** To evaluate the effectiveness of the program, instrumental research methods and pedagogical testing were used.

To study the motor functions of the lower limbs, the goniometry method was used – an assessment of the motor function of the joints of the limbs by measuring the direction and amplitude of movement in them using a goniometer. The angular parameters of flexion / extension in the hip and ankle joints of the right and left legs were studied.

Pedagogical testing was carried out according to the following control tests:

- maintaining balance (support ability), standing on one leg (s);

- walking in place for speed in 1 minute (number of steps);

- squatting on two legs in 1 minute (number of squats).

Before the initial stage of rehabilitation, each child was examined for indicators of the functional state of the musculoskeletal system, concomitant diseases, and features of psychophysical development. According to the results of the study of goniometry indicators in the experimental group, a reliable ($p<0.05$) improvement in the angular flexion indicators in the hip joints was noted (from ~67–68° to ~92–93°). At the same time, dorsiflexion in the ankle joint improved by an average of 8–10%, which indicates greater mobility of the feet. In the control group, the changes were less pronounced (an increase of 3-7%).

Pedagogical tests demonstrated the following results:

- maintaining balance: the time of standing on one leg in the EG increased almost twice (from 4.0–4.5 sec to 8.9–9.7 sec), while in the CG – only up to 5.6–6.1 sec.;

- walking in place (1 min): in the EG the number of steps increased from 50.2±0.6 to 66.8±0.6, in the CG – from 48.7±0.6 to 54.9±0.6;

- squats (1 min): in the EG – from 16.1±0.4 to 22.9±0.4, in the CG – from 16.3±0.4 to 19.6±0.4.

**Conclusions.** The developed rehabilitation program based on physical culture (general development exercises, exercises with a fitball, water exercises) contributes to a significant improvement in the functional state of the musculoskeletal system of children

with cerebral palsy. This is expressed in an increase in the angle of flexion in the hip joints, improved dorsiflexion in the ankle joint, as well as an increase in the ability to maintain balance and perform dynamic loads (squats, walking). The results of the study confirm that the systematic use of the indicated AFC means can increase the effectiveness of complex rehabilitation of children aged 7-9 years with cerebral palsy, improving their motor abilities and creating the preconditions for further social and educational integration.

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# Formation of personal and team skills among students of humanities during swimming lessons

UDC 797.2

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**Abstract**

**Objective of the study** is to substantiate the use of swimming facilities for the development of personal and social qualities of students in an educational environment.

**Methods and structure of the study.** The purpose of the scientific research conducted at the Don State Technical University during one semester was to determine the degree of influence of regular swimming training on the development of key personal qualities such as self-discipline, responsibility, teamwork and sociability. The study involved 60 students of the Faculty of Humanities, who made up an experimental group that regularly attended swimming classes.

**Results and conclusions.** Research has shown that swimming promotes the development of personal qualities of students of humanities and improves their interaction skills. Systematic training increases self-confidence and a sense of responsibility, both for one's own actions and for the well-being of the group. The example of self-discipline demonstrated by the participants motivates other students to take a more responsible attitude towards their studies. Group classes strengthen team spirit, a sense of belonging and mutual understanding between students.

***Keywords:*** *individual and collective qualities of students, swimming, effectiveness of swimming lessons, personal qualities, social skills.*

**Introduction.** The problem of developing students' personal qualities and social skills in the process of their education and upbringing occupies a central place in pedagogical and psychological research. Particular attention is paid to physical activity as a tool for harmonious development of personality.

According to research, physical activity is an effective tool for developing personal characteristics such as determination, self-control and stress resistance. Scientists emphasize that regular exercise improves cognitive abilities, develops emotional stability and contributes to the formation of motivation for self-development [3].

Humanities specialties require the development of interpersonal skills, empathy and communicative competence in students. Physical education, integrated into the educational process, stimulates the manifestation of such qualities as responsibility, mutual respect and collectivism.

Swimming stands out among other sports for its versatility. Exercises in water contribute to the development of physical endurance, coordination of movements and psycho-emotional stability. Water creates unique conditions that help reduce stress and increase concentration, which is especially important for students under intellectual stress [1, 5].

The authors' works emphasize that swimming helps strengthen interpersonal ties in a group. During training, students learn to cooperate, support each other and solve problems together. This is the basis for developing the qualities necessary for interaction in a team, such as trust, mutual understanding and the ability to work in a team.

Swimming is actively used to prevent stress and psycho-emotional disorders. According to research, systematic training in water helps improve overall well-being, increase endorphin levels and reduce anxiety. An important aspect is the combination of aerobic exercise with the gentle impact of water, which minimizes the risk of injury and allows people with different levels of physical fitness to swim [2]. At the same time, there is a relationship between swimming and the development of volitional qualities. The ability to overcome physical difficulties in water is directly related to increased self-confidence and the development of independence. Research shows that students who engage in swimming demonstrate higher rates of psychological stability and the ability to adapt to change. Swimming also increases life satisfaction and strengthens personal resources [4, 5]. Despite the fact that swimming has the potential to develop students' personal qualities and social skills, there are still open questions about adapting swimming methods for humanities majors, as well as studying the long-term impact of this activity on students' personal development.

**Objective of the study** is to substantiate the use of swimming facilities for the development of personal and social qualities of students in an educational environment.

**Methods and structure of the study.** The research was conducted over the course of one semester (12 weeks) at the Don State Technical University. The experiment involved 60 students from the Humanities Department, divided into two groups: the experimental group: 30 students who regularly attended swimming classes and the control group: 30 students who continued to participate in standard physical activity not related to swimming.

Each lesson lasted 60 minutes and included three stages: 1. Warm-up on land (10 minutes). 2. The main part (40 minutes): performing exercises aimed at developing physical qualities, coordination and teamwork. 3. The final part (10 minutes): relaxing exercises in the water. The 12-week program of swimming classes for students included both individual and group exercises.

The main focus is on determining the impact of regular training on such qualities as self-discipline, responsibility, teamwork and communication skills. The testing used standardized psychological tests, such as the Cattell Personality Inventory, as well as methods for assessing teamwork.

**Results and conclusions.** Before the experiment, an analysis of the initial level of students' personal qualities and teamwork skills (social skills) was conducted, which showed that they were developed at an average level. No differences were found between the experimental and control groups before the program ($p > 0.05$) (see table).

After 12 weeks of swimming, significant changes were recorded in the experimental group:

- self-discipline: participants in the experimental group demonstrated an increase of 28% ($p<0.01$), while in the control group the changes were insignificant (+ 5%, $p > 0.05$).

- self-confidence: according to test data, this indicator in the experimental group increased by 21% ($p<0.01$). Participants noted that regular swimming helped them overcome their fear of water and improve their self-esteem.

- teamwork skills: indicators increased by 34% in the experimental group ($p<0.01$), which indicates a better ability of participants to interact and coordinate in group tasks. - communication skills: the experimental group demonstrated an increase of 17% ($p<0.05$). Participants noted that performing joint exercises in the water contributed to the improvement of communication skills.

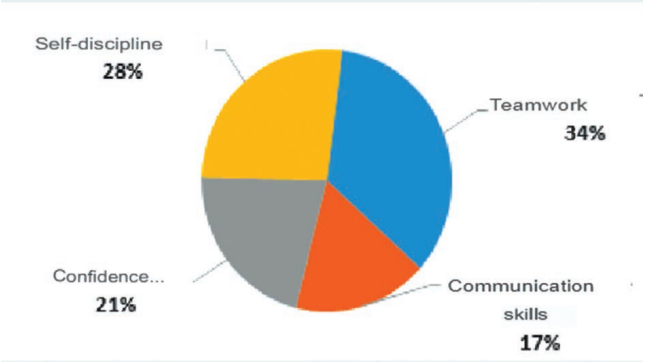
A comparative analysis of the diagnostic results of the experimental and control groups revealed reliable

*Indicators of the state of development of personal qualities and social skills of participants in the CG and EG*

| Group | Before the experiment | | | |
|---|---|---|---|---|
| | Self-discipline | Self-confidence | Teamwork | Communication skills |
| Experimental | 3,5 | 3,6 | 3,7 | 3,4 |
| Control | 3,4 | 3,5 | 3,6 | 3,3 |
| **Group** | **After the experiment** | | | |
| | Self-discipline | Self-confidence | Teamwork | Communication skills |
| Experimental | 4,3 | 4,2 | 4,7 | 3,9 |
| Control | 3,5 | 3,6 | 3,7 | 3,4 |

differences between them in the measured indicators (see table).

After completing the program, the students in the experimental group shared their opinions about swimming lessons. In particular, they noted that they began to understand each other better, to take initiative more often, and to cooperate in a team. Most students emphasized that swimming became a way for them to relieve stress and improve their mood (see figure).




*Percentage changes in the experimental group*

**Conclusions.** The study found that for students majoring in the humanities, swimming is one of the effective tools for developing personal qualities and teamwork skills. Systematic classes stimulated the personal growth of the participants, which was expressed in an increase in self-confidence, as well as responsibility for their actions and for other members of the student body. Demonstrating self-discipline to other members of the study group contributed to a positive change in their attitude towards learning. Group classes led to stronger cooperation between students, an increased sense of belonging to the team and mutual understanding.

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# Design technology of students' sports training based on martial arts classes in physical education at the university: theoretical aspect

UDC 796

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**Abstract**

**Objective of the study** is to theoretically substantiate and develop program and methodological content of the technology for designing sports training for female students based on martial arts classes in physical education at the university and recommend it for practice.

**Methods and structure of the study.** The experimental base of the research is the Russian Timiryazev State Agrarian University.

Over the course of two years, a sociological survey and questionnaire survey of students and teachers of the university was conducted on the subject of designing a sports-specific approach to physical education of modern student youth. Also, an analysis of scientific and methodological literature on the topic of the study was carried out, factual material was formed, and the theoretical content of the experimental technology for designing sports training for female students in physical education at the university was built and filled.

The program and methodological support of the pedagogical technology of designing sports training for female university students based on martial arts classes was developed. The organizational and methodological algorithm for including sports training for female students in physical education at the university was formed.

**Results and conclusions.** Based on the preliminary theoretical study, it was revealed that only no more than 10% of students from the total number of students are involved in sports at the university, including 3% of girls. At the same time, the Government of the country has planned the need to involve up to 70% of student youth in active physical education and sports by 2030.

The conducted sociological analysis and survey showed that 80% of teachers and 90% of students are not against physical education at the university being sport-oriented. Based on the results of the conducted theoretical study, a program and methodological support for the pedagogical technology of sports training for female students based on martial arts classes in physical education at the university was developed.

Also, an organizational and methodological algorithm for the implementation of theoretical developments of experimental technology in physical education at the university has been formed.

***Keywords:*** *technology, design, sports training, physical education, university, female students, martial arts, software and methodological support*

**Introduction.** Currently, one of the basic socio-educational tasks of the state is to improve the program content of physical education and sports in the country's universities. All this is due to the strategy of socio-economic development of the Russian Federation for the period up to 2030, which defines the important role of physical education and sports in the development of human potential in Russia. The inclusion of sports-oriented physical education of students, classes in sports will contribute to the formation of a sports culture in young people, the development of individual psychophysical potential, the formation of stable motor skills and abilities for systematic classes in a chosen sport throughout their life, etc. At the same time, human life safety is of particular importance in the modern world. In state documents defining the principles of policy in the field of physical education and sports in the Russian Federation, phys-

ical education and sports are considered as one of the means not only to strengthen health and maintain high human performance, but also to form people's readiness to protect themselves and their loved ones from various forms of violence.

Recently, the number of crimes has been growing, where women, girls, children, and the elderly are the victims. The aggressor chooses females because they are less protected and are in a vulnerable position. The female body can easily be subject to violence, while only a small percentage of girls can protect themselves from criminals, since they are not prepared either physically or psychologically. All this as a whole determined the relevance and necessity of developing a technology for sports training of female students in physical education at a university.

**Objective of the study** is to theoretically substantiate and develop program and methodological content for the technology of designing sports training for female students based on martial arts classes in physical education at the university and recommend it for practice.

**Methods and structure of the study.** The experimental research base is the Russian Timiryazev State Agrarian University.

Over the course of two years, a sociological survey and questionnaire survey of students and teachers of the university was conducted on the subject of designing a sports-specific approach to physical education of modern student youth. Also, an analysis of scientific and methodological literature on the topic of the study was carried out, factual material was formed, and the theoretical content of the experimental technology for designing sports training for female students in physical education at the university was built and filled.

A program and methodological support for the pedagogical technology for designing sports training for female university students based on martial arts classes was developed. An organizational and methodological algorithm for including sports training for female students in physical education at the university was formed.

**Results and conclusions.** Upon completion of the preliminary theoretical study, a pedagogical technology for the sports training of female students based on martial arts classes in physical education at the university was developed, which includes the following stages of operation:

Stage 1 (September-October) – selection and testing of first-year female students for martial arts classes;

Stage 2 (November-May) – basic sports training based on martial arts classes;

Stage 3 (second-year students, September-May) – advanced sports training;

Stage 4 (third year, September-May) – improving sports fitness;

Stage 5 (fourth and fifth years, September-May) – systematic sports training, participation in various

*Table 1. Program and methodological content of support for the technology of sports training of female students at the university*

| No. | Contents of program sections | Time | Courses | | | | Total hours |
|---|---|---|---|---|---|---|---|
| | | | I | II | III | IV-V | |
| I | Theoretical foundations of martial arts | 4 | 1 | 2 | 1 | - | 4 |
| | Modern types of martial arts | 1 | 1 | - | - | - | 1 |
| | Applied focus of martial arts training | 1 | - | 1 | - | - | 1 |
| | Martial arts as a means of safe human life | 1 | - | 1 | - | - | 1 |
| | Martial arts in physical development of student youth | 1 | - | 1 | - | - | 1 |
| II | Practical foundations of martial arts training | 290 | 85 | 85 | 60 | 60 | 290 |
| | 2.1. General physical training (GPT) | 110 | 40 | 30 | 20 | 20 | 110 |
| | 2.2. Special physical training (SPT) | 130 | 30 | 40 | 30 | 30 | 130 |
| | 2.3. Technical training | 50 | 15 | 15 | 10 | 10 | 50 |
| | 2.4. Psychological preparation | 25 | 5 | 5 | 5 | 10 | 25 |
| | 2.5. Tactical training | 30 | - | 5 | 10 | 15 | 30 |
| III | Control testing of sports fitness | 51 | 5 | 10 | 14 | 22 | 51 |
| | 3.1. General physical fitness testing | 8 | 2 | 2 | 2 | 2 | 8 |
| | 3.2. SFP testing | 12 | 3 | 3 | 3 | 3 | 12 |
| | 3.3. Control competitions | 15 | - | 3 | 5 | 7 | 15 |
| | 3.4. Participation in competitions | 16 | - | 2 | 4 | 10 | 16 |

student sports competitions, achieving sports categories, designing a sports culture in future social and professional life.

Table 1 presents the program and methodological content of the pedagogical technology of sports training of female students based on martial arts classes in physical education at the university.

The presented program and methodological material for the sports training of female students is consistently implemented by the years of study, where in the first year, recruitment, selection, general physical training and basic sports training are carried out; in the second year – in-depth sports training; in the third – improving sports preparedness and in the 4-5 years – participation in competitions, achieving sports categories, etc.

**Conclusions.** The conducted theoretical work allowed us to collect sufficient factual material that contributed to the development of program and methodological content to support the technology of sports training of female students based on martial arts classes in physical education at the university; to form an organizational and methodological algorithm for the implementation of the experimental technology.

All this as a whole allowed us to update and prepare a scientific and methodological base for the implementation of the theoretical idea in practice.

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# Complex approach in the process of physical education physical education of foreign students of technical specialties

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**Abstract**

**Objective of the study** is to increase the level of physical fitness of foreign students using an integrated approach in the educational process. The object of the study is the process of physical education of foreign students in higher education institution. The subject of the study is the physical training of foreign students of the faculty "Aircraft Engineering" within the discipline "Physical Culture and Sports".

**Methods and structure of the study.** The pedagogical research was organized in DSTU "Don State Technical University" Rostov-on-Don by the teaching staff of the department "Physical Culture and Sports and Recreational Technologies" within the framework of the educational process in the discipline "Physical Culture and Sports".

**Results and conclusions.** As a result of using an integrated approach to conducting physical education classes in the experimental group there was no significant difference in the level of physical fitness in relation to the control group. The problem of physical fitness of both foreign and Russian students, on our example, should be solved by increasing the number of practical classes in physical culture. Large breaks between classes can be the result of readaptation – return to the previous level of physical performance.

***Keywords:*** *physical education, international students, integrated approach.*

**Introduction.** At present, physical education, as evidenced by this, acts as an underestimated process of teaching young people. The age of globalization, digitalization, consumer culture forms other ideas about the value of one's own health, the physical development of an individual throughout life, maintaining proper physical fitness, which acts as a guarantee of optimal functioning of all body functions. In addition to this problem, it should be noted that there is a lack of physical activity of a modern student at all stages of training, mastering "insufficient" knowledge in the field of physical education and sports, which is the result of a low health culture. Attempts made in the last decade by the Russian education system to reform physical education programs for students have proven to be ineffective [1-3].

To achieve the main objectives of physical education, namely: increasing the level of physical fitness, forming a motivational and value-based attitude towards physical culture, physical self-education and self-improvement, mastering the skills and abilities that ensure the preservation and strengthening of health, etc., the teacher must rationally use the allotted time and search for the most optimal approaches to physical education and health improvement of students. In the study, we touched upon the category of foreign students, where the issue of physical education is most acute.

This is due to the difference in previously mastered physical education programs in their country with the programs of the Ministry of Education of the Russian Federation and the period of adaptation in the new educational space.

**Objective of the study** is to improve the level of physical fitness of foreign students using an integrated approach in the learning process.

**Methods and structure of the study.** The research work was organized at DSTU "Don State Technical University" in Rostov-on-Don by the teaching staff of the Department of Physical Education and Sports and Health Technologies within the framework of the educational process of the discipline "Physical Education and Sports". The participants of the experiment were students of six groups, first-year young men of the Faculty of Aircraft Engineering, where three groups were designated as experimental (EK) and three as control (CG). All subjects were assigned to the main and preparatory health groups and have no contraindications to physical education classes. According to the educational program at DSTU, physical education classes are held once a week for 90 minutes. Students assigned to a special medical group for health reasons (according to the conclusion issued after passing a medical examination) are engaged in a different program.

The control group included 15 foreign and 15 students from Russia, the experimental group was formed in a similar way. Classes in the control group were held according to the generally accepted program in all sections once a week. In classes with students assigned to the experimental group, an integrated approach was mainly used, which was expressed in the creation of a gaming and competitive environment by means of sports, outdoor and folk games. Fitness technology tools were used in combination with general physical training (GPT) from martial arts, athletic gymnastics, athletics with alternating exercises within the framework of competitive, variable, game methods. The integrated approach also involved creating conditions for self-realization and self-determination of motor activity with an independent choice of means and methods of physical development under the supervision of a teacher.

The pedagogical experiment was conducted from 09/15/2023 to 06/10/2024, at the beginning and at the end of the experiment, all participants were tested for their level of physical fitness. Research methods: analysis of literature in electronic scientific sources (elibrary.ru, cyberleninka.ru, scholar.ru, scholar.google.com), pedagogical experiment, pedagogical testing, methods of mathematical statistics.

**Results and conclusions.** Based on the results of the experiment, diagrams were compiled displaying quantitative data on the level of physical fitness of students in the CG and EG divided into foreign students and students from Russia. The subjects performed the following tests (standards): 100-meter run, 3x10-meter shuttle run, pull-ups on a high bar, 16 kg kettlebell snatch (number of repetitions in 4 minutes), standing long jump, forward bend from a standing position on a gymnastic bench, jumping rope (number of times in 1 minute). The results obtained during the experiment were reduced to an average value for each test using the formula $x=(X_1+X_2+X_3+...+Xn)/n$. (X1, X2, X3,...Xn – individual student result, n – total number of results (Fig. 1-6).

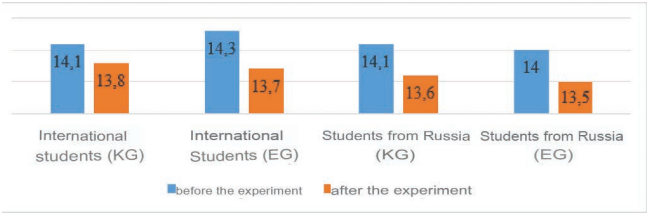


*Fig. 1. Results of the 100-meter run test*

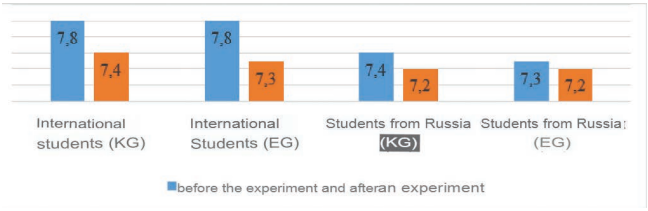


*Fig. 2. Results of the 3x10 meter shuttle run test*

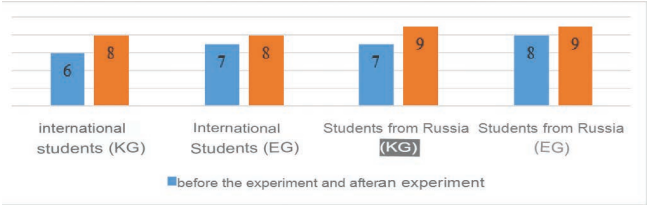


*Fig. 3. Results of the high bar pull-up test*

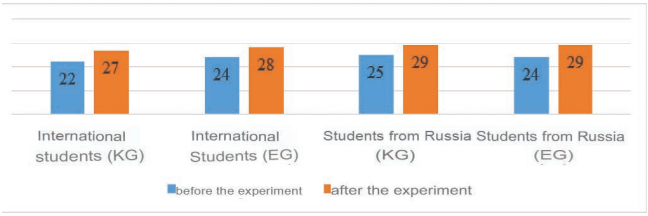


*Fig. 4. Results of the 16 kg kettlebell snatch test for 4 minutes*

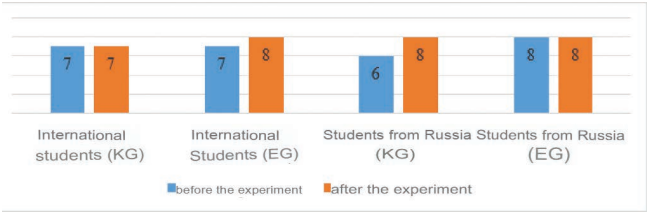


*Fig. 5. Results of the incline test on a gymnastic bench*

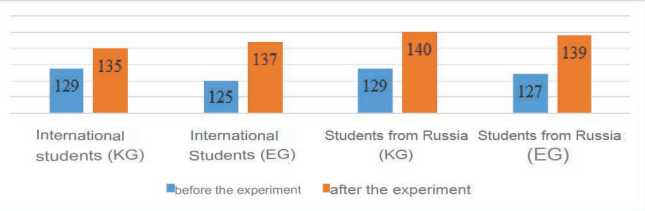


*Fig. 6. Results of the jump rope test for 1 minute*

**Conclusions.** After analyzing the available numerical data, we conclude that the result of using an integrated approach in physical education classes in the experimental group did not reveal a significant difference in the level of physical fitness in relation to the control group.

The problem of physical fitness of both foreign and Russian students, in our example, should be solved not only by searching for rational approaches, means and methods in physical education, but also by increasing the number of practical classes in physical education, at least three times a week for 90 minutes. This will meet the principle of consistency and continuity, which is expressed in regular physical education classes, with a rational alternation of load and rest. Long breaks between classes can be the result of readaptation – a return to the previous level of physical performance.

Fulfilling the task of improving the motor abilities of students and increasing the level of functional fitness of students requires reforming the physical education program in relation to the number of classes and time allocated to the subject "Physical Education and Sports" at the university.

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# Science without borders: from the icy expanses of the North to Chinese megacities

UDC 001.8:327

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**Abstract**

**Objective of the study** is to analyze and summarize the research conducted within the framework of the scientific school on the problems of physical culture and sports in the Sakha Republic.

**Methods and structure of the study.** An analysis of scientific and methodological literature, a method of comparison and contrast, theoretical analysis and analytical review of scientific publications and the results of intellectual activity obtained within the framework of the scientific school of the Republic of Sakha were conducted.

**Results and conclusions.** From 2011 to 2025, research on the theory and methodology of training athletes in mas-wrestling, Thai boxing, basketball, golf and athletics was carried out within the framework of the FKiS scientific school in Yakutia. In addition, the history and development of the Yakut national wrestling khapsagai, as well as issues of ethnopedagogical education of a healthy lifestyle and recreational physical culture were studied. During this period, seven dissertations were defended, including six candidate's and one doctoral dissertations, in specialties related to the theory and methodology of physical education, sports training, general pedagogy and the history of pedagogy.

***Keywords:*** *scientific school, Sakha Republic, dissertation, results of intellectual activity, theory and methods of training athletes.*

**Introduction.** At the present stage of development of theory and methodology of sports, the training of highly qualified competitive, creative specialists regularly engaged not only in educational and coaching, but also in scientific activities, working in higher educational institutions of physical education profile remains relevant. Involvement in scientific research, search for new problems and ways to solve them are becoming more and more difficult every year due to the extensive accumulated experience of domestic and foreign leading specialists in the field of physical education and sports [2].

Historically, in the largest and coldest subject of Russia, located in the Far North – in the Sakha Republic, interest in scientific research in the field of physical education and sports is concentrated in two higher educational institutions – IPCSSVFU named after M.K. Ammosov and ChGIFKiS, which is confirmed by regular publications in scientific journals of the Russian Federation, obtaining patents for utility models and inventions. Thanks to scientific mentors, a new generation of scientists is involved in the world of science, defending dissertations. However, the number of scientific schools headed by mentors from local residents does not show positive dynamics every year.

Over the past 15 years, the school of Doctor of Pedagogical Sciences, Professor I.A. Cherkashin has borne fruit in the form of new candidates and doctors of science. The study of scientific directions and research conducted under the supervision of the professor in the Republic of Sakha and beyond its borders – in the PRC, over the past 15 years will allow us to identify the priority areas of this school. Professor I.A. Cherkashin turns 55 this year.

**Objective of the study** is to analyze and summarize the research conducted within the scientific school on the problems of physical culture and sports in the Republic of Sakha.

**Methods and structure of the study.** An analysis of scientific and methodological literature, a method of

comparison and contrast, theoretical analysis and analytical review of scientific publications and the results of intellectual activity obtained within the scientific school of the Republic of Sakha were conducted.

**Results and conclusions.** In 2016, one of the first dissertations on mas-wrestling in specialty 13.00.04 was defended under the supervision of Doctor of Pedagogical Sciences, Professor I.A. Cherkashin (on the same day, two applicants from the Sakha Republic, A.A. Zakharov and E.P. Kudrin, defended their dissertations on mas-wrestling in the Dissertation Council of the Moscow State Academy of Physical Culture and Sport). Since 2011, this defense was preceded by E.P. Kudrin's research under the supervision of a scientific supervisor, aimed at developing technical and tactical actions of qualified athletes in mas-wrestling using technical equipment. A methodology for developing technical and tactical actions was developed, the "Lower Pull" simulator was modified for the parallel development of technical and tactical actions and physical fitness, for which a patent for a utility model was obtained, and criteria for assessing the development of technical and tactical actions of qualified athletes in mas-wrestling were developed [4].

During the same period, P.P. Okhlopkov conducted research on the problem of physical training of athletes in Thai boxing at the training stage, as a result of which a combined test was developed to determine the level of SFPti of qualified athletes, a methodology for the integrated assessment of FPti, which includes a set of pedagogical tests, differentiated assessment scales, an algorithm for testing and identifying the level of preparedness of athletes; a methodology for the physical training of athletes of light weight categories in Thai boxing was developed, a patent for a utility model was obtained. The result of this research was the defense of the dissertation of P.P. Okhlopkov under the supervision of I.A. Cherkashin in 2017 [7].

From 2015 to 2020, under the supervision of the professor, scientific research is being carried out on the development of the Yakut national wrestling hapsagay and the implementation of the historical and pedagogical experience of practicing this sport in the modern practice of physical education. In this direction, I.I. Druzyanov defended his dissertation in 2020. The research made it possible to specify the conditions for the development of the hapsagay wrestling, which include natural and climatic, ethnic, historical ones, and also determined the place of the hapsagay wrestling in the physical education of students, as a combat sport with its own customs and traditions, occupying one of the leading positions in the ethnopedagogy of the Sakha people; the main ways of developing the hapsagay wrestling were outlined [3].

A year later, another representative of the Sakha people, S.I. Gavriliev, defended his dissertation, whose research, under the supervision of I.A. Cherkashin, was devoted to the issues of organizing health-improving classes with elements of tennis for men aged 40-49. In the period from 2015-2021, research was conducted on health-improving physical education: the structure and content of the program of health-improving physical education classes using elements of tennis for men aged 40-49 were developed, aimed at correcting their physical condition, taking into account the level of physical and functional fitness; Differentiated scales for assessing the physical fitness of men aged 40-49 years have been developed, which make it possible to increase the effectiveness of monitoring those involved, determine the level of general and special physical fitness and heart rate variability indicators of men aged 40-49 years, for which certificates of database registration have been received [1].

In the field of health-improving physical culture, research was conducted by a graduate student from the PRC, Huang P., who defended his dissertation in 2022. He studied the effects of martial arts on the physical condition of mature men who lead a sedentary lifestyle and are overweight and obese. The positive effect of the integrated use of Muay Thai elements, strength exercises, and Tai Chi Qigong in the training process of men aged 40-60 who lead a sedentary lifestyle on heart rate variability, general physical fitness, body composition, and the risk of sudden cardiac death in those involved was determined [8]. Another representative of the Celestial Empire, Cai Ch., who devoted her research to women's sports, in particular the training of female athletes in Thai boxing, taking into account the characteristics of the female body, defended her dissertation in 2023 in specialty 5.8.5. During 2019–2023. The applicant conducted research to determine the heart rate variability indicators in female athletes at rest and after exercise, to identify the features of the external respiration function, as well as the SFPti indicators in different phases of the OMC in the annual training cycle; the author developed a basic mesocycle in the preparatory period, taking into account the features of the cardiovascular, autonomic nervous systems, external respiration function, SFPti in different phases of the OMC of female athletes [9].

In the period from 2018 to 2025, graduate students from the PRC under the supervision of Professor I.A.

Cherkashin conducted scientific research aimed at studying the pedagogical features of the use of Tai Chi Chuan in the training of amateur basketball players to improve the effectiveness of throwing the ball into the basket, increasing the effectiveness of the general physical training of children involved in golf at the initial stage, finding ways to improve physical fitness, functional and psychophysiological state of 400 m runners using oriental breathing practices. The results of the above studies are reflected in scientific articles of leading domestic and international scientific journals [5, 10, 11, 12]. It should be noted that in 2022, N.P. Olesov defended his doctoral dissertation in specialty 5.8.1. on the topic "Ethnopedagogical system of education of a healthy lifestyle of students: concept, model and practice (on the example of the Republic of Sakha (Yakutia)" [6, 7].

**Conclusions.** Within the framework of the scientific school on physical education and sports in the Sakha Republic for the period from 2011 to 2025, studies were conducted on the theory and methods of training athletes in mas-wrestling, Thai boxing, basketball, golf, track and field, on the history of the formation and development of the sport – Yakut wrestling hapsagay, the ethnopedagogical system of education of a healthy lifestyle of students and health-improving physical culture. Such aspects of sports training as technical and tactical actions of mas-wrestlers using technical means, physical training of qualified athletes in Thai boxing and children involved in golf, the use of Tai Chi Chuan to improve the effectiveness of throwing the ball into the basket and the oriental breathing practice "Baduanjin" to improve the functional capabilities and psychophysiological state of 400 m runners, planning physical activity taking into account the physiological characteristics of the female body in the mesocycles of training were studied. Based on the results of scientific activity, 7 dissertations were defended in scientific specialties 13.00.04, 5.8.5, 5.8.1.

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# Cultural code in sports: definition, functions, types and categories

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**Abstract**

**Objective of the study** to substantiate and formulate the term "cultural code in sports", define its functions, and also identify the relationship between its types and categories.

**Methods and structure of the study.** In the course of the research, the following methods were applied: general (collection and analysis of scientific research and the available source base on the problem under consideration), general logical (generalization, comparison, analogy, comparison, systematization, etc.).

**Results and conclusions.** The authors indicate that the cultural code in sports is a multifunctional system. The following functions have been identified and defined: accumulative, diplomatic, identification, image, integrative, communicative, cognitive, aesthetic, which are responsible for preserving the ideals and values of sports, creating a favorable friendly atmosphere in the sports arena, and are aimed at uniting people for the implementation of cultural interaction.

Based on the system analysis of the totality of components of the cultural code, a structure of the relationship between the types and categories of the cultural code in sports has been developed.

***Keywords:*** *cultural code in sports, classification of cultural code, functions, meaning, types, categories, relationships.*

**Introduction.** Currently, the importance of sports in the system of values of world culture has increased significantly. Through sports activities, not only problems of a sports nature (development of physical qualities, strengthening health, preparation for professional activity, etc.) are solved, but also spiritual, moral, ethical and aesthetic ones.

At present, the national interests of the Russian Federation are: "preservation of the identity of the multinational people of the Russian Federation; support of public projects aimed at patriotic education of citizens, preservation of the tangible and intangible cultural heritage of the Russian people, popularization of the achievements of Russian science and technology, literature, art, music and sports." Thus, there is an increase in the spiritual potential of Russian culture, without which it is impossible to ensure the stability, sustainability and viability of the state and society.

The key category, which serves as the foundation of the cultural system, is the "cultural code", to which the President of the Russian Federation V.V. Putin has repeatedly drawn attention [1]. The theoretical and methodological basis of the study was formed by fundamental works of domestic and foreign scientists in the field of history and current issues of sports and the Olympic movement, philosophical, sociological, cultural foundations of physical culture and sports, as well as works devoted to understanding the concept of "cultural code", a number of scientific methods and approaches within the framework of the theory and history of culture.

**Objective of the study** – the purpose of the study is to substantiate and formulate the term "cultural code in sports", to determine its functions, as well as to identify the relationship between its types and categories.

**Methods and structure of the study.** In the course of the research, the following methods were

applied: general (collection and analysis of scientific research and the available source base on the problem under consideration), general logical (generalization, comparison, analogy, comparison, systematization, etc.).

**Results and conclusions.** Based on the conducted analysis of the source base devoted to the cultural code, it was revealed that this concept is found in philosophical, cultural, philological, sociological and semiotic works that reflect its various aspects, from the point of view of a specific science: N.N. Izotova, B.I. Kononenko, V.V. Krasnykh, N.G. Kurilo, Yu.M. Lotman, U. Eco and others [3, 2, 4-8].

Sociologists focus on the influence of the cultural code on the behavior and interaction of people; cultural scientists consider it as the basis of cultural identity and worldview; philologists attribute to it the features of language, speech genres, stylistic devices that reflect cultural values; semioticians study the sign systems and symbols that form the cultural code [2].

The theoretical analysis of the source base allowed us to state the absence of relevant scientifically substantiated systematized data in the field of terminological approaches, which determined the objective need to define the term "cultural code in sports" and develop its concept; as well as to define and systematize its functions and their meaning, types and categories. Taking into account some inconsistency of existing definitions, we were the first to identify, formulate and scientifically substantiate the term "cultural code in sports", defining the socio-cultural approach as a basis – consideration of the system of cultural coordinates that ensure the transmission of socially significant meaning necessary for mutual understanding of people, social control of their actions and thinking [5].

The object of definition or the defined phrase is the cultural code in sports. The defining part is a combination of meanings and symbols expressed in a system of images, sounds, signals. Essential, specific distinctive features: preservation, transmission, promotion, formation, maintenance, development.

Thus, in our opinion, the cultural code in sports is a set / combination of meanings and symbols expressed in a system of images, sounds, signals, including art, religion, traditions and rituals, norms and rules, values and beliefs created in the course of the development of society, which are manifested in the process of holding competitions, including opening and closing ceremonies, and contribute to the preservation and transmission of cultural heritage, promotion of the national image in the international arena, the formation of ethical and moral standards in sports, promoting the maintenance of humane relations between participants and fans and the development of the sports community as a factor in intercultural interaction.

The essence of any phenomenon can be understood and explained through the definition of its functions. Based on theoretical analysis, generalization, system analysis, we identified the functions of the cultural code in sports and their meaning, presented in Table 1.

*Table 1. Functions of the cultural code in sports and their meaning*

| Function | Meaning |
|---|---|
| Accumulating | The role of "memory", the content and preservation of spiritual values of a universal and national nature, which are transmitted and broadcast within the framework of a sporting event |
| Diplomatic | Elimination/leveling of political tensions, creation of a favorable friendly environment, transmission of the values of sport taking into account the promotion of the interests of the country/region |
| Identification | A system of orientations that determines identification with a model, with a social group within the framework of participation, organization and holding of a sporting event |
| Image | Getting to know the host city within the framework of a sporting event, helping to strengthen the image of the region/country |
| Integrative | Focus on uniting people, organizing the system of interaction between people within the framework of a sporting event |
| Communicative | Features of information transfer, including language, gestures, manner of communication to achieve cultural and social community while maintaining the individuality of each participant in a sporting event |
| Educational | Summing up the social experience of generations of people, historical and cultural values of countries within the framework of sporting events, formation of an ideological position |
| Aesthetic | Formation of a person's desire for beauty of the body, movements, technique of performance; harmony of relationships, including through works of art |

*Table 2. Correlation of types and categories of cultural code in sports*

| View | | Category |
|---|---|---|
| Required/Accessories | Animal/Natural | Symbols of the city/country; competition mascots |
| | Operating | Rituals, rituals, customs, traditions |
| | Character | Prominent persons; characters of works; saints |
| | Material, Subject | Costumes; uniforms of national teams; souvenirs; inventions |
| | Geographical, architectural | Geographical features; sacred places; landmarks; sports facilities |
| | Temporal | Significant dates, events |
| | Attributive | Properties, characteristics, character, abilities (of a people, talisman, city, region, etc.) |
| | Language | Sign systems: language, gestures, logos |
| | Aesthetic | Works of art: painting, ballet, music, etc.; artistic sports programs |

Thus, the data presented in Table 1 indicate that the cultural code in sports is a multifunctional system. The following functions have been identified and defined: accumulative, diplomatic, identification, image, integrative, communicative, cognitive, aesthetic – they are responsible for preserving the ideals and values of sports, creating a favorable friendly atmosphere in the sports arena, and are aimed at uniting people for the implementation of cultural interaction.

Based on the systems analysis of the totality of the components of the cultural code, a structure of the relationship between the types and categories of the cultural code in sports has been developed, presented in Table 2.

The basis is the interpretation of culture as a sign system, and its basic categories, the content of which determines the perception and understanding of the world by a person of a specific cultural system [3, 2, 4-8].

Thus, all cultural codes in sports can be classified into two main types:

- Mandatory cultural code in sports - refers to protocol elements;

- Accessory cultural code in sports – includes artistic manifestations of a sporting event.

Within the framework of a detailed classification of the cultural code in sports based on the structuring of its two main types – mandatory and accessory, the following were identified and analyzed: animal/natural, operational, character, material/object, geographical/architectural, attributive, temporal, linguistic, aesthetic. The identified types of cultural code in sports are correlated with the corresponding categories that facilitate their differentiation taking into account the characteristic features.

**Conclusion.** Thus, the term "cultural code in sports", defined and substantiated within the framework of the study, its concept, as well as the identified functions, types and categories create conditions for further comprehensive analysis of the constituent components of the cultural code in the program of opening and closing ceremonies of complex sports competitions and the determination of priority areas in which recommendations can be given for the transfer of the cultural code in sports.

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# Sports television on Russian state TV channels in the winter seasons 2021-2024

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**Abstract**

**Objective of the study** is to identify the composition and dynamics of indicators of sports programs on publicly available Russian state television channels in the winter competition seasons of 2021-2024.

**Methods and structure of the study.** An analysis, comparison and generalization of the indicators of sports programs on Russian state television was conducted.

**Results and conclusions.** The IOC's decision to suspend Russian athletes from participating in international competitions from March 2022 led to the forced change of international tournaments with Russian on the broadcast network of state TV channels. Two years of isolation of Russian athletes from major international competitions did not change the structure of sports programs in the winter seasons of 2021-2024, but played a major role in the sharp decline in interest in these programs on Russian television. So, after the successful Olympic season 21/22, the ratings of sports programs in the next two winter seasons decreased at least 2-3,5 times.

***Keywords:*** *Russian state TV channels, structure and indicators of sports programs, winter competition seasons 2021-2024.*

**Introduction.** The leading positions of Russian athletes in international tournaments of the highest rank (European Championships (EC) and World Championships (WC), World Cups (WC), Olympic Games and Olympic Winter Games (OWG), etc.) generate increased interest in these tournaments on Russian television [1, 4, 5]. The leading TV channels – Channel One, Russia-1 and Match! TV – often used their right to the priority broadcast of these competitions or divided it between themselves. After its creation in 2015, the bulk of TV broadcasts of sports programs passed to Match [2], thanks to which biathlon took a leading position in winter sports seasons [3-5]. Other state TV channels (NTV, REN TV, Russia-24, etc.) also broadcast sports programs, but in much smaller volumes.

**Objective of the study** is to identify the composition and dynamics of indicators of sports programs on publicly available Russian state television channels in the winter competition seasons of 2021-2024.

**Methods and structure of the study.** In each of the three winter competition seasons of 2021-24, popular sports programs on Russian state TV channels were determined. For this purpose, according to the data of Mediascop (the leader of the Russian media research market), weekly ratings and number of TV broadcasts in the first hundred popular programs (TV-100) and in the first ten sports programs (TOP-10) were analyzed and summarized. The studies were conducted in Russian cities with a population of 100 thousand; the audience is the population aged 4 years and older [6]. The duration of each winter season was 20 weeks (from mid-November to early April).

**Results and conclusions.** The main indicators of sports programs in the 2021/22 Olympic season on Russian TV channels are presented in Table 1.

*Table 1. Indicators of sports programs in the 2021/22 Olympic season (in brackets – OZI-22 indicators)*

| No | Sports programs | Sports program with the highest rating | Channel | TV-100 | Rating | TOP | TOP-10 |
|---|---|---|---|---|---|---|---|
| 1 | Biathlon | KM. Relay. Women.<br>(OZI. Pursuit. Women.) | M<br>P | 19 (10) | 2,3<br>(5,9) | 8 | 40 (4) |
| 2 | Figure skating | KR. Short program. Women.<br>(OZI. Short program. Women.) | P<br>P | 22 (13) | 3,4<br>(7,1) | 6 | 40 (12) |
| 3 | Football International tournaments | LE. Legia (Poland) – Spartak | M | 1 | 1,7 | --- | 12 |
| | All-Russian tournaments | ChR. CSKA – Zenit | M | 1 | 1,6 | 2 | 27 |
| 4 | Cross-country skiing | KM. Pursuit race.<br>(OZI. Relay. Men.) | M<br>P | 1<br>(12) | 1,7<br>(5,6) | --- | 30 (9) |
| 5 | Information and analytical | All to Match | M | (1) | 1,3 (2,3) | --- | 6 |
| | | Biathlon with D. Guberniev and others | M | 2 | 1,8 | --- | 6+6 |
| 6 | Sports News | Today. Sport | NTV | --- | 1,2 | 3 | 10 |
| | | News on Match | M | (1) | 1,1 (2,3) | --- | 4 |
| | | News. Sport | P-24 | --- | 1,0 | --- | 3 |
| 7 | Hockey | CPC. Russia – Finland<br>(OZI. OKR – Sweden. Male) | P<br>P | 4<br>(8) | 2,3<br>(5,2) | 1 | 9<br>(3) |
| 8 | Martial arts | Fight Club. Boxing | REN | --- | 1,0 | --- | 3 |
| 9 | Artistic gymnastics | Heavenly Grace | P-1 | --- | 1,3 | --- | 1 |
| 10 | Motorsport | Formula 1. Qatar Grand Prix. | M | --- | 0,7 | --- | 1 |
| 11 | Short track | OZI. Relay. Mixed com. | M | (1) | (2,6) | --- | 1 |
| 12 | Freestyle | OZI. Mogul. Qualification. | M | (1) | (2,4) | --- | 1 |
| 13 | Mini-football | CH. Russia - Portugal | M | 1 | 1,9 | --- | 1 |
| | TOTAL: | | | 55 (77) | | 20 | 200 |

The data in Table 1 show that in the Olympic season, biathlon and figure skating are the leaders in the number of TOP-10 broadcasts, followed by football. Cross-country skiing is in 4th place, hockey is in 7th place, behind news and information and analytical programs. The list is closed by martial arts, motor racing, short track, freestyle, rhythmic gymnastics and mini-football. The main event of the season is OZI-22, where the maximum ratings were recorded (from 2.3 to 7.1%) in 8 out of 13 sports programs. The result of the season can be considered 132 broadcasts (including 125 in winter sports) in TV-100, which indicates a great interest of Russians in OZI-22 and in winter sports. Knowing the subsequent course of events, it can be argued that the indicators of the Olympic season were the best on Russian sports television for 2021-2024.

But in early March 2022, politics intervened in sports: the IOC Executive Committee suspended Russian athletes from participating in all international competitions due to the start of a special military operation of the Russian Armed Forces in Ukraine. This decision led to the fact that interest in sports programs on Russian television has noticeably decreased, as evidenced by the indicators of the winter competition seasons of 2022-2024, presented in Table 2.

In the conditions of international isolation, the composition of sports programs in each winter season of 2022-2024 was almost no different from the Olympic one and included: football, hockey, figure skating, biathlon, cross-country skiing, martial arts, rhythmic gymnastics, information and analytical and news programs. The replacement of international competition broadcasts with domestic ones in the TV channel broadcasting grid turned out to be unequal, since the ratings of sports programs decreased by 2-3.5 times and amounted, with rare exceptions, from 0.2 to 0.9%. If we take into account the indicators of Olympic broadcasts, then the decrease (especially in winter sports) is even greater – 5-8 times.

Cross-country skiing "sagged" most noticeably: after 30 broadcasts in the Olympic season, only 7 and 9 hits in the TOP-10. Biathlon and figure skating (the flagships of Match! TV and Channel One) were inferior not only to football but also to hockey in the number of TOP-10 broadcasts, and in the 22/23 season to informational, analytical and news programs about sports. Hockey is the only representative of winter sports that

managed to increase the number of TOP-10 broadcasts: from 9 to 21 and then to 34. The crisis situation was smoothed out by broadcasts of the final tournament of the World Cup in football (November 20 – December 18, 2022).

Even without the participation of the Russian team, it aroused great interest in the country: all 64 games were broadcast on Match, 44 were included in TV-100, 5 became TOP leaders, and the rating of the final was higher than on OZI-22 (respectively – 8.1% and 7.1%). Taking into account the broadcast of other international and all-Russian tournaments, football has become the leader among sports programs in the winter seasons of 2022-24 on Russian sports television, displacing biathlon and figure skating from the leading positions. The increase in the number of broadcasts in the TOP-10 over three seasons is observed in news programs: 17, 24 and 29 broadcasts, respectively.

The progress of the "Segodnya. Sport" broadcast on NTV is especially noticeable, which occupied the TOP positions 3, 8 and 9 times and was included in the TV-100 twice. Information and analytical programs also have good indicators – 48 (18 + 20 + 10) broadcasts, of which 22 is the broadcast of the "Vse na Match" program. The rest are author's information and analytical programs about football and biathlon

*Table 2. Indicators of sports programs on Russian television for two winter competition seasons of 2022-24.*

| No | Sports programs | Sports program with the highest rating | Channel | TV-100 | Rating | TOP | TOP-10 |
|---|---|---|---|---|---|---|---|
| **Winter competition season 2022/23** | | | | | | | |
| 1 | Football World Cup | Argentina – France | M | 44 | 8,1 | 5 | 33 |
| | Int. tournaments | Real – Barcelona | M | --- | 0,7 | 1 | 20 |
| | All-Russian tournaments | TM. Iran – Russia | M | --- | 1,2 | 1 | 28 |
| 2 | Sports news | Today. Sport | NTV | 1 | 1,3 | 8 | 16 |
| | | News. Sport | P-24 | --- | 0,6 | --- | 6 |
| | | News on Match | M | --- | 0,4 | --- | 4 |
| 3 | Hockey | KHL. SKA - CSKA | M | --- | 0,8 | --- | 21 |
| 4 | Information and analytical | All to Match | M | --- | 0,6 | --- | 10 |
| | | Rest | M | 1 | 1,7 | --- | 10 |
| 5 | Figure skating | CR. Short program. Women. | P | 10 | 2,6 | 4 | 17 |
| 6 | Biathlon | CR. Relay | M | --- | 0,7 | --- | 17 |
| 7 | Martial arts | Fight Club. Boxing | REN | --- | 0,8 | --- | 9 |
| 8 | Cross-country skiing | CV. Team Sprint | M | --- | 0,6 | --- | 7 |
| 9 | Artistic gymnastics | Heavenly Grace | P-1 | --- | 1,3 | 1 | 1 |
| 10 | Volleyball | CR. Zenit – Zenit (Kazan) | M | --- | 0,2 | --- | 1 |
| | TOTAL: | | | 56 | | 20 | 200 |
| **Winter competition season 2023/24** | | | | | | | |
| 1 | Football International tournaments | Real – Barcelona | M | --- | 0,7 | --- | 28 |
| | All-Russian tournaments | CR. Zenit – Spartak | M | --- | 1,3 | 4 | 25 |
| 2 | Hockey | KHL. SKA – Avtomobilist | M | --- | 0,9 | --- | 34 |
| 3 | Figure skating | CR. Short program. Women. | P | 2 | 1,8 | 5 | 31 |
| 4 | Sports news | Today. Sport | NTV | 1 | 2,3 | 9 | 18 |
| | | News on Match | M | --- | 0,7 | --- | 8 |
| | | News. Sport | P-24 | --- | 0,5 | --- | 3 |
| 5 | Biathlon | KR. Pursuit race. Women. | M | --- | 0,7 | 1 | 28 |
| 6 | Information and analytical | All to Match | M | --- | 0,6 | --- | 6 |
| | | Rest | M | --- | 0,4 | --- | 4 |
| 7 | Cross-country skiing | KR. Mass start | M | --- | 0,7 | --- | 9 |
| 8 | Martial arts | Boxing. D. Bivol – L. Arthur | P | --- | 0,5 | --- | 4 |
| 9 | Artistic gymnastics | Heavenly Grace | P-1 | 1 | 1,4 | 1 | 1 |
| 10 | Billiards | Super League. Doubles Tournament | M | --- | 0,4 | --- | 1 |
| | TOTAL: | | | 4 | | 20 | 200 |

on the same "Match". Overall, the total share of informational, analytical and news programs about sports remains at 20% among the TOP-10 for all three winter seasons of 2021-2024.

**Conclusions:**

1. The composition of sports programs on Russian state TV channels in the winter competition seasons of 2021-2024 was almost constant and included broadcasts of competitions in football, hockey, biathlon, figure skating, cross-country skiing, martial arts, rhythmic gymnastics, as well as informational, analytical and news programs about sports.

In the winter season of 21/22, the indicators of sports programs were the best for 2021-2024, as evidenced by high ratings and 132 broadcasts in TV-100. Biathlon, hockey, figure skating and cross-country skiing accounted for 89 broadcasts (67.4%) in TV-100 and 119 in the TOP-10 (almost 60%). The maximum ratings were recorded on OZI-22 and amounted to: in hockey – 5.2; in cross-country skiing – 5.6; in biathlon – 5.9 and in figure skating – 7.1%.

2. The disqualification of Russian athletes and the subsequent replacement of international competition broadcasts with domestic ones in the broadcasting schedule of state TV channels became the main reasons for the decline in interest of Russians in sports programs in the winter seasons of 2022-24. Thus, ratings decreased by 2-3.5 times (from OZI-22 – by 5-8 times), and the number of sports broadcasts included in TV-100 decreased sharply: from 132 in the Olympic season to 56 in the 22/23 season and to 4 in the 23/24 season.

3. Two years without the participation of Russian athletes in international competitions had a particularly negative impact on the performance of winter sports. The only one who gained in this situation was the "king of sports" – football. Thanks to the broadcasts of the final tournament of the World Cup-22, it becomes the leader of sports programs on Russian television in the winter seasons: 44 broadcasts in TV-100 (all from the World Cup-22), 81 broadcasts in the TOP-10 and 7 TOP positions in the 22/23 season; 51 broadcasts in the TOP-10 and 4 TOP positions in the 23/24 season. The rating of the final match at the World Cup-22 was 8.1%, which is the highest figure among all sports programs in the winter seasons of 2021-24. In conclusion, it should be noted that the Russian sports TV channel Match, together with the sports federations responsible for the development of winter sports, are doing everything possible to minimize the consequences of sanctions from the IOC.

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