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The journal is intended for teachers, coaches, athletes, postgraduates, doctoral students research workers and other industry experts.

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1. Physical education of different population groups.
2. Improving the training of athletes of different qualification.
3. Biomedical Aspects of Physical Education and Sports.
4. Human health, physical rehabilitation and physical recreation.
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***CONTENT***

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# Dynamics of indicators of respiratory function in elderly men under the influence of rehabilitation measures in the immobilization period of the disease after the fractures of the tibial plateau

***Tetiana Ananieva***

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***Purpose:*** *to determine the effectiveness and justify the use of physical rehabilitation on respiratory function of patients with older men who are in immabilizatsionom period of the disease after the fractures of the tibial plateau.*

***Material & Methods:*** *analysis of special scientific and methodical literature; analysis of medical records of patients under study; methods of research indicators of respiratory function; methods of mathematical statistics. Analyzed contingent – 15 male patients of advanced age who are in a hospital in the immobilization period after fractures of the tibial plateau.*

***Results:*** *the studies showed significant positive changes in lung function in patients with elderly men under the influence of the proposed complex physical rehabilitation.*

***Conclusions:*** *the proposed complex of physical rehabilitation can be used in hospital patients who are in the immobilization period (bed, motor mode) after the fractures of the tibial plateau with a view to improving respiratory function and prevention of complications in the respiratory system due to the reduction of motor activity after the injury.*

**Keywords**: *fracture of the tibial plateau, respiratory function, the means of physical rehabilitation.*

## Introduction

Injuries, according to the World Health Organization (WHO), is important not only medical but also social problem which concerns a diverse population and is characterized by constant growth injury, a significant level of disability, and major economic costs, experiencing trauma, their families and the state [5]. In recent years, attracted the attention rehabilitators injured knee, which make up 10–22% of all lower extremity injuries [4; 7], among them is common, especially in middle and old age, fractures of the proximal end of the tibia (plateau fractures) [1].

Among the early motor complications due to decreased motor activity affected most common and difficult is the development of congestive hipostatychnoyi pneumonia [2; 3; 6], which requires the appointment of the first days after surgery or limb immobilization of physical rehabilitation. In the available literature lack reflects the problem of physical rehabilitation of older age groups after intraarticular fractures of the knee, so the development of the program of physical rehabilitation for injured persons from the age of victims, the exact location and the nature of fracture, treatment, stage rehabilitation period of the disease, presence of complications and concomitant somatic pathology is an actual medical problem.

### The purpose of the research

To define and research to prove the effectiveness of the complex of physical rehabilitation on respiratory function of patients older man who is immobilization period of the disease after the plateau fractures.

*Objectives of the study:*

1. Analyse the current professional literature on the problem of physical rehabilitation of patients after fractures plateau.

2. Define and justify changing the parameters of lung function that occur in the affected elderly men in the immobilization period after fracture fee under the influence of optimal rehabilitation.

## Material and Methods of the research

Under our supervision in a hospital bed was located in the motor mode injured 15 elderly men (60–70 years), who underwent skeletal traction damaged lower extremity (as the method of staged repositioning) on the closed fractures of the proximal end of the tibia, namely condyle bone fragments shift. Traumatized men were randomly divided into 2 groups: control (CG) – 7 patients; basic (CO) – 8 patients. Most of the victims injured in the street because of ice and while in transport during sudden accident. Research conducted by us for 2 years. Due to reduced physical activity (bed motor mode) and the presence in most patients with concomitant chronic diseases of cardiorespiratory system, we used the following methods: analysis of medical records of victims clinical methods (history, somatoskopiyu, palpation, percussion, auscultation); pulsometry, arterial tonometry, spirometry, pnevmatohometriyu, measurement of chest excursion and frequency of breathing hypoxic test Stange and Ghencea, functional tests Rosenthal, medical and pedagogical observations, methods of mathematical statistics. All studies were conducted according to conventional methods. The results of lung function parameters were processed using software Microsoft office,

Statistica 7,0.

## Results of the research and their discussion

Initial examination of the studied contingent victims was held on 5–6 day after overlay injured lower limb skeletal traction, re – 2–3 day after withdrawal (28 days). In the primary of the patients complained of pain in the injured limb, the appearance of swelling toes, insomnia, irritability or depression. A history and histories of patients showed the presence of most of these concomitant somatic pathology of the different systems of the body: hypertension degree of I–IIA – in 26,6% of patients, coronary heart disease – in 33,3%, chronic bronchitis – in 66,6%, diabetes – 20%, asthma – 6,64%, chronic gastritis – in 13,3%. When comparing the value of the index of the functional state of the respiratory system of patients and the main control groups did not reveal significant differences between them on all parameters specified function of the respiratory system (Table).

The data history and medical records and the results of the initial survey of the functional state of the studied group of patients showed the homogeneity of both groups and reduced respiratory function compared with appropriate indicators of healthy men of this age (according to the data resulted G. A. Makarova, 2002; O. P. Smirnova, 2014 [8]), in our opinion, was not only due to a decrease in motor activity affected (bed motor mode because of injuries and treatment), but also the presence of the affected concomitant chronic diseases of the respiratory system.

To improve respiratory function and prevent possible development hipostatychnoyi pneumonia we proposed the use of a means of physical rehabilitation for male patients of the main group, which includes a modified technique of breathing exercises on a background of generally accepted for this period of illness and treatment exercise, ultrasound inhalation dekasan and classical technique therapeutic massage chest.

The distinctive features of our proposed set of physical rehabilitation assignment is 20–30 minutes. Ultrasound dekasan after inhalation (10 min) physiotherapist occupation, which in the main after the general development exercises for the body, the muscles of the neck, upper limb and lower limb healthy and special exercise for damaged limbs, used static breathing exercises (from 2–3 min to 6–8 minutes) through additional dead space "DMP". Research several authors [2; 6] show high efficiency breathing "DMP" hipostatychnoyi to prevent pneumonia in patients with significantly reduced physical activity due to the presence of serious injuries (burn disease, hip fractures, etc.). The authors found that while breathing through a "DMP" function not only respiratory muscles, but the muscles of the neck, abdomen and torso, chest and the associated energy consumption efforts eliminate the negative impact of hyperventilation observed in the performance of conventional static exercise muscle in a state of rest. After 40-60 minutes. therapeutic exercises classes after patients received treatments of massage therapy for chest classic technique.

Affected male control group received inhalation eufillin, doing

**The evolution of respiratory function affected men and the main control groups influenced rehabilitation**

| No. | Indexes | Examination | Control group (n=7) | Basic group (n=8) | t | p |
|---|---|---|---|---|---|---|
| | | | $\bar{X}$±m | | | |
| 1. | Respiration rate per minute | I | 23,86±0,90 t=2,84; p<0,05 | 24,0±0,85 t=5,50; p<0,001 | 0,06 | >0,05 |
| | | II | 20,57±0,74 | 18,5±0,53 | 2,27 | <0,05 |
| 2. | Excursion chest, cm | I | 3,74±0,05 t=1,64; p<0,05 | 3,76±0,06 t=5,83; p<0,001 | 0,25 | >0,05 |
| | | II | 3,86±0,05 | 4,16±0,04 | 5,13 | <0,001 |
| 3. | Vital capacity, l | I | 3,31±0,04 t=5,26; p<0,001 | 3,28±0,07 t=5,83; p<0,001 | 0,23 | >0,05 |
| | | II | 3,61±0,04 | 3,73±0,04 | 2,15 | <0,05 |
| 4. | Breath to breath, s | I | 34,71±0,45 t=1,96; p<0,05 | 34,13±0,55 t=4,86; p<0,001 | 0,41 | >0,05 |
| | | II | 35,86±0,37 | 37,58±0,37 | 2,90 | <0,05 |
| 5. | Breath exhale, s | I | 14,29±0,61 t=1,54; p<0,05 | 14,25±0,61 t=3,81; p<0,01 | 0,02 | >0,05 |
| | | II | 15,57±0,57 | 17,38±0,53 | 2,31 | <0,05 |
| 6. | The power of inspiration, $l \cdot s^{-1}$ | I | 3,30±0,10 t=3,25; p<0,01 | 3,34±0,08 t=4,09; p<0,001 | 0,18 | >0,05 |
| | | II | 3,69±0,07 | 3,69±0,04 | 0,02 | <0,05 |
| 7. | Power exhale, $l \cdot s^{-1}$ | I | 3,16±0,07 t=2,75; p<0,05 | 3,21±0,07 t=4,81; p<0,001 | 0,29 | >0,05 |
| | | II | 3,43±0,07 | 3,64±0,04 | 2,37 | <0,05 |
| 8. | Rozentalya sample:types of reactions: – satisfactory | I | 2–28,6% | 2–25% | | |
| | | II | 4–57,2% | 7–87,5% | | |
| | – unsatisfactory | I | 5–71,4% | 6–75% | | |
| | | II | 3-42,8 | 1-12,5 | | |

therapeutic exercises for common injuries and for this period of the disease and the method of receiving therapeutic massage treatments for chest classic technique.

Under the influence of the proposed complex of physical rehabilitation for men the main group and the conventional hospital complex for the affected control group there were positive changes values parameters of lung function investigated troops injured in both groups, but the most expressive positive dynamics of these options is most clearly observed in the patients of the group (Table).

Comparative analysis of parameters of lung function of external breathing the percentage spent between groups of male patients, testified reliable increase of these quantities in the main group affected against the background of a significant decrease in respiratory rate at rest and increased chest excursion (Table).

Thus, the increase in value of the index VC men in the main group was 13,7%, against 9,0% – kontrolnoyi group; increase the quantities duration of breath at inhalation and exhalation men was the main group respectively 10,1% and 12,1% versus 3,3% and 8,9% – in the control group; increase performance capacity inhalation and exhalation of patients the main group constituted respectively 10,04% and 13,3% versus 9,0% and 8,5% – in the control group. It is necessary to note the significant increase in response to such a satisfactory sample Rosenthal core group of men.

Received regular growth dynamics parameters of respiratory function showed improvement airway, increasing the endurance of the respiratory muscles, the stability of the respiratory system of the body of patients the main group to hypoxia, which led to a significant improvement of lung function and absence of all patients hipostatychnoyi pneumonia (according to medical records). But the value derived indicators of the functional state of the respiratory system have not reached the proper parameters of healthy men age, in our opinion, was appointed term duration due to research and presence in most patients with concomitant chronic diseases of the respiratory system.

## Conclusions

1. Analysis of the sources of modern literature revealed the need for the appointment of the patients in the first immobilization period after fracture plateau of physical rehabilitation with a view to not only accelerate the formation of primary callus in the fracture, but also prevention and elimination of possible complications in the cardiorespiratory system by reducing motor activity (bed motor mode), especially in the elderly.

2. The used complex methods of research of health and functional status of the respiratory system affected elderly men revealed during the initial examination prohodymosti deterioration of the respiratory tract, reduced endurance of the respiratory muscles and respiratory system resistance to hypoxia, indicating a significant reduction of lung function in patients of both groups.

3. The complex of physical rehabilitation for the main group of men using a modified breathing exercises, ultrasound dekasanu inhalation and therapeutic massage to be effective and has significantly improved respiratory function and prevent the development hipostatychnoyi pneumonia.

**The prospect of further research** related to the development of science-based physical rehabilitation program for injured people after the plateau fractures in regenerative period of the disease.

**Conflict of interests.** The author declares that there is no conflict of interests.
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# Game method application efficiency for speed and power capability development of trampoline athletes at the initial training stage

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***Purpose:*** *to prove the effectiveness of using the game method for speed and power capability development of trampoline athletes at the initial training stage.*

***Material & Methods:*** *in the article the materials of the research that was carried out with the help of pedagogical testing of trampoliners of 7–8 years on the basis of the Children and Youth Sports School No. 7, Trampoline Department of Kharkov.*

***Results*:** *conducted pedagogical experiment showed the effectiveness of the developed methodology for the development of speed-strength abilities of trampoline athletes at the initial training stage using the game method.*

***Conclusion*:** *results of the experiment confirm the importance of the use of the game method for the development of speed-strength abilities in the initial training of young trampolines, which further affects the level of their technical preparedness and the effectiveness of competition activities.*

**Keywords:** *game method*, *speed and power capability*, *trampoline athletes*, *initial training stage*, *testing.*

## Introduction

In the current conditions for the training of young athletes, there is a need to develop and improve methods for the development of their physical qualities, especially at the stage of initial training, on which the fundamentals of the sport technique are laid, a variety of physical training is conducted and a steady interest in pursuing the chosen sport. The effectiveness of the training process is directly dependent on the funds used in the classes with athletes in accordance with the physiological characteristics of this age [7]. Children 7–8 years old are inclined to games, fantasies, imitations, and that is why the game method of teaching motor actions is especially productive in training sessions. According to a number of scientists [2; 4; 5; 11; 12], the game method helps with the study of the technique of movements, creates opportunities for the integrated development of motor skills and qualities, develops the ability to correctly assess the spatial and temporal characteristics, quickly and correctly react to the situation that develops under changing conditions of the game. Recently, outdoor games have become widely used as an effective tool in the training process in connection with the significant capabilities of the game method of training in sports training, as well as due to the early specialization of various sports [1]. This fact actualizes the use of the game method as a key aspect in the formation of a sustainable sporting interest, the development of physical qualities, namely, in improving the speed-strength abilities [2; 5; 12]. The development of speed-strength qualities in jumping on the trampoline is one of the main indicators of the physical preparedness of athletes, on the level of development of which, at the stage of initial training, the achievement of a further sporting outcome depends. In a number of studies [2; 11; 12], scientists note that the age of 7–8 years is the most significant for the growth of speed-strength abilities, which play an important role in the sports training of trampolines on the trampoline. The mechanical capabilities of the trampoline and the specificity of the sport, which involves the execution of a combination of 10 elements at the maximum flight altitude, requires the athlete to a high level of development of all physical qualities, and especially – speed and power at the stage of initial training [6; 7].

### The purpose of the research

To prove the effectiveness of using the game method for speed and power capability development of trampoline athletes at the initial training stage.

## Material and Methods of the research

The experiment, in which 14 sportsmen of 7–8 years took part, was held on the basis of the Children's and Youth Sports School No. 7, trampoline department of Kharkov. During the research at the beginning of the experiment, the speed-strength abilities of young trampoline athletes were tested and a methodology for their improvement was developed using the game method. The experimental method of developing the speed-strength abilities included the use in the preparatory, main and final parts of the training session of specially selected mobile games and gaming assignments [3; 8]. In the preparatory part of the training session, games and game assignments for the concentration of attention and setting up children for future physical activity were conducted, games with rhythmic walking and additional gymnastic movements, demanding from the players organized, coordinated movements and contributed to overall physical development. In the main part of the lesson, games and medium and high intensity game tasks were conducted to develop speed and agility. Also, games were used in which children after a quick run with eversion, jumping, jumping could rest. The prevailing place was occupied by games with short rushes in all

directions, in a straight line, in a circle, with a change in the direction of movement (such as «catch-up-run»), with a twist, with bouncing on one or two legs, with jumps through conditional obstacles (a ditch is drawn) and through objects (a low bench), with the transfer, throwing, catching and throwing balls at a distance and at the target, with various movements of imitative or creative nature. In the final part, games were used to relax and concentrate on further activities not related to the training process [3; 9].

*Research methods:* theoretical analysis and generalization of literary sources; pedagogical observations; testing; pedagogical experiment; methods of mathematical statistics.

## Results of the research and their discussion

At the core of the methodology for the development of the speed-strength abilities of trampoline athletes 7–8 years was the use of specially selected mobile games and game assignments during the entire training session [3; 9]. To test the effectiveness of the developed methodology, a special pedagogical experiment was conducted. In the course of the experiment in the training process of young trampoline athletes developed method was implemented and observed the dynamics of speed-strength abilities (Table). As can be seen from the presented materials, in the test «Throwing a small ball» young trampoline athletes showed an average result of 9,1 m at the beginning of the experiment and a high enough end – 14,4 m. The difference between these indicators is statistically significant, $t_p=8,4>t_{gr}=2,78$. This means an objective improvement of the result, which increased by 58% (see Table). When performing the test exercise «Jumping up in a bent position» athletes of 7–8 years showed an average result of 12,1 times before the experiment and 20,4 times after it. A comparison of these results by the Student test shows that the difference between the mean group values is statistically significant ($p<0,01$), the improvement of the results is 68% (see Table). It should be noted that according to this test the group of children studied became more homogeneous – V=11,9% (see Table). In the process of comparative analysis of indicators of the development of speed-strength abilities in the test «Hanging leg raises», a significant improvement in the results after the proposed technique, $t_p=5,6>t_{gr}=2,78$. Improvement of the result was 34% (see Table). The results of the «Rope climbing» test have also changed over the period of using the game method in the preparatory, main and final parts of the training session for trampoline athletes at the initial training stage. If at the beginning of the experiment young trampoline athletes could perform climbing along the rope on an average of 2,3 m, then at the end of the experiment this result increased to 3,9 m (see Table). The result of comparing these indicators indicates a statistically significant difference ($p<0,01$). Thus, the increase in the results as compared with the beginning of the experiment is 69%. The results of the study also showed that in the test «Triple jump on the right and left», which was used to determine the explosive force, mean group result at the beginning of the experiment on the right leg was 198 cm, on the left – 204 cm. After applying the experimental technique, the result on the right leg was 209 cm, on the left – 216 cm (see Table). The difference between these indicators is statistically unreliable ($p>0,05$).

The results of the performance of the test «Long jump from place» (110,7 cm at the beginning of the study and 134,6 cm at the end), obtained by young athletes, indicate that the difference between their average results is statistically not significant, since $t_p=1,15<t_{gr}=2,06$. Their increase was 22% (see Table). In the next test «Jump over rope» during the experiment, the difference in the mean group results was also unreliable ($p>0,05$). But the coefficient of variation improved by almost two times, it indicates that the group has become more homogeneous in the performance of this test (see Table). Results

**Dynamics of speed-strength abilities of young trampoline athletes in the course of pedagogical experiment (n=14)**

| No. | Test | Before experiment | After experiment | Before experiment | After experiment | Growth, % | Confidence estimation | |
|---|---|---|---|---|---|---|---|---|
| | | $\bar{X}\pm m$ | | V (%) | | | t | P |
| 1. | Throwing a small ball (m) | 9,1±0,4 | 14,4±0,5 | 16,6 | 11,4 | 58 | 8,4 | <0,01 |
| 2. | Jumping up in a bent position (number of times) | 12,1±0,9 | 20,4±0,7 | 26,5 | 11,9 | 68 | 7,5 | <0,01 |
| 3. | Hanging leg raises (number of times) | 9,4±0,4 | 12,6±0,4 | 14,2 | 11,9 | 34 | 5,6 | <0,01 |
| 4. | Rope climbing (m) | 2,3±0,2 | 3,9±0,2 | 31,8 | 19,9 | 69 | 5,4 | <0,01 |
| 5. | Triple ump (cm) right | 198±17,4 | 209,0±17,2 | 31,6 | 29,6 | 5 | 0,4 | >0,05 |
| | Triple ump (cm) left | 204±16,3 | 216±16,1 | 28,6 | 26,9 | 6 | 0,5 | >0,05 |
| 6. | Long jump from place (cm) | 110,7±8,7 | 134,6±9,8 | 9,33 | 9,52 | 22 | 1,15 | >0,05 |
| 7. | Jump over rope (number of times) | 16,4±2,9 | 21,6±1,9 | 64,4 | 33,4 | 32 | 1,5 | >0,05 |
| 8. | Jump up from a place without a swing in hands (cm) | 12,6±0,9 | 22,0±0,7 | 25,5 | 11,8 | 75 | 8,3 | <0,01 |
| 9. | Sit-up (number of times) | 17,8±0,9 | 23,4±0,7 | 23,6 | 18,8 | 31 | 4,6 | <0,01 |

***Note***. *$p=0,01$, $t_{gr}=2,78$; $p=0,05$, $t_{gr}=2,06$.*

of the study also showed that in the «Jump up from a place without a swing in hands» test, which was also used to assess the level of development of speed-strength qualities, athletes of the initial training group showed a result of 12,6 cm before the experiment and 22,0 cm – after. The difference between these indicators is statistically significant ($p<0,01$). Improved results were 75% (see Table). It should be noted that according to the test at the beginning of the experiment the group of children studied was less homogeneous (V=25,5%) than at the end (V=11,8%), which indicate the effectiveness of the experiment. Similar positive changes in the test results were observed when the test «Sit-up» was performed 17,8 times at the beginning of the experiment and 23,4 times at the end, the increase in the results was 31% (see Table). According to the Student's test, the difference between the average indicators of this test is statistically significant (see Table). Thus, for most of the proposed tests, there is a tendency to increase the level of development of the speed-strength abilities of children in the experimental group with significant differences ($p<0,05$; $p<0,01$).

## Conclusions

Based on the results of repeated testing of trampoline athletes, statistically significant differences in the initial and repeated test results were recorded for almost all indicators (except for tests: triple jump on the right and left, long jump from place, jump over rope), That testifies to the influence of the developed methodology on the development of the speed-strength qualities of the trampoline athletes. As a result of repeated testing in all tests, the value of the coefficient of variation became statistically significantly smaller. So, the group has become more homogeneous in terms of the level of development of speed-strength abilities, which is one of the results of the impact of the game method.

**Prospects for further research**

In the future, it is planned to evaluate the influence of the developed method of developing the speed-strength abilities of athletes at the stage of initial training using the game method in other gymnastic sports.

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# Special aspects and implementation of the system approach into trainer's professional activity

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***Purpose:*** *to determine the special aspects and implementation of the system approach into trainer's professional activity.*

***Material & Methods:*** *the content of the systemic approach was considered. The following research methods were used: theoretical analysis and generalization of scientific and methodological information, structural and functional analysis, system analysis.*

***Results:*** *defines the principles, the content of the system approach and the algorithm of its realization in practice of trainer.*

***Conclusion:*** *the basis for the use of the system approach in practice is the expected sport outcome; a systematic approach in the work process should be implemented through coordination, subordination, hierarchical links, development links, backward and direct links.*

**Keywords:** *trainer, training system, system approach, links.*

## Introduction

Modern sport of higher achievements requires many years of intense sports training, performance of training and competitive loads at the limit of the functional capabilities of the athlete's body. In connection with this, the champion's pedestal is reached only by a few out of many thousands of talented athletes. The large losses in the pursuit of the champion's achievement in most cases are associated with the performance of training and competitive loads exceeding the functional capabilities of the athlete's body [4; 6]. Especially it is dangerous, and categorically it is inadmissible, in youth and junior age, as the nature and laws of development of the growing, forming organism of young sportsmen [4; 5].

Considering that the paradigm of the unity of man and nature, based on the co-evolutionary strategy in human cognition and activity, is the basic attitude of mankind in the XXI century, there must be a prudent, scientifically grounded invasion of human nature [9; 10].

Often there is a contradiction in the practice of training an athlete between age and the tasks of the coach, between heavy loads and functional data of athlete, Between the model characteristics and individual indicators and the abilities of the trainees can be removed in the process of sporting growth by means and techniques that are in systemic unity with the structural formations of the system of training and preparation of the athlete as a whole [1; 2; 8]. The methodological basis for achieving harmony between these contradictions is the consideration of the laws of the universal connection of development and the systemic representation of the changes occurring in the athlete's body, the regularities and principles of long-term sports training and the formation of a sports form [7; 11]. These recommendations can be implemented when considering the process of training an athlete as a system object and observing the principles of a systematic approach [3; 7; 8]. This possibility is explained by the fact that the system approach allows us to consider such a complex object (the process of training an athlete) as a set of interacting structural entities, and is aimed at identifying the features of the connection between the elements and the laws of bringing them into a single integrated system.

**The relationship of research with scientific programs, plans, themes**

The research was carried out in accordance with the Consolidated Plan of Research Work in the Sphere of Physical Culture and Sports on the topic 2.6. "Teoretikal and methodical bases of perfection of training process and competitive activity in structure of long-term preparation of sportsmen (No. of the state registration 0111U001168).

**The purpose of the research**

To determine the special aspects and implementation of the system approach into trainer's professional activity.

## Material and Methods of the research

*Research methods:* theoretical analysis and generalization of scientific and methodological information, structural and functional analysis, system analysis.

## Results of the research and their discussion

In the theory and practice of sports training in determining and developing an athlete's training program, one can not do without a general assessment of the conditions and the possibility of implementing plans, without a comparative analysis of previous indicators, without regard to the degree of influence of a complex of various factors and the systematization of the state of all components of the athlete's training struc-

ture. Thus, in the process of training the athlete, the following methods and approaches to solving the problem are used: descriptive, comparative, analytical, integrated and systemic approach.

The descriptive method is based on visual observation using qualitative criteria – more, less, closer, farther, lower, higher. For example, this method can be used to describe the technique of motor actions of an athlete.

Comparative method is based on comparison of indicators, characteristics of phenomena, process, object. For example, the indicators, parameters, and results of motor actions of athletes of different qualifications or readiness.

The analytical method is used in the study of complex objects, phenomena, processes, when these formations are artificially divided into parts and considered separately, in isolation. For example, an isolated examination of the level of each type of preparedness of athletes – technical, physical, psychological, functional and tactical.

The complex method is based on the method of considering complex objects, phenomena, processes on the basis of analysis and synthesis of knowledge from different disciplines with their subsequent summation and generalization. For this, an interdisciplinary approach is used, taking into account two or more factors, indicators that affect the effectiveness of the training and competitive activity of athletes, But it does not take into account the relationship between the constituent elements of the object, process or phenomenon.

The system approach is based on the method of considering complex objects, processes, phenomena as an integral system, as a set of interacting elements. At the same time, on the one hand, the structural formations of the whole system are revealed, the features of the connection and the interrelations between them, and also between the elements and the system, features of the functioning of the system are examined, the characteristic properties of each element are determined, and on the other, the integrity of the complex system is revealed. Proceeding from this, it can be noted that the system approach allows us to consider complexly organized objects, phenomena, processes as a system consisting of structured and functionally organized elements.

In the process of studying and analyzing such a complex, multi-structure object, as an athlete's training system, on the basis of a systematic approach, one should know such basic principles:

a) process should be viewed as an integral entity consisting of relatively independent subsystems, structural entities, elements that closely interact with each other;

b) when considering the structural elements of a system, the focus should be on the degree of interaction and the relationship between them;

c) in the study of the structural entities of the system need to be considered and subordinate hierarchy (subordination, sequence, relationship and order relationship) between the elements;

d) process of training an athlete is a dynamic (changing) and evolving process;

e) dynamic objects are mainly considered as a set of control and controlled subsystems;

f) control and correction of the process of the functioning of the system is provided by a "control loop" (based on feedback and direct communication);

g) for the training system of the athlete is characterized by a multiplicity of models, in the analysis of elements and the sys-

**Comparative analysis of complex and systemic approaches in the process of training athletes**

| Characteristics of the approach | Integrated approach | System approach |
|---|---|---|
| 1. Purpose | Achievement of the highest sport result | |
| 2. Ways of realization | Interdisciplinary approach based on knowledge of different disciplines | Training athlete on the basis of new knowledge, which have a system-forming character |
| 3. Object | The condition of the athlete, the level of different types of his preparedness | A holistic system consisting of regularly structured subsystems and systems |
| 4. Method | Comprehensive method taking into account two or more factors or indicators affecting the effectiveness of the training process | A systematic approach focused on a specific time frame for preparation for major competitions, taking into account all the indicators affecting the effectiveness of training |
| 5. Principle | Manageability, controllability, the relationship between training and competitive activities, the variability of the loads | Integrity, structure, hierarchy; subordination, plurality of models, patterns of functioning of the elements of the system and the formation of the system, its development and feedback, communication with the external environment |
| 6. General characteristics | Purposefulness, versatility, approximation, interdependence | Purposefulness, organization, orderliness, interconnectedness, interaction |
| 7. Development | Within the existing knowledge of a number of disciplines, acting separately | Within the framework of systemology at the level of knowledge of system-creating characteristics |
| 8. Theory | Theory of sports training | Theory of system, functional systems, management, operations |
| 9. Characteristics | Limited coverage of the problem, related to the determinism of the problem | Widespread coverage of the problem, but under the conditions of probability |

tem as a whole, you can use a number of models: anthropmorphological, functional, competitive activities, types of preparedness and other.

Comparative analysis of complex and systemic approaches to the process of training athletes allows us to determine that in a complex approach, various aspects of the athlete's preparedness are analyzed and based on knowledge of interdisciplinary summarizes these data and systematic approach, on the one hand, is aimed at establishing a whole structural entities, their content and to determine the characteristics of their operation and communication between, on the other hand, defines a mechanism functioning as a system integrity (Table).

Thus, it can be noted that an integrated approach is used for a comprehensive review of the object and is a particular requirement, and in the system approach, integrity is the main methodological principle. At the same time, the systemic nature consists in the desire to consider the object comprehensively (it can be said that it is complex). But taking into account the different types of connections between structural elements, subsystems, between them and the whole system, as well as the connection between the system and its components, with external factors.

From the results of comparing these approaches to the athlete's training system, it should be noted that these methods of studying the object can not be contrasted, since they complement and enrich the training methodology of the athlete. But at the same time it should be emphasized that a systematic approach is characterized by a certain rigor and orderliness, which in a complex approach is not. The systems approach is based on the objective laws of development of the theory of adaptation, operations, management, functional systems and the systematic and comprehensive – on the laws of particular disciplines (theory of sports training, sports physiology, biochemistry and other sports.)

Systemic approach in the activity of the trainer is realized as follows:

1. In the basis of the construction of the training system for the athlete, training group, sports team, the expected result of the competitive activity at the main competitions.

2. The athlete, group, the teams should be perceived as an organic structural element of the complete system of training the athlete.

3. Training system of an athlete should be considered as a purposeful, complex structure, functionally organized on the principles of hierarchy and subordination, but has a probabilistic character.

4. Probabilistic nature of the system assumes certain deviations from the planned loads and, as a result of the competitive activity.

5. Structural formations of the system are considered as relatively independent elements, which have a close interconnection, interact with each other and the system as a whole.

6. Structure of the training process should correspond to its content, forms of organization and methodological requirements.

7. The system approach involves the use of advanced forms of organization and conduct of the training process, taking into account the resource capabilities of the athlete's body, the degree of his giftedness, genotypic predisposition, internal and external limitations, age, gender and individual characteristics of the athlete.

8. In the process of training the athlete it is necessary to use the achievements accompanying sports training, scientific disciplines – the psychology of sports, social psychology, sports biochemistry and sports physiology.

9. In the athlete's training system, it is necessary to allocate and actively use system-forming factors – coordination and subordination links (interaction links) between structural formations of the system, allowing to ensure the consistency of the action between the coach and the athlete, between the athletes, between the athlete and the environment, and determine the optimal ratio between training loads and recovery tools.

Noting the positive aspects of the use of the system approach in the training of an athlete, it should be noted that this method is limited in the consideration of systemic formations:

1. Systematicity provides certainty, and the environment, including the athlete's training system itself, is largely undefined. Sports achievement due to objective, subjective reasons is uncertain. Uncertainty is essentially present in human relations – between the coach and the athlete, between the coach and the team.

2. Systematicity prefers consistency, and in the athlete's training system, controversial situations often arise, for example: in value orientations between the coach and the athlete; between the coach and the team; in management decisions; between the load and the capabilities of the athlete, between the model indicators and the individual characteristics of athletes.

Despite this, it should be noted that in general, the systemic approach allows you to organize and streamline a person's thinking, to find the best ways to solve the problem.

## Conclusions

1. In the basis of the use of the system approach in the practical activity of the coach, the expected sporting result at the main competitions.

2. Due to the fact that the athlete training system is a complex structured, functionally organized, evolving and dynamic system, systemic approach should be implemented through coordination, hierarchical, subordinate links between the elements of the system, the links of development, feedback and direct communication.

3. Thus, the methodological approach to the process of training an athlete based on the theory of systemic and systemic approach will allow us to identify possible ways of solving the problem and choose the optimal solution for solving it.

**Further research** will be aimed at determining the features of the system approach in the management of the training process of athletes.

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# Psycho-corrective humanity actualization resources for students: sport and arts

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***Purpose:*** *to substantiate the perspective effectiveness of the interdisciplinary system "sport – psychoanalysis – art" for effective psychological and pedagogical influence in the development of humanity in students in the teaching and educational process.*
***Material & Methods:*** *observation in higher educational institutions of the pedagogical and sports orientation, theoretical analysis and synthesis of philosophical-psychological and valeo-pedagogical publications on the research problem.*
***Results:*** *considered humanistic significance of sports activities and the arts at the planetary level of human development. The psychoanalytical and philosophical aspects of surrealism are presented in the context of the actualization of humanity in student: future teachers and trainers.*
***Conclusion:*** *theoretically designated psycho-correctional resources in the spectrum of physical, aesthetic and moral education for the progressive dynamics of humanity in the personal development of students.*
**Keywords:** *students, humanity, sports, physical culture, physical education, art, psychoanalysis, surrealism.*

## Introduction

Sociocultural features of the development of civilized society of the planet at the present stage allow us to assert that the most progressive and effective types of professional activity, social activity in realizing the potential of humanity – sport and the sphere of art. This statement is proved by an analytical and synthesizing study: a retrospective of the "sport biography" of civilization, the history of the initial requirements of the Olympic movement [6], psychological and art-ethnic excursion [15]. Olympic Games, a variety of international competitions, world sports and cultural events become the most productive and effective international projects of our time, which globally contribute to the cooperation of various states, have a dominant influence on the consolidation of peace on our planet. The saying-slogan: "Oh, Sport - you are Peace!", Which became a "winged expression", in our opinion, can be viewed as a metaphor in diverse psychological and sociocultural contexts: in the specificity of the "sports world", as a special social community of people for whom sport is a profession; in the spectrum of the "sports world" in a psychological profile professional athletes and sports fans with the main, vitally important priorities – sports interests; and from the perspective of planetary trends, the peacekeeping mission of sport in modern society. We believe that similar vectors are typical for the field of art criticism, the psychology of art, so it is legitimate to verbalize: "Oh, Art – you are Peace!" especially in a humanistic context.

Modern interpretations of "humanity" – are close in content, synonymous, with notes of kindness, empathy, altruism, tolerance. "Humanity [lat. Humanus – human]" – denote as a system of personal attitudes to social objects, which is conditioned by "moral norms" and "represented in the consciousness by the experiences of compassion and sympathy", "realized in communication and activity in acts of assistance, participation, assistance". Also, for example, «frans. humanitй» – "Humanity, responsiveness, attentiveness to another person, culture ... Philanthropy, but developed by consciousness and education"; "respect to the individual". According to Kant's definition: "Humanity is a benevolent attitude towards people". To the transition of the situational humane attitude to the humane semantic attitude of the personality is promoted by significant joint activity by creating a community of emotional experiences (V. V. Abramenkov) [18].

Sport and self-realization of the individual in art (in the context of general collective, group goals and tasks) – represent examples of "meaningful joint activities". Despite the hypercompetition in the field of sports achievements and with social recognition in art –these areas of activity that maximize the development of personal humanity. Moreover, the educational effect presupposes the specific nature of these activities. In art, the humaneness of the subject is largely generated – artistic and creative cross-cultural projects [9]. Sports-competitive activities are unique in that even in the case of an athlete not in "team" sports, performances always take place in the interests of the "team" (the overall result is important): for the sports school, city, country, etc. In these conditions, the person is formed "collectivist identification" [18], which is an empirical expression of humanity. Also, athletes and fans, artists and spectators are always "obligated" to sports and art "by creating a community of emotional experiences," which contributes to the actualization of humanity in man (Z. Freud in this perspective singles out the "public function of art" [12]).

In the sphere of education, in the aspect of upbringing: psychology and pedagogy of higher education [4; 17], ethnopedagogy and ethnopsychology [15] focus on humanity in relations in the learning process. When organizing the educational process, coaches and university teachers, to implement the psycho-corrective capabilities of sports and artistic activity, it is necessary to maximally include young people in these activities, cultivating humanity. The urgency of the

problem of education of humanity in the educational process of young people of the XXI century is dictated by the social problems of civilization, the ideas of multiculturalism typical of world modern society. First of all, "humanity", as T. A. Andreeva emphasizes, is "a term denoting the universal social interconnection of people" [1]. At the same time, in the world-civil retrospective, the special social activity and mobility has proved itself – student youth. Students, as a social resource for future achievements of the civil society, which reflects the psychological atmosphere of the state of humanity and requires the attention of theoreticians and practitioners of education in the spectrum of the problem of personal actualization of humanity.

Manifestation of humanity by social subjects, of course, implies personal harmony, moral principles and emotional balance in the context of the mental health of individuals. In terms of constructive psychological prophylaxis and therapy, stabilization of mental health in the Ukrainian-European cultural and scientific space allocated effectiveness of psychoanalytic practice [10; 12; 16; 19]. A favorable effect on the human psyche, leveling destructive personal tendencies is determined by art [5; 9; 10; 12; 14; 20]. Psychocorrectional guarantor in the formation of personal collectivist identification is – sports [3; 6; 18]. The interdisciplinary system "sport – psychoanalysis – art" seems to be a progressive resource in solving the research and educational problem of educating humanity in the student age.

Analysis of literature sources demonstrates a certain interest of Ukrainian scientists in the research problem. In modern philosophical-educational and psychological-pedagogical discourse, the possibilities of art in the actualization of humanity in the development of personality are indicating. For example: – in situations of cooperation, co-creation in the creation of international projects, with the emphases of the tasks of higher education [9]; – in the spectrum of the formation of peacemaking views in a new generation in the disclosure of the moral and aesthetic content of art works by means of fine art, illustrations [20]. Considered [5]: "intermediary activity" of visual activity in the establishment and dynamics of intercultural communication; educational potential of art in assimilating various cultural experiences, which contributes to the formation of a humanistic worldview of the individual. The idea of a "humanistic mission" of fine art as an incentive for a constructive dialogue between "cultures" in a multicultural modern society is grounded.

The national Ukrainian idea is presented in the discussion of psychoanalytic problems: the scientific views of Z. Freud and Slavic humanism [16]; historical aspects of the formation of national psychoanalysis [19]. In the aesthetic psychological perspective, today, the scientific position of the Ukrainian classical scientist, the researcher of the psychology of D. Ovsyaniko-Kulikovsky creativity, acquires a special urgency, that "the mission of art is the education of man and the affirmation of morality" [16, p. 229]. In educational and methodological literature on the problems of psychology of higher education [4; 17], emphasizes the sensitivity of the student age for the development of "moral and aesthetic feelings" (as complementary categories).

In modern publications in the context of studying students: the problem of the formation of an image of a humane and responsible person [13], aspects of the interdependence of the moral development of the individual and the phenomenon of art [14], the role of art in the actualization of humanity in adolescence [9; 10]. The modern tendencies of physical education in the university are marked on the basis of classical philosophical traditions [3]; topical psychological problems of physical culture and sports are considered. The presentation of the humanistic mission of "sport" was carried out: in the world historical retrospective and, at present, in terms of sports competitions with the participation of Ukrainian athletes. Patriotic ideas-variants of the repertoire of attracting university students to the sport are expressed [6]. It is not enough analysis productivity of the system "sport – psychoanalysis – art" as an integrative model maximally contributing to the development of humanity among students in the process of education.

**The purpose of the research**

To substantiate the perspective effectiveness of the interdisciplinary system "sport – psychoanalysis – art" for effective psychological and pedagogical influence in the development of humanity in students in the teaching and educational process.

*Objectives of the study:*

1. To uncover the concept and certain psychological mechanisms of the development of humanity in the formation of personality.

2. To analyze publications devoted to scientific and methodological developments in covering the problems of the psychoanalytic concept, the possibilities of art and sports activity in the personal development of students.

3. To formulate conclusions and prospects for further research in the view of the discussed psychological-valeological problem.

## Material and Methods of the research

*Methods of research* – observation in pedagogical and sports schools of higher education, theoretical analysis and synthesis of philosophical-psychological and valeo-pedagogical information of literary sources on the research problem.

## Results of the research and their discussion

The results allow us to state that the psychological aspects of physical culture and sports, the specificity of the psychoanalytic approach and trends of various types of art now – is an area of research scientists of higher education. We are interested in the problem of a hypothetical constructive influence on the humaneness of the subject – combining the possibilities of sports activity, psychoanalysis and art, in terms of: educational impact, developing effect, psycho-correction of personality. At the beginning of our study, we consider it expedient to consider the features of the system "psychoanalysis – art" with philosophical emphases.

Psychoanalytic and art history evidence of the influence of psychoanalysis on the development of certain trends in art [16]. Information on the theoretical prerequisites for the emergence of the surrealistic direction has been revealed ambiguously. According to a certain philosophical version [2],

the theoretical premise of surrealism is the work of I. Kant. It is the "Kantian vision" in the art of "purposeless expediency" that the author associates with the main aesthetic, world-view idea of surrealism – "going beyond the limits of one's consciousness, reaching what is above reality ...". E. V. Andrienko [2] points out that in scientific works devoted to surrealism, there is basically a parallel with psychoanalysis, but concludes that the surrealistic tendencies arose much earlier and are due to the inspiration of the philosophy of I. Kant. In support of his own version, the modern philosopher, referring to the heritage of I. Kant, draws an analogy with surrealistic conclusions and quotes S. Dali: "The very existence of reality is a great mystery. And not only the great is high and beyond, that is the most surreal of secrets" [2, p. 43]. The presented modern philosophical and aesthetic view to a certain extent is probably legitimate ("surrealism" – "from the French surrealisme – supra-reality" [16, p. 206]).

Fr. Schelling drew attention: "It has long been noted that in art, not everything is full of consciousness that, along with conscious activity, a certain unconscious force must be connected" [22, p. 193]. Probably, at the moment, it is possible not to specify the specifics of the emergence of surrealism and to consider this provision as an open, debatable question. There are reports that the emergence of the surrealistic trend in the early twentieth century is determined by the psychoanalytic concept. The scientists [16] emphasize that psychoanalysis influenced to the formation of the aesthetic-theoretical program and the realization of the creative practice of surrealism. The positive comments of Z. Freud, the founder of psychoanalysis, on the creativity of the surrealists of that period are given. In L. T. Levchuk opinion: "surrealism is a kind of artistic illustration of psychoanalysis" [16, p. 208]. Surrealists are in solidarity with the ideas of Z. Freud about the global significance of subconscious processes for the activity, vital activity of the person and the infinite possibilities of the subconscious for creativity in art.

In the context of our research problem, it is advisable to emphasize the desire of artists of surreal stylistics, in the imaginative interpretation of dreams, to prove the universal foundations of art. For example, most surrealists tend to ignore the reproduction of real-time indicators: the art plots depict a dial that does not reflect the dynamics of time. Researchers [16] suggest that in this symbolic form, artists denote the universal philosophy of art. Ideas of surrealism – "aesthetic revolution, ... spiritual elevation ..." [2], surreal art – beyond time, beyond social contradictions, political polemics and economic conditions, globally contributes to democracy and the progress of society [16]. Although there is a modern philosophical opinion (appealing to the authority of I. Kant) [1, p. 41] that the social problems of civilization, which are of fundamental importance for the well-being of mankind, can become "the basis of uniting people ...", "(According to I. Kant – antagonisms) – a necessary condition for humane interaction, the search for consent, the survival of people ..." at the planetary level.

Representatives of surrealism, with a humanistic outlook – "a man from the planet Earth" [16], strived for the creative realization of art forms as accessible to the general understanding. Promoting the ideas of equality and progress, the universality of art in solving complex life situations, the surrealists declared "cultural internationalism". The declarations of the representatives of the surrealistic trend in art are reflected in the actual multicultural strategy of the present time and, in our view, correlate with philosophical interpretations [7]: "Culture as a special way of being a person"; "Aesthetic experience and daily routine"; "Aesthetics of the surrounding space"; "Phenomenon aestheticization of reality", as the "main general cultural tendency".

In accordance with the progressive goals of the educational process, we consider it necessary to verbalize the idea that in the psychological and pedagogical influence of modern higher education there is a sense to be guided: multicultural concepts of the surrealists, philosophical attitudes of "aestheticization" with constructive aspects of psychoanalysis, actively involving students in sports activities, realizing the cross-cultural educational potential of physical culture and sports. With the high intellectualization of the educational process of universities [8], it is important to remember the psycho-prevention of overstrain and stresses from forms of educational control [11], on strengthening and preserving the mental health of the individual [12; 21], as well as the formation of a "useful habit" among students, perhaps at the level of a reflex: to be both intellectuals and humane, and esthete; cultivate the mind, kindness, aesthetics of physical self-improvement and contribute to the aesthetics and intellectual atmosphere of humanity in society. Create a presentable image of the future teacher, trainer – humane, professional and esthetic erudite! In this context, in our opinion, the actual statement of I. Goncharov: "Great love is inseparable with a deep mind; breadth of mind is equal to the depth of the heart. From that the extreme peaks of humanity reach great hearts, they are great minds " [22, p. 485].

It is important that emotionally mature people, "adults" from the immediate social environment of the emerging personality, are sufficiently humane and feel responsible in situations of communication, interaction with the new generation. Especially representatives of the pedagogical professions of both secondary and higher schools, so that they are aware of the possible consequences of psychological and pedagogical influence in the process of education, in the conditions of purposeful education. The philosopher I. A. Il'in recalls: "All people continuously educate each other ... all manifestations of their own; Answer or intonation, a smile or lack of it, coming and going, exclamation and silence, request and demand ... " [15, p. 385]. We believe that this statement is of fundamental importance for the education sector employees, as it reflects the specifics of human relationships, the complexity of correct educational impact, the responsibility of teachers and coaches.

In the palette of philosophical and pedagogical recommendations of our time, emphasis is placed on the unity of physical and mental factors in human development: «... normal development of personality is impossible without motor activity, but can be full only under the condition of inspiration ...» [3, p. 77]. When setting a comprehensive approach to the education of students, the objectively conditioned "interconnection of all types of upbringing" – "physical, mental, moral, aesthetic", etc., is indicated. [3]. The complex approach is expedient and progressive from the psychological point of view, since all physical and mental functions of a person are interconnected, in the person – everything is whole. The stressed interdependence of physical and mental categories of the individual and determines the effectiveness of interdisciplinary systems, the need for their implementation in the educational space of universities for the harmonious development of student youth.

## Conclusions

1. Sport and the sphere of art – unconditional world leaders in the implementation of humanistic mission in the modern multicultural society.

2. In a multicultural context with a moral and aesthetic emphasis - the universal psycho-correctional and peacemaking educational potential of sport and art – generates a global implementation of the tasks of physical, aesthetic and moral education of student youth.

3. Requirements and conditions for performing sports (in team) and artistic activities (group forms of work, collective projects) – produce the actualization of humanity in the subject of activity. In situations of interaction and empathy in sports and art, personal collectivistic identification is formed, which determines the humanistic tendencies in the personal development of students.

4. A productive kind of psychological support for the personality of students in creative: sports and artistic activity is the psychoanalytic approach.

5. The analyzed and presented information proves the promising positive effectiveness of the implementation of the interdisciplinary system "sport – psychoanalysis – art" in the modern space of higher education.

Prospects for further research. Psychological and pedagogical impact in the sphere of higher education should be directed both at the development of intellect, special abilities, Physical perfection, mastering of professional expertise, knowledge and skills, and on the actualization of aesthetic and moral feelings, humanity in youth. The theoretically grounded psychocorrectional effectiveness of the system "sport – psychoanalysis – art" is, in the long term, to be tested in an empirical study to determine the degree of effectiveness of this integrative model. As a technology and tools for psychocorrection, as a symbiosis of the concept of psychoanalysis with art resources, it is constructive to consider group art therapy with "surrealistic" tasks. Use of tasks of art therapy: in the educational process of psychological and pedagogical and valeological disciplines, in the work of the psychological service of universities, in recreational activities between training and competition periods, in our opinion, will naturally have a positive effect on personal development, mental health and improving student athletic performance.

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# A comparative analysis of young tennis player target accuracy when using balls inflated under different pressures

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***Purpose:*** *make a comparative analysis of the target accuracy of ten-year tennis players in performing test exercises with balls with a pressure of 75% of the standard and balls with standard pressure.*

***Material & Methods:*** *in the study participated 8 tennis players of ten years of age, the group 5 years of training. In the course of the research, the following methods were used: analysis and generalization of literature sources, analysis of documentary materials, testing, method of expert evaluations.*

***Results:*** *replacing balls with a pressure of 75% of the standard for standard leads to a deterioration in the target accuracy of ten-year tennis players, which is a consequence of distortion of the technical characteristics of movements.*

***Conclusion:*** *results of the study indicate the need for correction of the technique of players of this age in the transition from balls with a pressure of 75% from the standard to standard.*

**Keywords:** *tennis player, the assessment of technology, the target accuracy of the ten-year-old athletes.*

## Introduction

Testing technical actions of tennis players is a test of their target accuracy, that is, the accuracy of getting a tennis ball to certain points of the court. Accuracy is a complex quality, maximally manifested in motion, with an appropriate combination of its spatial characteristics. The development of the accuracy of movements is determined by two factors: the level of development of physical qualities and the perfection of control of movements.

V. P. Guba, S. A. Tarpischev, A. B. Samoylov argue that "under the condition of the development of physical qualities, the accuracy of movements can be developed by improving the management of movements, through the improvement of its components, increasing the accuracy of the accuracy of the musculo-articular sensations and motor components, vision (reactions to moving objects, depth of peripheral vision), increasing psychological stability in the accuracy of movement when striking the ball (attention, concentration)" [2].

Raising the question of analyzing the technical preparedness of a young tennis player, it is necessary to take into account the stability of performance by a particular player of certain technical techniques [1; 4].

The main existing methods for determining the target accuracy in tennis and the specific application of each of them are described in the work of D. S. Krylov, L. E. Shesterova [5]. Of the five variants of the assessment methods given in this work, let us dwell on three that give the most objective assessment of the technique of tennis players and determine their target accuracy at the time of testing. This is a technique for determining the International Tennis Number, its detailed description is available on the website ITN [6], technique T. S. Ivanova, a detailed description of the rules of testing is given in the training manual "Organizational and methodological foundations for the training of young tennis players" [3], and the technique proposed by D. S. Krylov [5]. To assess the technical preparedness of players of different ages, the most commonly used method of determining the International Tennis Number [6], but a comparative analysis of testing techniques and the target accuracy of ten-year tennis players in the transition from balls with a pressure of 75% from the standard to the standard, either by this or by other methods was not carried out.

**The purpose of the research**

make a comparative analysis of the target accuracy of ten-year tennis players in performing test exercises with balls with a pressure of 75% of the standard and balls with standard pressure.

## Material and Methods of the research

The studies were conducted on the basis of Kharkiv tennis club "SportKort". The study involved eight tennis players of ten years of age, the fifth year of training. To obtain a reliable result of changes in the target accuracy of tennis players of 10 years of age, testing was carried out according to the methods proposed by ITF, T. S. Ivanova and D. S. Krylov. Testing was conducted for one day, in two stages, with sufficient rest breaks between performing exercises. At the first stage of the study, the exercises were performed with balls with a pressure of 75% of the standard, on the second – with standard balls. In the testing involved sparring, who has a high level of preparedness in tennis.

In the course of the research, the following *methods* were used: analysis and generalization of literature sources, analysis of documentary materials, testing and method of expert evaluations.

## Results of the research and their discussion

The first stage of testing was carried out with balls with a pressure of 75% of the standard. The results of the evaluation of the technique of one of the players using the ITN method are presented in Fig. 1.

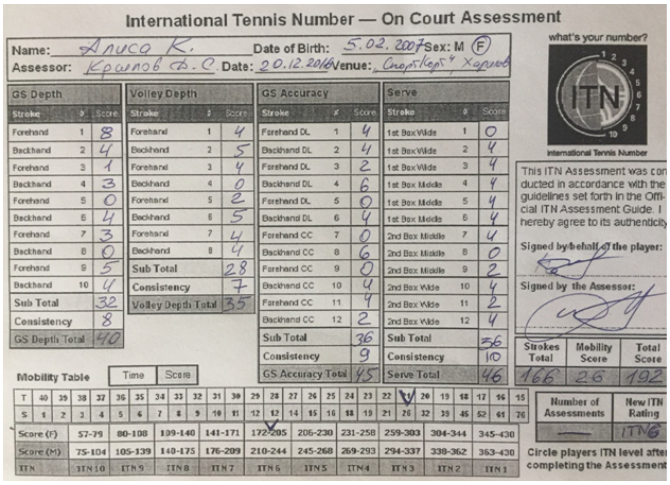


**Fig. 1. Table of assessing the technique of the player by method ITN**

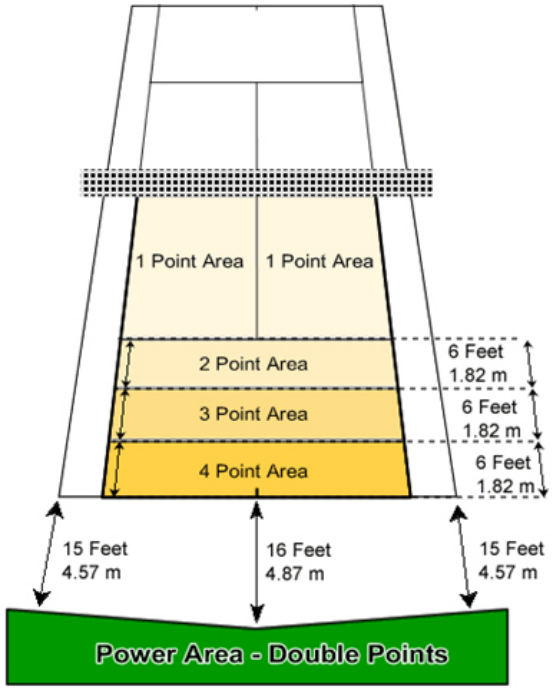


**Fig. 2. Marking courts to test the ITN (for strikes with the rebound and rally on line) [6]**

The table (figure 1) shows an assessment of the performance of 10 strikes on the right and left in the given court zone along the line (the left column of the Table). In column 2 of the table, estimates are given for 8 strokes in a given direction.

Column 3 presents an estimate of 12 hits to the right and left from a rebound along the court's diagonal. Column 4 – the results of 12 serve, in the presence of a second feed, into different parts of each of the feed squares.

The maximum number of points for passing the test (8 points) can be obtained if the ball hits the far court zone and rebounds it into the bonus zone. Zero points the player receives when the ball hits the net or outside the single court.

Detailed instructions for calculating points and the method itself are given in the ITF website [6]. Figure 2 shows the marking of the court areas for evaluating the strikes to the right and left along the line and to assess the strikes of the rally.

The results of the mobility test are shown in the bottom lines of the table in Figure 1.

Evaluation of the technique and target accuracy of young tennis players, taking into account the recommendations of ITF, was conducted by experts – qualified tennis coaches.

The total number of points received by this player, when performing technical elements is 166, an additional 26 points were awarded for mobility. In total, the player scored 192 points, which corresponds to ITN No. 7 for female players. The maximum possible value of ITN is ITN No. 1, the minimum – ITN No. 10. Thus, the better the technical preparedness and the target accuracy of the player, the lower his ITN number.

After the completion of testing using the ITF methodology, the group moved to testing according to the methodology of T. S. Ivanova. The results of testing balls with a pressure of 75% of the standard one of ten years tennis players by the variant of evaluation described by T. S. Ivanova are shown in the Table 1.

The Table shows the scores of one of the tennis players for each of the tested technical elements, exhibited by experts taking into account the target accuracy of the athlete. The last line of the Table shows the average score received by the athlete for technical readiness. It is the arithmetic mean of the estimates for each completed element. The method is described in detail in the training manual "Organizational and methodological foundations for the training of young tennis players" [2]. So, for 15 hits in the court on the diagonal, an estimate of 5, when hit 10–14 times – an estimate of 4 and so forth.

The results of testing the technical preparedness of one of the athletes according to the method proposed by D. S. Krylov, when using balls with a pressure of 75% of the standard, are presented in the Table 2.

**Table 2**
**Evaluation of the technique of the athlete by the method D. S. Krylov**

| Technique elements | Player's ratings | |
|---|---|---|
| | Balls with a pressure of 75% of the standard | Standard balls |
| Right with a rebound | 5 | 4 |
| Left with a rebound | 4 | 3 |
| Right volley | 4 | 4 |
| Left volley | 4 | 3 |
| Serve | 4 | 3 |
| Smash | 4 | 4 |
| Average rating for the complex | 4,17±0,28 | 3,5±0,5 |

A distinctive feature of this technique is that testing is conducted without a sparring partner who performs the return of balls, i. e., first, there is no error in the sparring game, and secondly, there is no need to search for it, which allows the trainer to conduct testing more often and, accordingly, to determine the target accuracy of the athletes and see its dynamics. The evaluation system is described in detail in the article by D. S. Krylov, L. E. Shesterova "Evaluation of the technique of ten-year tennis players" [4].

After testing with balls with a pressure of 75% of the standard, the group rested for 15 minutes. After the rest was a 10-minute warm-up with standard balls. Then the tennis players were tested on the three methods described above with standard balls.

To compare the results of technical preparedness and target accuracy of young athletes when using balls with different pressures, a Table 3 was filled.

It recorded the results obtained by each of the 8 players with balls with a pressure of 75% of the standard and standard balls in testing for each of the three methods.

The data in Table 4 indicate a decrease in ITN per unit in the first test of seven tennis players in the study group. Player No. 7 retains the ITN value, but there is a decrease in the estimate for the target accuracy.

Significant changes are observed in assessments of the technique of athletes by other methods. So, the target accuracy of tennis players with standard pressure ball by T. S. Ivanova technique is 0,6–1,1 points lower than when testing them with balls with a pressure of 75% of the standard. Assessments of young athletes for the target accuracy by D. S. Krylov technique also decreased within the limits of 0,67–1,17 points. Visually, when using standard balls, experts observed the inaccuracy of the ball hit the center of the racket, the delay of the swing to rebound the ball from the court, an insufficiently accurate accompaniment of the ball with a racket and other errors, which lead to loss of target accuracy, acquired using balls with a pressure of 75% of the standard.

For a more directional correction of the technique of a specific player, it is necessary to conduct a detailed analysis of the technique of performing each of the control exercises given above.

**Table 3**

**Comparative evaluation of players' technique according to the used methods**

| Player number | ITN balls with a pressure of 75% of the standard | ITN with standard balls | Delta ITN | Evaluation by Ivanova technique with balls with a pressure of 75% of the standard | Evaluation by Ivanova technique with standard balls | Delta by by Ivanova technique | Evaluation by Krylov technique with balls with a pressure of 75% of the standard | Evaluation by I Krylov technique with standard balls | Delta by by Krylov technique |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 6 | 7 | 1 | 4.3 | 3.4 | 0.9 | 4.17 | 3.5 | 0.67 |
| 2 | 6 | 7 | 1 | 4.6 | 3.5 | 1.1 | 4.17 | 3.16 | 1.01 |
| 3 | 6 | 7 | 1 | 4.1 | 3.4 | 0.7 | 4.33 | 3.16 | 1.17 |
| 4 | 6 | 7 | 1 | 4.4 | 3.3 | 1.1 | 4.5 | 3.5 | 1 |
| 5 | 6 | 7 | 1 | 4.2 | 3.6 | 0.6 | 4.33 | 3.66 | 0.67 |
| 6 | 6 | 7 | 1 | 4.5 | 3.5 | 1 | 4 | 3.16 | 0.84 |
| 7 | 7 | 7 | 0 | 4.1 | 3.2 | 0.9 | 4.33 | 3.16 | 1.17 |
| 8 | 6 | 7 | 1 | 4.2 | 3.3 | 0.9 | 4.17 | 3.5 | 0.67 |

## Conclusions

Comparative analysis of the technical preparedness of young tennis players when using balls with a pressure of 75% of the standard and standard showed a decrease in target accuracy, which is associated with a distortion of the technique of performing control exercises. The results of the research indicate the need to correct the technique of players of this age in the transition from balls with a pressure of 75% of the standard to standard.

**Prospects for further research**. Based on the use of computer technology and the method of expert assessments, determine the direction of correction of the technique of ten-year tennis players.

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# A physical quality improvement of special operations force candidates by means of a proprietary program

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***Purpose:*** *to determine the level of preparedness of cadets of the second year of military university – potential candidates for admission to the units of the Special Operations Forces.*

***Material & Methods:*** *experimental material was the official test results of cadets during the admission of current and test standards during the year of their studies at a military high school. Cadets of the second year took part in the experiment. Two groups of 26 cadets were created, identical in terms of physical preparedness. The testing of the physical readiness of the cadets was assessed by the exercises "Manual on physical training in the Armed Forces of Ukraine" (2014): running to different distances, exercises for strength and strength endurance, overcoming the combined arms obstacle course. A program for the development of endurance using the interval method of training is proposed.*

***Results:*** *after training on the proposed program, the results grew by almost 10%, and in the group that trained according to the traditional scheme, the results only increased by 3%.*

***Conclusion:*** *increase in results depends on the organization of the educational process and on the methods of training are used. In the CG the results are largely inferior to the increase in the results in the EG. The proposed program gives a significantly better result.*

**Keywords:** *forces of special operations, author's program, coefficient of technical efficiency.*

## Introduction

Among the components of the physical fitness of soldiers one of the main physical qualities is endurance. This is especially true for the personnel of special forces, which usually fulfill their combat missions far from the place of deployment of the military unit, overcoming long distances. The combat activities of the personnel of the units of the special operations forces (SOF) include the implementation of many kilometers of foot marches in full equipment, movement at night, overcoming water obstacles, versatility of professional and applied skills, management of any military equipment requiring significant physical effort (Y. P. Sergienko, 2005; O. M. Olkhovyi, 2005; V. M. Krasota, 2007; I. S. Ovcharuk, 2008; S. S. Fedak, 2013). In addition to general endurance, Special Forces must have a high level of development of strength and strength endurance.

The first experience of the selection of servicemen in SOF divisions revealed a certain problem. Only 20% of the candidates who participated in physical fitness testing could overcome this first stage. One of the main reasons for screening was insufficient overall endurance of candidates.

Given that the main candidates for SOF should be young people under the age of 30, and this is mainly cadets and graduates of military educational institutions, there was a need to study the level of development of the general (aerobic) and strength endurance of the cadets. It is also important to find ways to improve this level. Considering that the physical readiness of the officers of the Armed Forces is largely formed during their studies at the military university, it is advisable to constantly study the dynamics of endurance indicators for cadets in order to optimize the educational process in order to improve it.

An analysis of the research of scientists (V. M. Afonin, 2008; S. V. Romanchuk, 2011) showed that in the context of military operations, professional activity has certain characteristics and high demands on the physical and psychological preparedness of the servicemen of the Ground Forces [1; 2; 4; 6].

The modern view of military operations requires the military to have the necessary level of physical readiness for the rapid and high-quality performance of their official duties in various conditions, including extreme ones. Among physical qualities, endurance is important in the structure of physical preparedness of servicemen [1; 2]. This position is confirmed by the materials of foreign studies and recommendations [3; 13; 14]. Individual types are included in the list of tests, the results of which assess the level of physical preparedness in the Ukraine Army [6–8].

In many studies, it is noted that the speed qualities are quite conservative and difficult to improve in the conditions of the military university. For several years, the time of running exercise (100, 400, 1000, 3000 meters) improves in the range of 4–5%. On 3–4 courses the results practically do not improve. One of the reasons for this suspension is the scientists (A. M. Olkhova (2013), I. S. Ovcharuk (2007)) consider the loss of the incentive to improve the results if they are already at the level of positive (or good) evaluation. In addition, in the classroom does not always apply modern methods of various physical properties.

So, for example, S. G. Kharabuga (2008) proposed the author's coefficient of coordination and technical efficiency (CTE) under the conditions of manifestation of special endurance, which is expedient for applying to assess the effectiveness of cadets' training in the technique of overcoming obstacles [11]. M. Ena, A. Loiko, V. Afonin (2008) proposed to use the interval training method with the calculation of the «critical speed» for the time of overcoming two distances – 300 m and 1000 m for each cadet. This has improved the results on long distances to 10%.

If the topic of development of endurance is encountered and discussed in many scientific studies, then the strength endurance of the upper and lower extremities of publications is small. There is a statement of the results of pulling on the bar with an emphasis on the large coefficients of variation of this indicator, which indicates a significant difference in the level of preparedness of the subjects. In many cases, the level of development of the strength of the lower limbs. In our opinion, this is a lack of research, since in modern conditions the warrior in the performance of combat missions must move with a full combat layout, which weighs 40–50 kg or more. With weak legs it is difficult to count on the successful accomplishment of tasks.

Thus, the role of endurance (general and strength) in training a modern soldier is important, but there are still many ways to develop and improve it.

**The purpose of the research**

to determine the level of preparedness of cadets of the second year of military university – potential candidates for admission to the units of the SOF.

Before the study, the following *tasks* were posed:

1. Identify the dynamics of endurance indices in cadets during their studies at the military university.

2. Develop a program to develop the general and strength endurance of NAA cadets and test its effectiveness.

3. Determine the influence of endurance on the level of results of the performance of a specialized complex test (overcoming the obstacle course).

## Material and Methods of the research

The following *research methods* were used in the work: analysis of special scientific and methodological literature, testing of physical readiness of cadets, methods of mathematical processing of research results.

The study was attended by second-year cadets (as a contingent of prospective training for participation in the selection for SOF units in the future). Two groups of cadets of equivalent physical preparedness were created. Physical readiness of students was evaluated by Manual on physical training in the Armed Forces of Ukraine (MPT-2014) [6]: running on 100 m, 400 m, 1000 m, 3000 m, 5000 m; a accelerated march for 5 km in full equipment; exercises on strength and strength endurance (flexion-extension of the arms in the supine position; tilts forward from the supine position on the back pulling on the crossbar; jump in length from the place); overcoming the obstacle of combined arms length 400 m.

The material of the study was the official test results of cadets during the admission of current and test standards during the year of their studies at the military university. Mathematical processing of the results was standard [1; 9; 10].

The growth in test scores was calculated in absolute numbers and in percentage values at their baseline level, at which the results were taken at the beginning of the study.

The exercises were carried out in accordance with the requirements of MPT-2014 [6; 10]. All exercises are performed in military shoes (combat boots).

## Results of the research and their discussion

Mandatory control standards for the physical development of servicemen is a run of 1000 and 3000 m, which determines the level of endurance. Therefore, much attention is paid to the development of this quality. In practice, during physical training sessions, the simplest way of developing this quality is used, which consists in overcoming the normative distance of 1000 m or 3000 m. There is a simple «pulling» on the norm. Such training does not require special methodological skills from the leaders of physical education classes and the time for training can be reduced. But the effectiveness of such studies is also insignificant and the level of quality development is slow and insignificant. According to the data of the research [2; 5; 8], during the training at the military university, the result in the run of 3000 m improves on average by 3–5% from the initial (on the 1 course). During endurance training, the body must be in an oxygen shortage, and this is difficult to control when overcoming the control distance without specifying the load.

Therefore, to obtain better results, we used interval training with a near-critical speed. It is the overcoming of distance segments 200 and 400 meters for a given time [2]. Critical speed ($V_{cr}$) for the existing level of training is calculated for each student by the time of overcoming two distances – 400 and 1000 m. Further calculations were performed using the formula: $V_{cr}=(1000–400\ m)/(t_{1000}–t_{400})$, where $t_{1000}$ – time to overcome the distance 1000 m i $t_{400}$ – time to overcome the distance 400 m in second.

Interval training is conducted at a rate of 70–80% of the critical (the maximum possible speed of a serviceman in a given period). To bring the organism into an oxygen deficiency state, it is planned to run short segments with a supercritical velocity (200–400 m). For collective training, the critical speed was determined by the average performance of the cadets. The critical speed indicator constantly changes with the change in the state of preparedness.

The second methodical method of training endurance was the use of interval running at 200 m and 400 m with weighting in the form of transfer of a serviceman on his shoulders. Such work gave a significant load on the muscles of the legs and the cardiovascular system. The monthly schedule of training is presented in the Table 1.

Each lesson began with an active warm-up and the execution of scheduled tasks. The duration of the session was 45–50 min. Pauses between approaches (races) were within

**Table 1**

**The program of endurance development in a month (shock cycle)**

| Days of the week | 1-st week, load 20 km | 2-nd week, load 23 km | 3-rd week, load 25 km | 4th week, load 22 km |
|---|---|---|---|---|
| Monday | Warm-up – 15 min control races on 1 km and 400 m, twice | Warm-up – 15 min control races on 3 km | Warm-up – 15 min control races on 3 km | Warm-up – 15 min control races on 3 km |
| Tuesday | Warm-up – 15 min interval training (5x 400 m), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min interval training (8x 400 m), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min interval training (8x 400 м), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min interval training (6x 400 m), run on 1 km with «critical» speed. Exercises for developing the strength of the muscles of the arms, legs |
| Wednesday | Warm-up – 15 min interval training (4x100 m with burdening), running 2x1000 m. Flexibility exercises | Warm-up – 15 min interval training (2x200 m with burdening), running 2x1000 m. Flexibility exercises | Warm-up – 15 min interval training (3x200 m with burdening), running 2x1000 m. Flexibility exercises | Warm-up – 15 min interval training (2x300 m with burdening), running 2x1000 m. Flexibility exercises |
| Thursday | Warm-up – 15 min interval training (6x400 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min interval training (8x400 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min interval training (8x600 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min interval training (5x600 m), run on 1000 m «critical» speed. Exercises for developing the strength of the muscles of the arms, legs |
| Friday | Warm-up – 15 min interval training (8x400 m), with «supercritical» speed. Flexibility exercises | Warm-up – 15 min interval training (8x400 m), with «supercritical» speed, slow running 1 km. Flexibility exercises | Warm-up – 15 min interval training (6x600 m), with «supercritical» speed, slow running 1 km. Flexibility exercises | Warm-up – 15 min interval training (3x600 m), with «supercritical» speed, slow running 1,2 km. Flexibility exercises |
| Saturday | Warm-up – 15 min slow run on 5000 m. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min slow run on 5000 m. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min slow run on 5000 m. Exercises for developing the strength of the muscles of the arms, legs | Warm-up – 15 min slow run.<br>Control 5000 m |
| Sunday | Rest | Rest | Rest | Rest |

3–4 min. In the first lesson, the maximum distance traveled at a distance of 400 m and 1000 m was determined. After that, the "critical" speed for the entire group was calculated, which was the benchmark for performing the tasks on interval run. In the second part of the exercise, the complexes of strength exercises "to failure".

This training program was conducted for 3 months. The results of comparative tests are presented in the Table 2.

Analysis of the results of the study showed that at the end of the experiment the average results of cadets in both groups improved. But the results in the control group are significantly lower than those in the experimental group. Thus, the results of control measurements for almost all indicators increased by 7–11% (with the exception of running on 100 m – 2,7%). In the control group, the increase was 1–4%.

At the end of the experiment, the difference in the indices between the groups was reliable at the level $P<0,05–0,001$, except for the results in running at 100 m, pull-up and hand dynamometry. Sprinter qualities develop very slowly, and in power tests there are large fluctuations in results. The coefficient of variation is 10–33%. Therefore, with the growth of the results for weak cadets, the stronger they almost do not grow (lack of incentive to improve the results).

To ensure the readiness of servicemen to perform their official duties, the level of results of performing special tests with emphasis on endurance. Such tests include a general control exercise on an obstacle course 400 m long. As the results of our study showed, the improvement in the time of passage of the obstacle course during the experiment in the EG was 13 s or 10,1% of the baseline. The comparison shows that the improvement in the results of this exercise is dominated by the similar dynamics of other tests. Given this fact, an attempt has been made to determine the influence of various factors on the effectiveness of this test. On the one hand, it is clear that the result of overcoming the obstacle course is affected by the level of development of speed endurance (run on 400 m, 1000 m). However, in our study, the results of overcoming the obstacle course are dominated by the rate of increase in endurance. This allowed to assume the presence of influence on the overall performance of another factor: it is about improving the effectiveness of techniques to overcome individual obstacles in the training of cadets. The basis of this assumption is the well-known proposition that repeated repetition of physical exercises forms effective and better performance [3; 12].

To study this, we compared the results of overcoming the obstacle course and the results in the 1000 m run as the closest exercise time. The ratio of the time of overcoming the obstacle course to the result in the 1000 m run gave the coefficient by which the level of overall technical skill of the cadets was tried to be overcome in the obstacle course. This approach is constantly used in athletics in assessing the technical skill of the hurdlers.

**Table 2**
**Results of cadets testing**

| Exercises | EG (beginning) | CG (beginning) | EG (final) | CG (final) |
|---|---|---|---|---|
| 100 m, s | 14,7±0,56 | 14,6±0,55<br>$t_{1-2}$ – 0,493 | 14,3±0,21<br>$t_{1-3}$ – 1,109 | 14,5±0,65<br>$t_{2-4}$ – 0,606; $t_{3-4}$ – 1,15 |
| 400 m, s | 82,2±7,2 | 81,8±6,2<br>$t_{1-2}$ – 0,483 | 76,4±5,1<br>$t_{1-3}$ – 3,35*** | 80,3±7,1<br>$t_{2-4}$ – 0,813; $t_{3-4}$ – 2,28* |
| 1000 m, s | 252,2±18,9 | 253,1±20,6<br>$t_{1-2}$ – 0,163 | 231,2±12,3<br>$t_{1-3}$ – 3,74*** | 249,7±18,8<br>$t_{2-4}$ – 0,63; $t_{3-4}$ – 4,19*** |
| 3000 m, s | 803±36,4 | 799±31,4<br>$t_{1-2}$ – 0,44 | 752,8±17,2<br>$t_{1-3}$ – 6,35*** | 781±27,3<br>$t_{2-4}$ – 2,33*; $t_{3-4}$ – 4,45*** |
| 5000 m, s | 1712±47,4 | 1699±52,2<br>$t_{1-2}$ – 0,94 | 1579±48,3<br>$t_{1-3}$ – 10,05*** | 1659±50,2<br>$t_{2-4}$ – 2,81**; $t_{3-4}$ – 5,83*** |
| Obstacle strip, s | 142,2±8,4 | 141,1±9,3<br>$t_{1-2}$ – 0,94 | 129,1±4,2<br>$t_{1-3}$ – 7,12*** | 136,5±5,2<br>$t_{2-4}$ – 2,24*; $t_{3-4}$ – 5,63*** |
| Pull-up, times | 9,2±3,2 | 9,5±4,3<br>$t_{1-2}$ – 0,28 | 10,3±2,7<br>$t_{1-3}$ – 1,34 | 9,8±3,3<br>$t_{2-4}$ – 0,28; $t_{3-4}$ – 0,60 |
| Flexion-extension of hands, times | 51,6±6,2 | 52,2±4,8<br>$t_{1-2}$ – 0,39 | 57,4±3,9<br>$t_{1-3}$ – 4,04*** | 54,1±4,6<br>$t_{2-4}$ – 1,46; $t_{3-4}$ – 2,75* |
| Slopes forward, times | 63,3±7,1 | 62,8±6,4<br>$t_{1-2}$ – 0,26 | 68,2±5,6<br>$t_{1-3}$ – 3,27*** | 64,4±6,3<br>$t_{2-4}$ – 0,91; $t_{3-4}$ – 2,88** |
| Long jump from the place, cm | 199,7±8,2 | 202,3±7,2<br>$t_{1-2}$ – 1,21 | 214,6±5,8<br>$t_{1-3}$ – 7,56*** | 206,6±6,8<br>$t_{2-4}$ – 2,21*; $t_{3-4}$ – 4,28*** |
| Dynamometry of the right hand, kg | 40,1±6,1 | 39,1±5,4<br>$t_{1-2}$ – 0,84 | 43,6±5,8<br>$t_{1-3}$ – 2,91** | 42,6±6,6<br>$t_{2-4}$ – 2,8**; $t_{3-4}$ – 0,77 |
| Dynamometry of the left hand, kg | 38,2±5,7 | 38,5± 6,6<br>$t_{1-2}$ – 0,23 | 41,8±6,7<br>$t_{1-3}$ – 2,79* | 42,6±5,6<br>$t_{2-4}$ – 3,23**; $t_{3-4}$ – 0,63 |
| VC, $cm^3$ | 4053±51 | 4103±54<br>$t_{1-2}$ – 0,35 | 4265±46<br>$t_{1-3}$ – 15,7*** | 4153±61<br>$t_{2-4}$ – 3,7***; $t_{3-4}$ – 7,5*** |

***Note.*** *Significance of differences: P<0,05*, P<0,01**, P<0,001***.*

At the same time, the improvement of technical efficiency should be accompanied by a decrease in the coefficient value. The smaller the numerator (the time to overcome the obstacle course), the higher will be the technical skill in performing this exercise. This indicator was called the coefficient of coordination and technical efficiency (CTE). In the study, CTE decreased throughout the training period, which indicates a gradual mastery of the technique of overcoming obstacles. So, at the beginning of the CTE was 0,564 – in EG and 0,557 – in CG. At the end of the experiment, these indicators improved to 0.558 and 0.545, respectively. The overall improvement in CTE was 1,06% – in the EG and 2,1% – in the CG from the indices at the beginning of the experiment. Given that the result of overcoming the obstacle course in the EG improved by 10,1%, and the result of running at 1000 m – by 9,1%, it can be assumed that the technique of overcoming individual obstacles improved the result on 1%. In the CG, similar indicators were 3,7% and 1,4%, which suggests an improvement of 2% due to improved obstruction techniques. So, in the EG more involved in running exercises and the result of overcoming the obstacle course distance increased by 10,1%. In the CG less attention was paid to running exercises and the result grew by only 3,7%. But the technique of overcoming obstacles has improved. CTE was better in CG than EG.

The improvement in the result in overcoming the obstacle course in the process of cadets' training depended, on the one hand, on the improvement of endurance, which was estimated by the results of running at 1000 m, and on the other hand, on the effectiveness of the technique for overcoming individual obstacles, is confirmed by the dynamics of CTE. This suggests that using the CTE coefficient, it is possible to evaluate the effectiveness of the learning process both individually and collectively.

Thus, during the training using the proposed program, the results grew by almost 10%, while in the group, trained according to the traditional scheme, the results grew by only 3%. Particularly significant is that the overall assessment of EG increased from 3 points to 5. In the control group, there was also an improvement in the result, but a less significant – from 3 to 4 points. Thus, our studies have confirmed previous studies by military experts that, with an equal total time in training, the greater effect of increasing aerobic capacity (the direction associated with overall endurance) is achieved with an interval training method [4; 5].

## Conclusions

1. The dynamics of the results of running at different distances during the training of cadets in the military university has a wavy positive character. The increase in results depends on the organization of the educational process and the methods of training are used.

2. The increase in the results in the run at 1000 m, 3000 m in the CG is significantly inferior to the increase in the results in the EG. The same picture is also found in the strength indicators of physical readiness, which are controlled in the cadets' teaching process.

3. The application of the coefficient of technical efficiency

in conditions of manifestation of special endurance is most expedient to apply for assessing the effectiveness of training cadets in the technique of overcoming obstacles.

4. The proposed endurance program using the interval training method gives a significantly better result than traditional training.

5. The application of the proposed strength training program (with burdening) gave reliable improvements in the results of the studied indicators.

**Prospects for further research** are related to the study of the influence of various factors on the level of special physical performance of future officers, which is determined by the results of overcoming the obstacle course.

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# Biomechanical substantiation of mechanical impulse transfer mechanisms in the "athlete – sports equipment" system when performing moving actions in sports

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***Purpose:*** *to investigate mechanical impulse transfer mechanisms in the "athlete – sports equipment" system when performing moving actions in sports.*

***Material & Methods:*** *theoretical analysis and compilation of scientific and methodical literature and our own research results.*

***Results:*** *mechanism of interaction of individual body biolink's in the performance of physical exercises is studied, the basis of which is the coordination of accelerations and decelerations of the body's biolink's movement and the sequence of their incorporation into the work, which is crucial for achieving the necessary speed of the working biolink of the athlete's body when exposed to the equipment.*

***Conclusion:*** *mechanism of successive acceleration and successive braking of the body's biolink's in the final phase of motion ensures the transfer of the linear and rotational momentum from segment to segment, from the lower part of the body to the top and from the top to the shell, thereby informing him of the maximum speed.*

**Keywords:** *biomechanical, impulse, biolink, moving actions, sport.*

## Introduction

In the studies of the technique of sports movements, a special place is occupied by studying the position and interaction of different body biolinks during physical exercise, since these components of the final motor effect greatly influence the dynamic structure of its organization [3; 5–7]. The dynamic structure of physical exercise includes the vector set of forces involved in solving the motor problem. The strength of the action depends directly on the traction of the muscles, i.e., the forces with which the individual muscles pull the bone levers. However, there is no one-to-one correspondence between the tension of a particular muscle and the strength of the action, since the changes in the joint angles change the working conditions of the muscles, in particular, the length of the arms of the muscular traction forces [5; 15]. It is also known that the resultant force of the athlete's impact on the equipment depends on the magnitude and direction of forces produced by each link [1; 2]. Consequently, the manifestation of the greatest effort in the optimal direction depends on the coordination of accelerations and decelerations of motion of different parts of the body and on the sequence of their incorporation into the work that is determining for achievement of necessary speed of a working link of a body of the sportsman or equipment. In the scientific and methodological literature this phenomenon is represented by the biomechanical principle of the transmission (transfer) of the impulse in the system of links [15, 20], practical implementation of which requires a " single-discipline" adaptation to each specific type of movements and moving movements, in particular.

**The relationship of research with scientific programs, plans, themes**

The work was carried out in accordance with the "Plan for research work of the National University of Physical Education and Sports of Ukraine for 2016–2020" on topic 2.32 "Technical training of qualified athletes based on the modeling of the rational motor structure of sports exercises" (state registration number 0114U001531).

**The purpose of the research**

To investigate mechanical impulse transfer mechanisms in the **"**athlete – sports equipment**"** system when performing moving actions in sports.

## Material and Methods of the research

*Research methods*: theoretical analysis and generalization of scientific and methodological literature data and results of own research.

## Results of the research and their discussion

We can distinguish three types of interaction of the body links depending on the purpose, which is solved by this movement [11; 13; 16; 17]:

1. If the task is to develop the maximum force, then all links act simultaneously, with the exception of "weak" links.

2. If the speed of the equipment or biolinks is important, the links act sequentially, each following is activated at the moment when the previous one reached the maximum speed.

3. If there is an effect of one or more links, the underlying links should be fixed and create a base (support) for the more effective operation of the overlying links.

The task of optimizing the addition of the forces of individual links is complicated by the fact that in the throwing the athlete must unite all these types of interaction of the body links in a certain sequence. First, he must inform the equipment of the maximum speed of departure, secondly, to accelerate the equipment, it is necessary to show maximum effort and, thirdly – throw is completed with one hand. Therefore, it is necessary that all three types of interaction of the links of the body be: in javelin throwing – 0,12–0,15 s, in shot put – 0,25–0,30 s (time of final effort).

Considering the sequence of inclusion in the work of different links, it is necessary to take into account that the athlete faces the task of using the strength of different links when the muscles that move these links, can reduced at such a rate that the force action on the accelerated masses is the maximum. The strongest body links are the most massive and, therefore, have greater inertia. Therefore, the movement must begin the powerful muscles of the pelvic region, and to finish – limb muscles [17].

At the basis of the transfer of a mechanical pulse along the kinematic chain lies the mechanism of sequential inclusion of the body links, which in the literature has several alternative names: principle of summation of internal forces [11], principle of serial organization of motion [14], principle of speed summation [18], principle (mechanism) of the muscular wave [1]. When implementing this mechanism, it is important to coordinate as accurately as possible the switching from one link of the kinematic chain to another. On the importance (degree of influence on the sporting result), this principle of organization of movement is equated with the principle of preliminary stretching of the muscle-tendon complex, Noting that it is especially important to apply this principle in the throw disciplines (javelin and a discus throw, shot put), as well as in the performance of percussion actions.

Movement begins with large and strong muscle groups of proximal segments that are located near the common center of the body mass. These muscles are predominantly with a fan-shaped arrangement of fibers, i.e., muscles with a large physiological diameter and possessing a great contraction force. The main task of these muscles is to communicate speed to the entire system of "athlete – a sports equipment", to overcome the inertia of the body of an athlete and a sports equipment [13]. The continuation of the movement (dispersal of the working link and equipment) provides, from the point of view of the manifestation of force, less strong but faster muscles of the upper limbs. Their task is not only to ensure the rapid movement of the body links, but also the sufficient accuracy of the performed movement. In these muscles, the number of fibers is less than in the more massive and strong muscles, which affects the force of contraction. Less and the number of muscle fibers innervated by one motor neuron. This means that the central nervous system can provide a more perfect control of the work of these muscles, increasing not only the speed of movement, but also the accuracy of the movement [12; 21].

The speed of the working link in the impacts in equipment throws is the result of the summation of the velocities of the individual links of the body-legs, trunk and arms. The question arises as to how the velocity vectors of the individual body links must be combined in time, so that the velocities of the final link and the equipment are maximal.

Theoretically, there are two ways of interacting the body links to achieve the maximum speed of the final link. The first is characterized by such organization of movements, in which the maximum speeds of individual links coincide in time (Fig. 1).

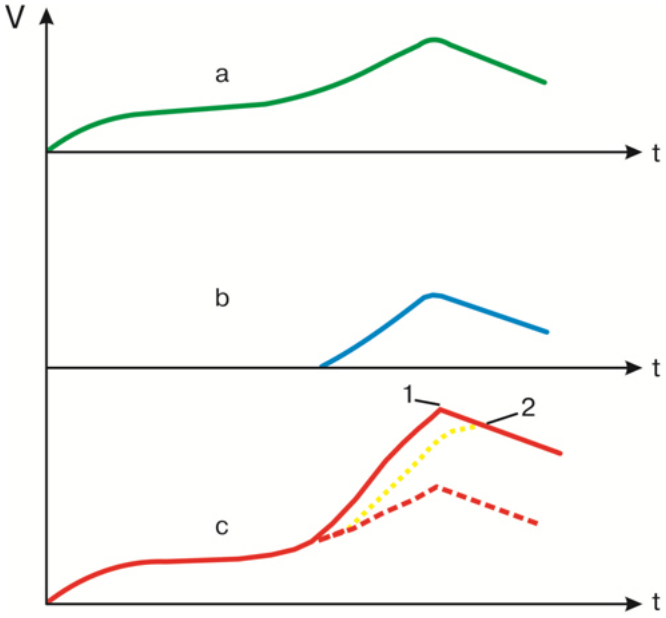


**Fig. 1. Scheme of a combination of the speeds of separate body links [26]:**
*a – torso speed; b – arm speed; c – equipment speed. 1 –speed of the equipment is maximum, if the maxima of the speeds of the links coincide in time; 2 – the mismatch of the speed maxima in time of the torso and shoulder reduces the speed of the equipment.*

In the second method, the body links are gradually accelerated from the bottom up, that is, each subsequent (overlying) link starts its movement when the speed of the previous one reaches a certain value. Schematically such interaction of links is presented in Fig. 2.

From the point of view of biomechanics, the most rational option is (a) – the overlying link is activated at the moment when the speed of the underlying link reaches a possible maximum. There is an effective accumulation of energy of motion. Option (b) – late, overlying bioscience is turned on when the speed of the underlying biofeedback began to decline, part of the energy has already dissipated; (c) ahead, the overlying bioscience is switched on prematurely, the athlete spends energy on maintaining the speed of movement.

The aforementioned variants of the interaction of the body's

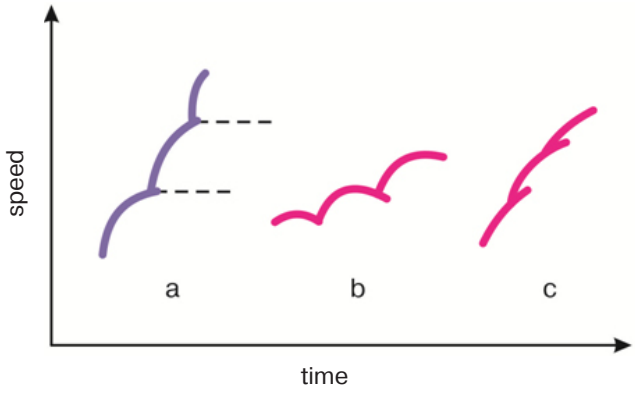


**Fig. 2. Variants of a speeds combination individual body's biolinks [5]:**
*a – timely; b – late; c– ahead.*

biolinks are rational from the point of view of biomechanics. But with their practical implementation, we must reckon with some biomechanical phenomena. First, each muscle has not only its maximum power and power capabilities, but also mechanical properties, for example, elasticity. Secondly, the body's biolinks differ in their mass-inertial characteristics. Even under the condition that the same moments of force are applied to them, each of them will accelerate in different ways. Thirdly, the time needed to achieve maximum strengths in muscles of different muscle groups varies significantly. Fourth, the power capabilities of the muscles depend on such conditions of movement as the speed of movement, internal resistance, the magnitude of the angles in the joints. In addition to all this, the biodynamics of muscle contraction changes significantly if it follows after their stretching. This means that it is impossible in principle to develop one, a rational model of the interaction of the body's biolinks, suitable for all, and based only on fulfilling the requirements of mechanics. Therefore, the search for rational technology mainly goes through the analysis of practical options for performing throw and shock movements by athletes of different readiness and sportsmanship.

The available numerous experimental data confirm that in order to provide the greatest momentum and momentum possible to the body's biolinks and as a result of the greatest final speed of the working link and equipment, the most effective model for the interaction of body links is the sequential "activation" (activation) of them from the proximal to the distal [3; 6; 7; 14; 17; 25]. This model of link interaction does not depend on the type of cast, the age or sex of the performer and the level of preparedness.

The results of our own studies of the dynamics of the speed of the main body biolinks during the shot putt forward by the stereo survey confirmed the rationality of the consistent nature of not only acceleration but also braking of the body links from the bottom up (Fig. 3).

As the qualification of the athlete's increases, the values of the maximum speed of individual parts of the body, starting from the right hip joint and ending with the brush of the throwing arm. In this case, not only the values of the speeds of individual links are important, but also the time of their achievement. Too early the achievement of maximum speed, as well as later, by one link in relation to the other or to the moment of launching the equipment reduces the result. There is an optimal sequence and a tempo-rhythm structure of the movement

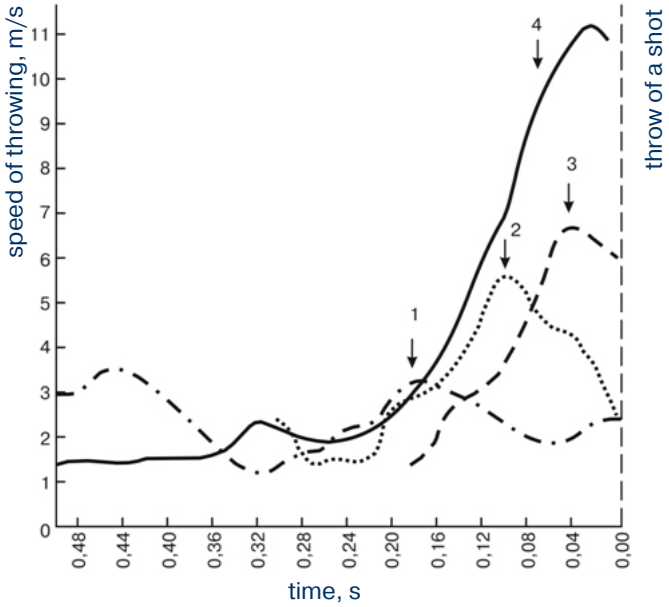


**Fig. 3. Speed of the main body bio-links in the phase of the final acceleration of the shot [25]:**
*1 – right knee joint; 2 – right hip joint; 3 – right shoulder joint; 4 – wrist joint of the right hand. Arrows indicate the maximum speeds.*

of the body links, especially massive and strong, at which the highest result is achieved.

The main conclusion that follows from the obtained data is that qualified athletes have a greater similarity in the temporal sequence of movement of the right knee, hip and shoulder joints. In athletes of less-skilled, the spread of these indicators is much larger.

A similar scheme of organization of movements is observed even in the execution of impact (Fig. 4).

Movement begins with the active interaction of the legs with the support, then follows the gradual inclusion of the muscles of the trunk, shoulder girdle and upper limbs, the action is completed by the hand in sequence – the shoulder, forearm and arm with the racket. Consistently from the link to the link, their speeds also increase. Movement of individual parts of the body are subject to one common purpose – providing the necessary amount of mechanical movement to the body of the athlete and the working link in the vertical and horizontal direction [10]. The principle of successive work of body biolinks during a strike in tennis implies the implementation of three strategies [23]:

1) inclusion of body's biolinks at the right time;

2) activation of biolinks from proximal to distal;

3) sequential acceleration and sequential braking of the body's biolinks.

Any shock action can be characterized as a series of time-coordinated translational-rotational movements of body parts. In this case, the proximal units produce more than 50% of the total speed of the end link of the kinematic chain or equipment [18].

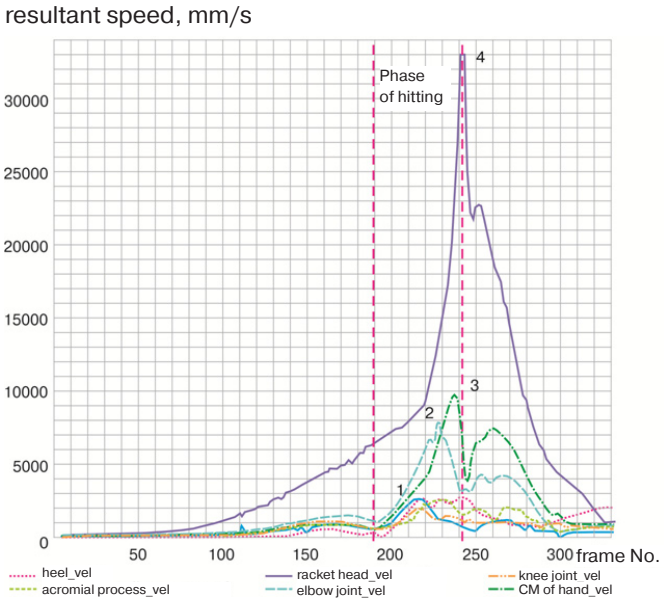


**Fig. 4. Speed charts of the center of the joints and racket in the performance of the forehand in tennis [4]:**

*1 – maximum speed of the right hip joint; 2 – maximum speed of the right shoulder joint; 3 –maximum speed of the CM of the right hand; 4 – maximum speed of the racket head.*

What are the mechanisms that ensure the maximum speed of the equipment can underlie the considered principle of interaction of the body links?

It is known that if external forces do not act on the body or system of bodies, then the velocity of the center of mass of the system remains constant (internal forces can not change its motion). However, within the system itself a redistribution of momentum is possible, that is, if the speed of any of the bodies entering the system is reduced (due to the action of internal forces), braking it, it will lead to an increase in the speed of the rest of the system. Of course, the law of conservation of momentum in application to the movements of the athlete does not manifest itself in pure form, because the athlete is affected by external and internal forces (reaction forces of support, friction, etc.), however, it can explain the successive nature of the speed increase body links from the supporting to the workers in shock and throwing movements.

The process of communicating the velocity of the projectile can be divided into two stages. At the first stage, the speed is communicated to the entire system of the athlete-equipment, as a result of which the system acquires a certain amount of movement. At the second stage, due to the braking action of the left foot, and then the right one, the braking of the body links from the bottom upwards. This leads to a decrease in the moving mass of the athlete's body and, as a consequence, to an increase in the speed of the overlying links up to the brush and projectile. In other words, there is a redistribution amount of movements (momentum) between the body links. The speed of movement of links that are successively drawn into the braking wave varies inversely with their mass, that is, the lighter the link, the greater its speed. Thus, the hand with the equipment, being not only the final, but also the lightest links of the system, get the highest speed in comparison with the other links that preceded them in the chain of actions [1].

The second mechanism, ensuring the growth of the speed of the equipment with the subsequent dispersal of the links of the body, is based on the use of the energy of elastic deformation of muscles. In throws and blows, pre-tensioning of muscles is created by overtaking links. When the body link is subsequently activated actively, the proximal joint of the link is accelerated in the direction of throwing. Acceleration of the joint is caused by a so-called articular force, the line of action of which passes through the joint axis [27]. Since the link has a definite mass, that is, it has inertial properties, its distal end lags behind in its motion, turns in the opposite direction to acceleration. As a result, stretching of the muscles takes place, which will participate in the acceleration of the link. As a result, they accumulate the potential energy of elastic deformation, which, with the subsequent contraction of muscles, partially transforms into kinetic energy of the moving link, increasing the speed of its movement.

Such a performance of the rotational movement in sports practice is often called a whip technique. The execution of the movement by the whip technique is based on the fact that the proximal joint first moves rapidly in the direction of throwing or striking, and then is sharply inhibited. This causes a rapid rotational movement of the distal part of the body link. Unfortunately, at present there is no exact data, what is the quantitative contribution, obtained by using the energy of elastic deformation of muscles, into the speed of the working link and the equipment. Indirectly, this can be judged from the contribution of the hand to the rate of emission of the nucleus (about 2 $m \cdot s^{-1}$) and javelin (about 8 $m \cdot s^{-1}$). The movement of the hand at the end of the ejection phase is due to the activity of flexor muscles of the hand and fingers, as well as the forces of elastic deformation arising as a result of the stretching of these muscles by the force acting on the part of the accelerated equipment. The magnitude of the forces of elastic deformation of muscles with the correct performance of the exercise is much greater than the magnitude of the force caused by the activity of muscles [19; 22; 24; 28].

Thus, skillful use of energy of elastic deformation of muscles is one of the main sources of increasing the speed of the working link and equipment [10].

When the muscles are stretched, this occurs when the body links are connected in series, the receptors located in it (neuromuscular spindles), which can lead to a reflex increase in the nervous impulse that comes to the muscle (the so-called stretch reflex).

The mechanism of active control of wave motion in the kinematic chain assumes not only correctly coordinated acceleration of links, which are included in the work, but also their equally strong braking, which is necessary for transferring the impulse along the chain [1]. The need for a clear temporary organization of accelerations and braking of the body links is emphasized by other specialists [1; 8; 9]. Some specialists, emphasizing the importance of the effectiveness of sequential braking of the speed of links in the final phase of throwing or strikes, discussed principle of organization of the interaction of the links of the body is called "principle of transmission (transfer of the kinetic moment in the multi-link kinematic chain" [15] or "principle of the transmission of momentum" [20].

## Conclusions

Consecutive dispersal of the body links is an important condition for the rational execution of impact or throws motion. The second equally important condition is the consecutive braking of the body links in the final phase of the movement, which also affects the dispersal of the working link and equipment. These actions transfer the linear and rotational momentum from segment to segment, from the lower part of the body to the top and from the top to the shell, giving him the maximum speed.

When the muscles are stretched, which occurs when the body links are sequentially inserted, the receptors located in it, which can lead to a reflex increase in the nervous impulse that comes to the muscle, and the possibility of using the energy of elastic deformation of muscles, which is one of the main sources of increasing the working speed link and equipment.

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# Methodological fundamentals of health-improving student youth training

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***Purpose:*** *to carry out a theoretical analysis of the problem of socio-pedagogical basis formation for effect of health training on the state of human health.*

***Material & Methods:*** *analysis and generalization of data from scientific and methodological literature.*

***Results:*** *factors are defined and systematized, and also their interrelation which determine possibility and reliability of achievement of the purpose – improvement of various groups of the population.*

***Conclusion:*** *obtained research results can be used as a basic basis for building health-training programs with different population groups, as well as for ensuring the effective solution of the problems of physical education in a higher educational institution.*

**Keywords:** *health-training, physical education, student youth.*

## Introduction

Now one of the most important indicators of the welfare of society and the state is the state of health of various groups of the population. However, the current state of health of the population of Ukraine as a whole, children and young people in particular, is a significant challenge for society and for the state and, without exaggeration, represents a real threat to its human security [13].

Strengthening and maintaining at a high level the psychophysical state of various groups of the population, the full development of the personality, the training of modern highly qualified specialists capable of ensuring the efficiency of production, is a composite educational process in higher education [6].

The issues of educating students of a holistic awareness of the relationship between the culture of health and personality are still in the research stage.

The analysis of the literature on the problem of the formation of a healthy lifestyle and health preservation shows that there are several theoretical areas, such as the dissemination of awareness of the state of the problem of deteriorating health of modern youth. Also important are the development of the concept of health improvement for students and youth in the process of education in educational institutions. Therefore, it is important to determine the main directions of man's striving for good health with the use of means and methods of health training.

**The relationship of research with scientific programs, plans, themes**

The research was carried out in accordance with the plan of research work of the Sumy State Pedagogical University named after A. S. Makarenko, the Ministry of Education and Science of Ukraine for 2015–2020. On the topic: “Theoretical and methodological foundations of physical culture education of different population groups”, approved by the State Registration Department of the Ukrainian Institute of Scientific and Technical Information in Kiev. (number of state registration 0116U000900).

**The purpose of the research**

To carry out a theoretical analysis of the problem of socio-pedagogical basis formation for effect of health training on the state of human health.

## Material and Methods of the research

*Methods of research*: analysis and generalization of data from scientific and methodological literature.

## Results of the research and their discussion

Health has always historically been considered one of the most important values of life. And there was always the problem of ensuring its high level.

Thanks to a large arsenal of remedies and forms of their use, the primary role belongs to health improving training. Health improving training, which carries a broad sense as a system of physical exercises in order to improve the level of physical condition to the due, is also called «conditioning training” [8].

To this we should add that always health training has occupied and takes priority positions in the development of general theoretical concepts and personal techniques of various types of exercises and their methodological generalization.

Generally, physical activity is pursued by one purpose – to achievement of psycho-physical perfection, depending on the individual characteristics of those involved, the state of health, physical development, motor skills and abilities, preparedness, motivation, conditions for classes, and so on. However, the main essence of the lesson is the desire to improve their psychophysical conditions and the ability to realize them.

In this regard, two areas of this improvement are possible::

– providing such psycho-physical capacity that would guarantee a person to carry out domestic and professional activities;

– achieving higher levels of quality development that can be implemented in a particularly difficult and challenging conditions. At the same time, there is a high probability that arbitrary manifestations of specialized abilities can occur in conditions of domestic and professional activity, that is, there will be some positive transfer of effectiveness from specific activities to activities that are not covered by this action [3].

It is known that the methodology of recovery, based on health training, is characterized by systematic [2].

If we construct an ideal model of a healthy person, whose realization should be sought, then it will include the following main blocks:

– absolute health;

– reliable motor potential;

– a stable complex of psychic qualities in the absence of pathology;

– intelligence as a system control tool for created blocks and the system as a whole [3].

The allocation of certain blocks of the model is done with analytical purposes: the whole essence of the model and the fundamental possibilities of its functioning are due to the unity of its constituent parts. The absence of any of the blocks or links between them excludes the correct representation of both the model and the system of its implementation, that is, even the technologies of psychophysical improvement.

The feasibility of implementing such a model depends primarily on the state of the individual, and the construction of a specific healing technology must be adjusted depending on the individual state of each significant characteristic of the person who is engaged in recreational training. But this all the same requires the construction of a generalized methodology that defines the tasks, the main groups of tools, the possibilities for their resolution and complex action, the final effect, methods of use, controls, correction and evaluation of results. Therefore, before we consider directly the methodology of recovery, it is necessary to analyze the factors and their interrelations that determine the possibility and reliability of achieving the goal of recovery and the reliability of the established healthy personality.

The purpose of improving the health of a particular person is to ensure that it is vital, that is, the capacity for a large number of actions due to the need to exist in certain natural and social conditions, as well as to perform labor operations of domestic and professional nature. This effect is carried out through the functional systems of the body, which are the main in the performance of vital functions: nervous, cardiovascular, respiratory, musculoskeletal, motor, excretory, endocrine and so on. The difference in the development of these systems, the presence and the degree of their diseases determines which health-improving effect is principally possible and expedient to admit in relation to a person: pedagogical or only medical, and what specific methods of influence are appropriate that are adequate to the functional state. It is they who dictate the choice of medical indications and limitations, the regimens of work and rest, nutrition, pharmacological additives and other [10].

The level of development and capacity of all the above functional system s is related to the physical sphere of man: his integrity, the presence and level of development of motor qualities and the ability to realize them in everyday, professional, social and other conditions.

With a complete musculoskeletal system, there are already certain levels of development of strength, flexibility, speed, the natural and definite connection of physical qualities with the nervous, cardiovascular, respiratory, excretory systems. The integrity of functional systems and the absence of pathological disturbances initially determine the very possibility of manifesting physical qualities, but the improvement of these systems and their capacity are ensured and limited by physical qualities, which, in turn, are improved by pedagogical, that is, those that are specially selected, and managed of action.

In a qualitative pedagogical process, it is impossible to influence a person, bypassing his psychic sphere, by which is meant the totality of mental properties and abilities for self-regulation in adequate psychological responses to external and internal motivations. Complex mental properties of the person is important not only in the perception and reflection of the external world, but in particular the assimilation influential on him educational activities and developmental nature.

However, the essential role in the initial attitude to self-improvement is played by the meaningfulness of necessity, the motivation of its recreational activities and its organization. But for this we need a certain intellect. Intellect is defined as a person's mental abilities and is interpreted in various language sources as "concept, understanding, sensation, facilitation, understanding, sense, cognition".

At the same time, psychophysical recovery should be viewed not so much as a process of physical training alone, rather than as a social and pedagogical system that shapes a meaningful attitude toward exercise, certain moral and ethical perceptions of them, the need for a healthy lifestyle and the relative construction of its content and regime, regular activity in the use of scientific principles and means of improvement – in general, ensuring the activity of life positions and the meaningfulness of their personal significance and social utility.

In accordance with this starting position, the general theoretical and general methodological principles of the improving and developing direction of physical culture are transformed into certain conditions, the unquestionable fulfillment of which can yield significant positive results. In health training, these

results are almost entirely dependent on the correct choice and correctness of the application of pedagogical influence.

The most significant are:

- choice of health-improving action depending on the presence and degree of functional deviations in the state of health;
- individual attitude to the content and characteristics of the selected species and means of recovery;
- degree of loading when using a certain healing effect;
- possibilities of mental state for the transfer of the proposed load;
- optimal ratio of combinations of different health-improving means;
- the ratio of the nature and amount of load to the state of the environment and individual biorhythms.

The state of functional systems is a prime factor on which virtually all health improvement depends on the possibilities to the result. First of all, the individual's attitude to the very necessity of recovery is determined from him. This need should be strengthened by understanding the possibility of reliable results of recovery. In general, they constitute the first level of motivation, which will ensure the emergence of an active interest in health improvement in general and the choice of a particular species and specific means.

The attitude toward health improvement differs from the lack of confidence in the need to spend time and energy and is associated with the habituation to special conditions, and also, as a rule, with the delayed manifestation of the results of studies. Therefore, here we need a special approach in determining both the forms, and composition, and nature, and the level of load and ways to stimulate [1].

That is why the selection of means and methods, modes of their use – must constantly reinforce interest in studies and gradually transform the motivation into positive skills. And although any kind of recovery requires a certain work, here, unlike sport, the meaningfulness of the need and usefulness of classes should be provided by pleasure. And this means that it is this criterion that should be used when choosing the type of recovery and rational ratio or combinations of various health-improving effects.

Motivation of students for physical training and sports we consider as a purposeful process of positive influence on the person through physical culture with the purpose of preserving and promoting health [9].

Anyway, the whole effect of the action is closed on the personality of the person who is engaged in health training. And this means that the use of any health facilities should be consistent with individual biorhythms and the state of the environment. As it was said, the effectiveness of the various means of recovery depends on the personal interest of the person who does health training. In this regard, it should be noted that different functional systems of the same person almost uniquely react to certain types of health effects, but different types of their responses are not identical. This should be used, more accurately approaching the choice of means and methods of using them for health purposes on the basis of the individual characteristics of those who are engaged in health training.

Based on the generalization of the theoretical and methodological foundations of recovery and analysis of the results of their introduction into practice, it is necessary to emphasize following the methodical principles of health-improvement training: the need, expediency, adequacy, complexity of impact, rationality of construction, load manageability, stimulation of interest in pursuing of students.

The necessity of exercising physical fitness exercises in the health-improving direction is determined by the state of functional systems and psychophysical preparedness, and also by the meaningfulness of the desire to improve them. In general, it is these two factors that determine the beginning of a person's exercise in physical fitness. With any, even the best, state of the body's functions, a systemic application of special means of psychophysical influence is needed that allows to prolong this state, to use effectively in a specific professional or sporting activity, to create prerequisites for achieving a higher level of improvement. Without comprehension of such necessity and positive influence of applied measures of improving effect it is impossible to reach. Formation of understanding the need for recovery and must be subordinated to any available means that are the content of pedagogy and psychology of physical education [9] The expediency of recovery is even more determined by the above reasons. But on their own they do not justify the referral to the health-improving direction, and not, for example, the sanitation-health form of recovery, or even more to some other types of recovery. Therefore, the expediency of resorting to recovery and the choice of one or another kind of it is determined to a greater extent by the comprehension of certain features of the person's psychophysical state and the possibility of influencing a particular type of recovery, which in turn has certain attributes (properties). For example, a completely different property of static and dynamic strength exercises, cross-country and other.

Undoubtedly, the doctor will better determine the expediency of recovery, the preferred form and form, but recommendations about a specific tool, methods of its use and some conditions will be more professionally made by a specialist in the field of physical education. Therefore, they need a close relationship. Adequacy of the choice of direction and type of recovery, in addition to the above reasons, depends on the interest, the desire to engage in this type of exercise and the appropriateness of the purpose of the exercises. Interest arises under the influence of subjective and objective reasons. For the emergence of desire, in addition to interest, it is necessary not only to make sense of the opportunity to heal and the speed of productivity, but also the attractiveness of the forms and nature of the activity, as well as the external accompanying signs of it: beautifulness, comfort, taste, etc.

But the preservation of the desire, plus all, requires the actual effectiveness of the lessons. Without it, there is a doubt in the appropriateness and necessity of classes, and in the adequacy of the chosen type of health training. It's good, when the lack or small effectiveness is caused not by the very successful or completely unsuccessful choice of the type of recovery, which turned out to be inappropriate for the individual characteristics of the person who does health training. This often happens when an individual approach is absorbed by a group way of organizing classes.

In this case, there is still the opportunity to correct the mistake

and choose a more effective way of health training. But often, especially at the initial stages of classes, disappointment is so great that the desire to deal with all the negative consequences disappears. Therefore, it is very important for each immediate period to set tasks in such a way that they can be solved by selecting the means that satisfied the person who is engaged in the maximum degree of application, content, external characteristics, but at the same time it is necessary to constantly encourage him successes at least to an insignificant degree and due to this formation of meaningfulness of usefulness and productivity of studies.

On the other hand, the organizer himself must analyze the adequacy of the funds used from various points of view, critically evaluate their effectiveness and their role in providing it, and at the same time make their own adjustments. The complexity of the impact, as a methodical principle, allows, if possible, simultaneous impact on the psychophysical sphere, functional systems, mobile abilities and intelligence [2].

As for the psychophysical sphere, its components are, in fact, inseparable from each other. If every physical exercise that is directed at the muscular system simultaneously carries out the psyche of those who are engaged, because it is reflected in the performance of mental processes: the activity of thinking and behavior, the analysis of tasks, attitudes and conditions for their implementation, the course of realization, and also in correction and evaluation of effectiveness, in general, health training is guided by the intellect. But, in turn, training stimulates the perfection of the intellect of the instrument of intelligent control of motor activity.

Functional systems react to significant shifts only with strong stimuli. As their act a large amount of motor actions and concentration per unit time (intensity), a long time of work, physical severity and mental tension exercise, a saturated mode of activity and repetition of the load at various degrees of restoring functions and other. It is the complex effect of the load that leads to better improvements in functions, physical qualities and motor abilities. But this does not mean that you have to engage in a wide variety of exercises. The essence lies in the optimal selection of the best combinations of exercise options and the constant accounting for the dynamics of various indicators of the state of the organism. This is the key to matching the exercises used to the individual characteristics of those who are involved, the productivity of the classes and the pleasure of domestic needs.

Rationality, or reasonable justification for the use of various remedies, consists of the adequacy of the means to the individual characteristics of those who are engaged in specific tasks of recovery, the optimality of the duration and frequency of its use, and the relationship with other means and methods, a positive trend in the dynamics of indicators [17].

Unlike developing exercises of a sports orientation, in improving training it is supposed simultaneous application of various exercises (for example on speed, force and endurance). At the same time, as in sports, it is advisable to first separate, but accentuated education of physical qualities and motor abilities – which, according to physiological laws and practical experience, allows achieving high results of improvement with less time and effort [3].

One of the most important principles of recovery is load controllability. But this does not mean minimizing the load, which is, using only warming up loads. They are good at getting into work, using for the purpose of rest, distraction from the main activity or keeping the constancy of physical exercises. But without stress, without effort, it is impossible not only to increase the psychophysical potential, but also to preserve it.

It often happens that exercises that are regularly performed with the same load, with the same ratios of work and rest, the one who does, begins to suffer with discomfort. Often this is regarded as a symptom of overtraining or fatigue and therefore the load is drastically reduced or at all time excluded from the established mode of life activity. As a result, there is a lack of training and lack of tolerance, and against this background – a decrease in functionality, since the low load ceases to fulfill the role of a factor that stimulates the deployment of functional reserves. Therefore, in this case, it would be necessary to reduce the load, and change its nature, perhaps even increase the intensity while reducing the volume and duration, but in general, keep its energy supply. Some and the same loads with different functional states cause different physiological changes. Uneven loads carry in themselves and various recreational exercises for the same duration of their.

Another important factor in load management is its distribution in one session. In each type of health-improving exercises there are their own traditional rules of construction and the criteria that are established based on the indices of averaged load of the exercises used, the age and qualification characteristics of the contingent are involved. Therefore it is important to know the load value of the exercises used, individual reactions to the load of a certain type, nature and different dosage, the degree of recovery of those who are engaged, immediately after the session and before the start of another workout – and in skillfully varying the load parameters, create better conditions for an effective recovery process.

Thus, unlike the sports where suitable stepwise construction loads, improving exercise fully principle be used sequences increases and smooth variation of the load.

Coherence of relative ease and stimulating exercise severity is the most important principle of methodical provision of recovery. Only due to light exercises and small loads it is impossible not only to improve, but also to maintain the necessary level of psychophysical state for a long time. Therefore, it is expedient to determine the maximal possibilities of the person who is engaged, and only then, with respect to this maximum, to establish retractors, basic, unloading, stimulating load levels and relatively light or heavy exercises. Then these easy exercises will carry a load within 20-40% of the maximum of the actual and subject to varying their application in coordination with other means to help maintain a stable state of the body. In accordance with such light exercises, medium and large loads are used. This increase in the load must be individual. The use of increased loads will provide a tendency to increase loads and transfer them to a higher level, and hence the relative functioning of the body [3].

Stimulation of interest in health improvement in general and in the selected type of health-improvement training takes place while observing the above-mentioned basic methodological principles, but special methods are also applied. Stimulation in health improvement is provided by a large number of exercises and the conditions for their implementation, a favora-

ble background that causes positive emotions, attention and help, gratitude to activity, the selection of adequate criteria for evaluating the performance of classes, and involving students in the evaluation of results; choice in connection with the individual characteristics of critical and incentive methods of evaluation as one of the possible options for stimulating activity, interest and the desire for self-improvement of students.

## Conclusions

1. Physical training will be effective only if it is part of a broad rehabilitation program, at the center of which are psychological and social, and not only – training aspects. Training can be called health-improving if it passes on a positive psycho-emotional background, helps to relieve stress and relax the psyche, causing a state of rest and comfort.

2. Socio-pedagogical aspects of health training in general are characterized by the provision of a pedagogically directed process of psychophysical personality improvement based on the choice of the effective use of individually adequate means and their positive evaluation as a significant contribution to the social environment. In this sense, it is important to realize that the set of tools should be optimized for effective action on the human body.

3. Stimulating the students' interest in health improvement is ensured by pragmatic studies and the meaningfulness of their usefulness.

**Prospects for further research** are the development and implementation of innovative technology in the structure of the training professionally-oriented program of the military applied section.

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# Modern aspects of the e-learning usage in the field of physical culture

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***Purpose:*** *actualize the introduction of e-learning to motivate students to engage in movement activity.*

***Material & Methods:*** *method of generalization and analysis are selected, which was used to study the approaches, definitions and results of the study among different authors on the research topic.*

***Results:*** *generalized and analyzed: approaches to the formation of motivation in students for movement activity; definition of e-learning; results of the introduction of e-learning in the educational process of students from different authors.*

***Conclusion:*** *it is proved that the approaches of different authors on motivating students to movement activity do not include the use of modern e-learning tools; it is established that e-learning can be an excellent complement to the full-time form of education; directions for further scientific research are updated.*

**Keywords:** *physical education, motivation, e-learning, students, educational process.*

## Introduction

The analysis of modern pedagogical studies indicates that the formation of positive motivation for learning is one of the most acute problems of higher education. It is well known that any activity is more effective when it is more motivated [6].

In the physical culture and health work carried out in the university, it is necessary to strive to solve the problems of the level of education, when cognitive interests in the field of physical culture grow into a need for movement, an increase in independent studies [5; 6].

Rapid progress in the field of information technology makes it possible to use personal computers as an effective means of teaching. Automation of the learning process is carried out using computer training programs and electronic textbooks that are used not only with the use of magnetic media (laser disks), but also with the use of local and global computer networks. In the latter case, a specialized information and educational environment is formed, which allows the implementation of modern teaching technologies. To fill the information and educational environment, as well as to effectively use local and global computer networks, it is necessary to develop online high-quality electronic training courses that correspond to the current state of science in this subject area [11].

The overall goal of creating e-learning courses – to increase the efficiency of the learning process and improve the quality of training of specialists. In the system of full-time education, electronic training courses can be used as additional training tools that allow to organize methodically the teacher's independent work of students. Thus, within the framework of full-time education, the gradual introduction of open education technologies, in particular, the e-learning method. At the same time in the open education system, e-learning courses are a major source of educational information for learners [25; 84]. The authors V. S. Ashanin and V. A. Druz point out in their studies that a special place among the means of information technologies of education is occupied by computer training systems. Such systems enable students to independently study the material by processing it interactively [4; 9].

An analysis of the state of the issue shows that at the present stage, information and communication technologies in the system of physical culture and sports have not yet been properly applied due to objective and subjective reasons [14].

**The relationship of research with scientific programs, plans, themes**

The work was carried out according to the research areas "Formation of motivation for motor activity, healthy lifestyle in the system of physical education of children and youth" and "Innovative methods and technologies in physical education of different population groups" passports specialty 24.00.02.

**The purpose of the research**

Actualize the introduction of e-learning to motivate students to engage in movement activity.

*Objectives of the study:*

1. Analyze: the approaches of different authors on the formation of motivation in students for motor activity; Definition of the concept of e-learning.

2. Identify and analyze the results of the introduction of e-learning in the educational process of students in different authors; update the directions for future research.

## Material and Methods of the research

To achieve this purpose, a generalization and analysis method was chosen that was used to study the approaches, definitions and results of the study in different authors on the topic of the study.

## Results of the research and their discussion

To solve the first task of the study, we studied and analyzed: modern approaches of various authors on the formation of motivation in students for motor activity; the definition of *e-learning.*

We examined the innovations of various authors regarding the components of learning, namely: the means, forms, methods, principles, content and pedagogical conditions.

The analysis made it possible to determine that the majority of authors offer innovations in terms of content, pedagogical conditions, and also the means of training for the formation of motivation for the motor activity of student youth. It can be noted that the proposed innovations do not include the use of modern *e-learning* tools (personal training systems of students – PTS, electronic textbooks – ET, etc.).

From the above analysis of the definition of *e-learning,* it can be noted that this is a learning process using the Internet. They share such common features as the use of information technology in the provision of educational services; the possibility of communication between student and teacher online; remote access to educational materials.

To solve the second task of the study, we studied and analyzed the results of introducing *e-learning* into the educational process of students; we updated the directions for future research.

**Table 1**
**Synthesis and analysis of approaches**

| No. i/o | Author(s) | Training components | | | | | |
|---|---|---|---|---|---|---|---|
| | | Means | Forms | Methods | Principles | Content of training | Pedagogical conditions |
| 1. | Zakharina, E. A. [10] | – | – | – | – | + | + |
| 2. | Romanchuk, S. V. [24] | + | – | – | – | + | + |
| 3. | Boytsova, T. L., Zhukova, O. L. [7] | – | – | – | – | + | – |
| 4. | Mikheeva, T. M., Kholodova, G. B. [17] | – | – | – | – | + | – |
| 5. | Nazimko, V. V. [19] | – | – | – | – | – | + |
| 6. | Nagovitsin, R. S. [18] | – | – | – | – | – | + |
| 7. | Alyeva, Y. V., Popova, N. V. [1] | – | – | – | – | – | + |
| 8. | Bilichenko, E. A. [6] | – | – | – | – | – | + |
| 9. | Tarasova, O. A. [29] | – | – | – | – | – | + |
| 10. | Gruzhevskiy, V. A. [8] | – | – | – | – | + | – |
| 11. | Konkina, M. A. [12] | + | + | – | – | + | – |
| 12. | Konopleva, E. N. [13] | + | – | – | – | + | – |
| 13. | Pantyukhina, L. E., Makhov A. S., Matveev, A.P., Seagull J. Y. [21] | – | – | – | – | + | + |
| 14. | Anokhin, E. M. [2] | + | – | – | – | – | + |
| 15. | Ponomarenko, V. S. [22] | – | – | – | – | – | + |

**Table 2**
**The definition of e-learning and its analysis**

| No. i/o | Author(s) | Definition | Key words |
|---|---|---|---|
| 1. | Marc Rosenberg [36] | Use of Internet technologies to provide a wide range of solutions that increase knowledge and productivity. | Internet, learning process, interaction |
| 2. | Allison Rossett [34] | Training using computers that are connected to the Internet. | Internet, learning process, interaction |
| 3. | UNESCO Experts [33] | Training using the Internet and multimedia. | Internet, learning process, interaction |
| 4. | Bykov, V. Y. [35] | A variety of distance learning, according to which the participants and organizers of the learning process perform predominantly individualized interaction both asynchronously and synchronously in time, mainly and principally using electronic transport systems for delivery of training facilities and other information objects, computer Internet networks, media-educational tools and information and communication technologies . | Internet, learning process, interaction |
| 5. | Solovov, A. V. [26] | Technology of learning, based on the use of computer technology and data transmission systems for the presentation and delivery of knowledge, support the interaction of students and teachers, as well as knowledge control. | Internet, learning process, interaction |

**Table 3**
**Results of implementation of e-learning**

| No. i/o | Author(s) | Results of the study | |
|---|---|---|---|
| | | Theoretical | Practical |
| 1. | Malinov, M. B., Mochalov, S. P., Tretyakov, V. S. [15] | The functions, structure and interface of the e-learning system are presented. The possibilities of data analysis are described. | – |
| 2. | Toktarova, V. I. [30] | Educational and methodological support was developed and applied, based on the principles and means of e-learning. | – |
| 3. | Mikhailova, N. V. [16] | Specific features of asynchronous interaction between subjects of learning, factors that influence the success of e-learning. | – |
| 4. | Yadrovska, M. V. [31] | The characteristics of distance learning are defined, on the basis of which the classification of distance learning models is proposed; the factors of optimization of distance learning are determined from the point of view of the results of educational and pedagogical communication; the criteria for the design of educational material and the optimization of educational texts are formulated, are included in the content of distance learning. | – |
| 5. | Nizhnik, S. G, Batanina, I. A. [20] | The model of forming the professional competence of e-learning teachers is considered. | – |
| 6. | Akhmedova, A. M. [3] | The main problems of using e-learning tools in practice are considered. | – |
| 7. | Starshina, T. A., Makletsov, S. V. [28] | The problem of information preparation of students is considered. | – |
| 8. | Starychenko, A. E., Sardak, L. V. [27] | The technology of using a document camera during webinars as one of the most common methods of modern distance learning is proposed. | – |
| 9. | Yakusheva, N. M. [32] | Features e-learning, the question of approaches to the implementation of training are considered. | – |
| 10. | Rannikh, V. N. [23] | The examples of the organization of e-learning in the university, as well as the ways of its effective use are considered. | – |

From the foregoing we note that many researchers studied e-learning, namely: functions, structure, interface, and ways of effective use; data analysis capabilities; the features of asynchronous interaction of subjects of learning are determined; the model of formation of professional competence of teachers of e-learning, the main problems of the use of electronic teaching aids in practice; innovations for webinars. All of the above research results are of theoretical importance. However, in the available scientific literature, we did not find concrete practical (experimental) results of the introduction of e-learning tools in the educational process of students. We believe that it is in this direction that further research should be conducted.

## Conclusions

1. The analysis of the approaches of different authors on the motivation of students to motor activity allowed us to determine that they do not involve the use of modern means of e-learning, which ensure the quality of education through the substantive content of the educational environment, providing equal access to participants of the educational process to the quality of learning and teaching materials, regardless of where they live and form of training, create conditions for the personalization of learning and use of information continuously and communication technologies.

2. Based on the definition of *e-learning,* we note that it can be an excellent complement to the full-time form, as the technologies used in the development of training courses will be a good support for improving the quality and effectiveness of the traditional approach to learning.

3. All the results of studies on the introduction of *e-learning* are of theoretical importance. However, in the available scientific literature, we did not find concrete practical (experimental) results of the introduction of *e-learning* tools. We believe that further scientific research should be conducted in the direction of the experimental introduction of *e-learning* tools in the physical education of students, the analysis of practical results obtained and the optimization of the correlation between the use of traditional and innovative approaches in the educational process of students.

**Prospects for further research:** it is planned to obtain and analyze some results of the introduction of e-learning tools, and the appeal of users to the content of training courses from the sphere of physical culture; use of interactive tools of personal educational system of students.

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# An experimental program for physical education of rugby players at the stage of specialized basic training

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***Purpose:*** *to develop a program of general physical training of rugby players at the stage of specialized basic training and to investigate the dynamics of indicators of general physical preparedness using computer technology.*

***Material & Methods:*** *study involved 60 athletes aged 16–18 years.*

***Results:*** *content of the comprehensive program of general physical training of rugby athletes at the stage of specialized basic training and the results of an experimental verification of its implementation are presented.*

***Conclusion:*** *in the course of the pedagogical experiment, the effectiveness of using the developed experimental program for improving the training process of rugby players of 16–18 years is proved, which is confirmed by the results of the research.*

**Keywords:** *rugby league, training process, general physical preparedness, training computer program.*

## Introduction

Successfully manage the process of sports training is possible only if there is a well-organized and planned system for training athletes and the team as a whole [2; 6; 7; 10; 28; 29]. Physical training as one of the components of the system of sports training, as a rule, is associated with the development of the basic physical qualities of the athlete, necessary for him in sports activities – speed, strength, coordination, endurance and flexibility, as well as some of their complex manifestations - speed-strength, speed endurance, etc. [1; 3; 15; 26].

Modern rugby league makes high demands on the motor qualities and functional capabilities of the athlete [7; 12; 14; 18; 25]. The motor activity of a rugby player is very diverse and complex. It is characterized by a great variety of motor actions, different in character and structure, the complexity of individual, group and command actions, continuous change of situations, dynamic and static operation of variable power [11; 16; 22]. All this requires a purposeful comprehensive preparation of physical and technical qualities of athletes [24; 27]. The basis for the training of rugby players is the development of the main types of physical qualities and abilities: strength, speed, speed-strength, coordination abilities, and endurance [5; 17; 19; 20; 21].

Rationally organized process of general physical training contributes to the harmonious development of various motor qualities that manifest themselves in the chosen sport and determine the success of sports activities.

High indicators of the development of general physical preparedness is the functional basis for the development of special physical qualities and other aspects of the preparedness of athletes – technical, tactical, psychologically [4; 8; 9; 13; 23]. General and special physical training of rugby players is built with a predominance in the development of high-speed and speed-strength qualities, special and high-speed endurance for creating a high level of special functional readiness.

Thus, the means of sports training are aimed primarily at creating prerequisites for improving the qualitative and quantitative characteristics of competitive activity. This requires improving the individual athletic preparedness of athletes with an emphasis on improving speed (in all its directions), speed-strength abilities and certain types of special endurance.

### The relationship of research with scientific programs, plans, themes

The research was carried out in accordance with the Consolidated Plan of Research Work of the Ministry of Education and Science, Youth and Sports for 2011–2015. On the theme 1.1 “Scientific and methodological foundations of the use of information technologies in the training of specialists in the field of physical culture and sports,” the state registration number 0111U003130.

### The purpose of the research

To develop a program of general physical training of rugby players at the stage of specialized basic training and to investigate the dynamics of indicators of general physical preparedness using computer technology.

## Material and Methods of the research

The experiment involved 60 rugby players who are partici-

pants of the Ukrainian Championship among boys under 18. The control group was formed from two teams (Krivoy Rog), which included 30 athletes from the teams "Rhinos" and "Miners" (14 forwards and 16 defenders). The experimental group consisted of athletes from two teams (Donetsk), which included 30 athletes from the teams of the "Tigers of Donbass" and "Typhoon" (14 forwards and 16 defenders).

Research methods: theoretical analysis and generalization of literary sources, pedagogical testing, pedagogical experiment, methods of mathematical statistics.

## Results of the research and their discussion

For the study, a program of integrated general physical training for rugby players was developed. The content of the program took into account the practical experience of leading experts in rugby, analysis and synthesis of data from special literature, features of the stage of specialized basic training in rugby. Methodical approaches, technologies used to improve physical preparedness of rugby players are studied; pedagogical observations during training sessions. We used a wide arsenal and a variety of physical activities aimed not only at the development of motor qualities, but also to further improve the technical and tactical skills, which in combination provides an effective solution to the tasks of sports training.

The distinctive features of the developed program are the scientifically substantiated structure and content of the general physical training of rugby players at the stage of specialized basic training and depending on its periods, the form of organization of classes, the volume of training loads, the use of the computer program «Rugby-13», presented on the website of the Ukrainian Federation of Rugby League (www .rugby13.org.ua), during the training process [9].

The main component of the athletes training was a training plan reflecting the percentage of the orientation of the exercises on the development of basic physical qualities for the rugby player (Table 1) and the application of the computer program «Rugby-13». This program was used in the training process directly at the theoretical and training sessions. Formation of theoretical knowledge on the implementation of exercise complexes for physical training occurred both in the training process using the tablet, and when using the computer program independently.

or the development of general physical preparedness, exercises of predominantly speed-strength orientation are used. During the formation of exercise complexes, various exercises were selected for the development of speed abilities, in particular, running for short distances (in anaerobic alacate and anaerobic glycolytic energy supply zones). For the development of strength abilities and strength endurance, various exercises were used for push-up and with weights (barbells, dumbbells, simulators). These exercises were used in a dynamic mode with an emphasis on overcoming the nature of the work of the muscles and with a combination of progressive and overcoming the characters of the work of muscles, static-dynamic mode. Speed-strength abilities developed by various jumping exercises (with weights and without, the impact method), special exercises with a bar, fartlek (which in comparison with crosses are more intense and shorter in time). To develop speed-strength endurance and special endurance, special strength and jumping exercises were used (in the anaerobic energy supply zone). Stamina developed by continuous running for 30–40 min with an intensity of 140–150 heart rate (in the aerobic zone of supply).

The indicators of general physical readiness were determined using the tests presented in Table 2.

To confirm the effectiveness of the developed program, a pedagogical experiment was conducted. In this experiment, rugby players of the experimental (n=30) and control groups (n=30).

The experiment was conducted in conditions of the training process of rugby players. All training sessions for both the control and experimental groups of athletes were conducted in accordance with the curriculum for rugby for children and youth sports schools, specialized children's and youth schools of the Olympic reserve, schools of higher sportsmanship and specialized educational institutions of the sports profile (2013). The developed authoring technology was integrated into the traditional curriculum. Athletes of the experimental group were trained on the developed experimental program, which consisted in the rational planning of the percentage of training funds aimed at the development of motor qualities of rugby players, and the use of special funds for the improvement of physical preparedness of athletes who represented in a computer program «Rugby-13".

The results of the experiment show that before the experiment, the indicators of the overall physical preparedness of rugby players of different roles of the control and experimental groups did not have significant differences (p>0,05). After the experiment, comparing the parameters of the experimen-

**Table 1**

**The program of general physical preparation of the experimental group, which includes rational planning of the percentage of training facilities for the development of motor abilities of rugby players (%)**

| Orientation of training | Periods of preparation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Preparatory | | | | Competitive | | | | | | | TP |
| | GPS | | SPS | | CS | | | | | | | |
| **Mounts** | **12** | **01** | **02** | **03** | **04** | **05** | **06** | **07** | **08** | **09** | **10** | **11** |
| General endurance | 30 | 30 | 30 | 30 | | | | | | | | 20 |
| Absolute strength | 40 | 40 | 40 | 40 | | | | | | | | 10 |
| Strength endurance | 20 | 20 | 20 | 20 | | | | | | | | 20 |
| Exercises with body weight | 5 | 5 | 5 | 5 | | | | | | | | 30 |
| Flexibility exercises | 5 | 5 | 5 | 5 | | | | | | | | 20 |

***Note.*** *TP – transition period; GPS – general preparatory stage; SPS – special preparatory stage.*

**Table 2**

**Tests for determining the level of general physical readiness**

| No. i/o | Name of the test | Direction |
|---|---|---|
| 1. | Run at 30 m from the high start, s | Speed-strength abilities |
| 2. | Run at 60 m from high start, s | Speed abilities |
| 3. | Run at 100 m from high start, s | Speed abilities |
| 4. | Run at 400 m, s | Fast endurance |
| 5. | Running 12 min, m | Speed endurance |
| 6. | Jump in length, cm | Speed-strength abilities |
| 7. | Triple jump from place, cm | Speed-strength abilities |
| 8. | Jump up from space, cm | Speed-strength abilities |
| 9. | Bending / Extending the hands from the lying position, count times | Strength endurance |
| 10 | Tightening from the hinge, count times | Strength endurance |
| 11. | Benchpress, kg | Absolute strength |
| 12. | Lifting the bar on the chest, kg | Speed-strength abilities |
| 13. | Squats with shoulder straps, kg | Absolute strength |

tal and control groups, reliable differences were obtained for almost all parameters ($p<0,001$), except pulling out of the hinge from the defenders ($p>0,05$) (Table 3). In our opinion, in the training program of the experimental group there was a rational correlation of the volumes and intensity of training loads. In addition, the volume of training loads of general physical preparedness increased optimally, and the intensity was brought to the maximum.

Thus, the experimental data obtained by the general physical readiness of the rugby players of 16–18 years indicate the effectiveness of the influence of the implementation of the developed experimental program.

The content of the training was aimed at developing basic physical abilities. We used a wide arsenal and a variety of physical activities, specific methods aimed not only at developing motor skills, but also on improving technical skills, which together provides an effective solution to the tasks of sports training.

One of the most important criteria for assessing athletes during the training process can serve as the dynamics of their indicators of physical preparedness. The effectiveness of the management of the training process on the basis of studying the dynamics of the athletes' readiness indices provides opportunities for further improving the training system. Thus, the identification and definition of the dynamics of these indicators in the training process is an important task that will determine the motor potential and prospects of rugby players. In Fig. 1, 2 shows the dynamics of the increase in indicators of overall physical readiness (GPS).

So, there was an increase in strength endurance indicators according to the test results «bending / extending the hands from the lying position, count times»: EG (forwards) – 8,6%, CG (forwards) – 4,8%; ЕГ (defenders) – 8,5%, CG (defenders) – 4,8%; «tightening from the hinge»: in forwards of a EG – 5,1% and in defenders – EG – 7,5%, CG – 11,4%.

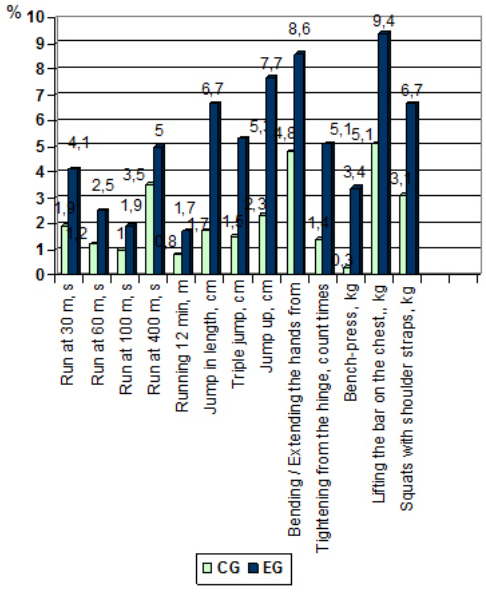


**Fig. 1. Dynamics of increase in GPS indices of forwards control and experimental groups after the experiment**

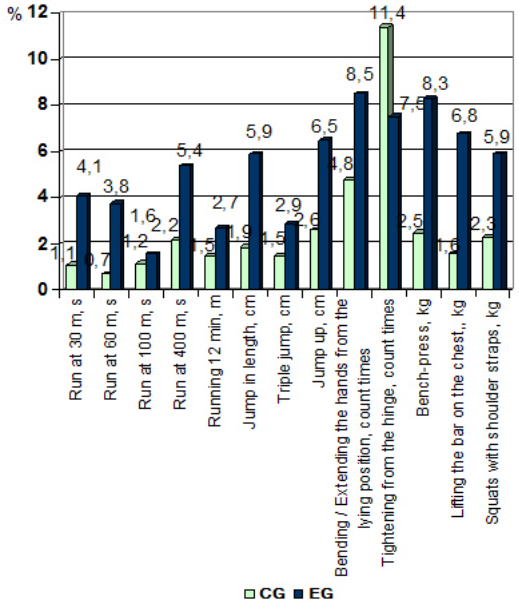


**Fig. 2. Dynamics of increase in GPS indices of defenders control and experimental groups after the experiment**

**Table 3**

**Indicators of general physical preparedness of rugby players of 16–18 years of control and experimental groups before and after the experiment ($n_1$=$n_2$=30)**

| Indicators | Position | Control group $\bar{X}\pm\sigma$ | Experimental group $\bar{X}\pm\sigma$ | Stat. indicators t | Stat. indicators p |
|---|---|---|---|---|---|
| **Before experiment** | | | | | |
| Run at 30 m from the high start, s | F | 4,67±0,06 | 4,63±0,10 | 1,24 | >0,05 |
| | D | 4,43±0,05 | 4,41±0,03 | 1,32 | >0,05 |
| Run at 60 m from the high start, s | F | 8,84±0,14 | 8,82±0,16 | 0,34 | >0,05 |
| | D | 8,45±0,04 | 8,48±0,08 | 1,30 | >0,05 |
| Run at 100 m from high start, s | F | 13,50±0,15 | 13,50±0,14 | 0,00 | >0,05 |
| | D | 13,10±0,19 | 13,00±0,17 | 1,52 | >0,05 |
| Run at 400 m, s | F | 70,00±1,47 | 70,00±1,41 | 0,00 | >0,05 |
| | D | 65,00±1,26 | 65,00±2,00 | 0,00 | >0,05 |
| Running 12 min, m | F | 2700,00±65,04 | 2703,00±60,33 | 0,12 | >0,05 |
| | D | 2903,00±93,93 | 2906,00±89,21 | 0,09 | >0,05 |
| Jump in length, cm | F | 220,50±9,49 | 220,40±4,99 | 0,03 | >0,05 |
| | D | 240,10±5,92 | 239,90±5,23 | 0,10 | >0,05 |
| Triple jump from place, cm | F | 679,90±11,28 | 683,60±9,08 | 0,92 | >0,05 |
| | D | 718,10±10,14 | 720,00±10,00 | 0,52 | >0,05 |
| Jump up from space, cm | F | 42,10±1,54 | 42,10±1,46 | 0,00 | >0,05 |
| | D | 52,10±2,03 | 52,10±1,65 | 0,00 | >0,05 |
| Bending / Extending the hands from the lying position, count times | F D | 50,00±3,94 | 50,30±3,85 | 0,30 | >0,05 |
| Tightening from the hinge, count times | F | 7,30±0,61 | 7,50±0,65 | 0,80 | >0,05 |
| | D | 9,30±0,82 | 9,80±0,91 | 1,58 | >0,05 |
| Benchpress, kg | F | 79,79±3,72 | 80,71±3,85 | 0,62 | >0,05 |
| | D | 71,00±4,08 | 73,13±3,09 | 1,61 | >0,05 |
| Lifting the bar on the chest, kg | F | 86,79±4,21 | 86,43±6,02 | 0,18 | >0,05 |
| | D | 78,75±6,71 | 81,25±4,65 | 1,19 | >0,05 |
| Squats with shoulder straps, kg | F | 109,64±6,34 | 110,00±8,09 | 0,13 | >0,05 |
| | D | 102,00±4,08 | 103,75±3,87 | 1,21 | >0,05 |
| **After experiment** | | | | | |
| Run at 30 m from the high start, s | F | 4,58±0,09 | 4,44±0,09 | 4,11 | <0,001 |
| | D | 4,38±0,09 | 4,23±0,08 | 4,82 | <0,001 |
| Run at 60 m from the high start, s | F | 8,73±0,16 | 8,60±0,09 | 2,55 | <0,05 |
| | D | 8,39±0,20 | 8,16±0,08 | 4,14 | <0,001 |
| Run at 100 m from high start, s | F | 13,36±0,19 | 13,24±0,13 | 1,88 | <0,1 |
| | D | 12,95±0,20 | 12,79±0,17 | 2,36 | <0,05 |
| Run at 400 m, s | F | 67,60±0,55 | 66,50±1,35 | 2,72 | <0,05 |
| | D | 63,60±1,67 | 61,50±1,89 | 3,22 | <0,01 |
| Running 12 min, m | F | 2722,00±42,07 | 2751,00±45,73 | 2,51 | <0,05 |
| | D | 2946,00±47,00 | 2986,00±48,01 | 2,30 | <0,05 |
| Jump in length, cm | F | 224,30±4,49 | 236,10±6,56 | 5,35 | <0,001 |
| | D | 244,70±4,63 | 255,00±6,07 | 5,23 | <0,001 |
| Triple jump from place, cm | F | 690,00±17,73 | 722,10±12,82 | 5,29 | <0,001 |
| | D | 729,10±13,12 | 741,90±12,55 | 2,73 | <0,05 |
| Jump up from space, cm | F | 43,10±0,99 | 45,60±0,93 | 6,64 | <0,001 |
| | D | 53,50±1,55 | 55,70±1,14 | 4,43 | <0,001 |
| Bending / Extending the hands from the lying position, count times | F D | 52,50±1,52 | 55,00±1,64 | 6,12 | <0,001 |
| Tightening from the hinge, count times | F | 7,40±0,75 | 7,90±0,73 | 1,72 | <0,1 |
| | D | 10,50±1,32 | 10,60±0,96 | 0,24 | >0,05 |
| Bench-press, kg | F | 80,06±5,42 | 83,57±3,06 | 2,03 | <0,1 |
| | D | 72,81±5,76 | 79,69±5,31 | 3,40 | <0,01 |
| Lifting the bar on the chest, kg | F | 91,43±4,57 | 95,36±4,14 | 2,30 | <0,05 |
| | D | 80,00±7,07 | 87,19±4,46 | 3,33 | <0,01 |
| Squats with shoulder straps, kg | F | 113,21±5,04 | 117,86±5,08 | 2,34 | <0,05 |
| | D | 104,38±5,74 | 110,31±5,16 | 2,98 | <0,01 |

***Note.*** *F – forwards; D – defenders. The experiment involved 14 forwards and 16 defenders in the control and experimental groups.*

A significant increase occurred in the fast endurance test results "run at 400 m": in forwards EG – 5%, CG – 3,5%; in defenders EG – 5,4%, CG – 2,2%.

Speed-strength abilities of rugby players were determined by tests "jump in length", "jump up", "triple jump", "lifting the bar on the chest", "run at 30 m" and "run at 60 m". Increase in indicators by test results "jump in length": EG (forwards) – 6,7%, CG (forwards) – 1,7%; EG (defenders) – 5,9%, CG (defenders) – 1,9%; "triple jump": EG (forwards) – 5,3%, CG (forwards) – 1,5%; EG (defenders) – 2,9%, CG (defenders) – 1,5%; "jump up": EG (forwards) – 7,7%, CG (forwards) – 2,3%; EG (defenders) – 6,5%, CG (defenders) – 2,6%; "run at 30 m": EG (forwards) – 4,1%, CG (forwards) – 1,9%; EG (defenders) – 4,1%, CG (defenders) – 1,1%; "run at 60 m": EG (forwards) – 2,5%, CG (forwards) – 1,2%; EG (defenders) – 3,8%, CG (defenders) – 0,7%; "lifting the bar on the chest": в EG (forwards) – 9,4%, CG (forwards) – 5,1%, EG (defenders) – on 6,8%, CG (defenders) – on 1,6%.

Identified changes in speed abilities, there was a percentage increase in the test results "run at 100 m": EG (forwards) – 1,9%, CG (forwards) – 1,1%; EG (defenders) – 1,6%, CG (defenders) – 1,2%.

Development of absolute strength by test results "bench-press" and "squats with shoulder straps". Increase in indicators "bench-press" observed in forwards: EG – 3,4%, CG – 0,3%, in defenders: EG – 8,3%, CG – 2,5%; from the test result "squats with shoulder straps" в EG in forwards – 6,7%, CG – 3,1 and defenders had a significant increase in indicators, both in EG – 5,9%, and in CG – 2,3%.

According to the indicators of general endurance test "running 12 min" there was an increase in forwards EG – 1,7%, CG – 0,8%; in defenders EG – 2,7%, CG – 1,5%.

Thus, there is a significant percentage increase in the rates of speed-strength abilities in the experimental group, indicating the effectiveness of the developed technology. It should be noted that the motor actions of speed-strength character is the main component in the process of playing in rugby, especially it is characteristic of Rugby League.

## Conclusions

1. Studies have shown that the developed program of integrated general physical training for the development of basic physical qualities using computer technology makes it possible to increase the effectiveness of the training process in Rugby League.

2. Experimental program with the use of special tools to improve the overall physical preparedness of athletes, which are presented in the computer program «Rugby-13», positively influenced the level of development of the overall physical preparedness of rugby players.

3. The introduction of the experimental program into the training process of rugby players contributed to a significant increase in the indicators of general physical readiness ($p<0,01$).

**Prospects for further research.** It is planned to study the technical preparedness of rugby players at the stage of specialized basic training using the experimental training program.

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# Improvement of the training process of qualified female athletes engaged in bodybuilding in the general preparatory stage of the preparatory period, taking into account the biological cycle

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***Purpose:*** *substantiation of the methodology of the training process of qualified female athletes engaged in bodybuilding in the general preparatory stage of the preparatory period, taking into account the biological cycle.*

***Material & Methods:*** *in the study participated 18 qualified female athletes engaged in bodybuilding, included in the Kharkov region team of bodybuilding.*

***Results:*** *comparative characteristic of the most frequently used methodology of the training process in bodybuilding are shows. An optimal methodology for qualified female athletes engaged in bodybuilding has been developed and justified, depending on the initial form of the athlete at the beginning of the general preparatory stage of the training. The dependence of the change in the body weight of female athletes from the training process is shows.*

***Conclusion:*** *on the basis of the study, the author suggests an optimal training methodology depending on the mesocycle of training in the preparatory period in the general preparatory stage.*

**Keywords:** *structuring of training, bodybuilding, training process, qualified female athletes, optimal technique, mesocycle.*

## Introduction

The growth in the popularity of sports aimed at developing basic physical qualities (strength, endurance, etc.), obtaining a beautiful physique is the basis for the growth in the popularity of bodybuilding. This relatively new and non-Olympic sport does not yet have a comprehensive theoretical and methodological justification.

The system of training qualified female athletes in this form is based on a rationally constructed training process taking into account the OMC and in combination with nutrition as a factor providing the necessary material for the growth of muscle mass and the formation of a good proportional build.

Therefore, the methodology of the training process of qualified female athletes engaged in bodybuilding in the preparatory period of the general preparatory phase was developed and justified [1; 2].

In the domestic sport there are very few scientifically based training methods for training qualified female athletes engaged in bodybuilding in the preparatory period of the general preparatory phase. Thus, the practical experience of coaches and athletes has to be typed through trial and error [6; 9].

In bodybuilding the preparatory period of the general preparatory stage lasts 12 weeks. During this period, qualified female athletes of different age groups and all categories try to work out as much as possible the technique of training exercises, pose and try to reduce the fat layer by training with optimal weights. At the end of each microcycle, the female athlete's form is evaluated by the coach, and adjustments are made to the training process. [3; 15–18].

This problem was dealt with by such outstanding domestic specialists in the field of physical culture and sports as V. M. Platonov, L. S. Dvorkin, A. I. Stetsenko, B. I. Sheiko, V. G. Oleshko, O. I. Kamaev, D. A. Beskorovainy, V. V. Usichenko, V. Y. Dzhym [4–10]. Their research was based on the experience of such foreign specialists in the field as Joe Wader, Ben Wader, E. Connors, T. Kimber, M. McCormick [12–14].

**The relationship of research with scientific programs, plans, themes**

The scientific research was carried out on the theme of the Consolidated Plan of Research Work in the Sphere of Physical Culture and Sport for 2011–2015. On topic 3.7 "Methodological and organizational-methodological basis for determining the individual rate of a person's physical condition" (state registration number 0111U000192).

**The purpose of the research**

Substantiation of the methodology of the training process of qualified female athletes engaged in bodybuilding in the general preparatory stage of the preparatory period, taking into account the biological cycle.

## Material and Methods of the research

In this study, participated female athletes who were members of the national team of the Kharkiv region. By the experiment, 18 female athletes were involved, bodybuilders, of which 2 – master of sports, 16 – candidate master of sports, aged 18-23 years, the average weight of the athletes body was 55±2–65±2 kg. Participants were distributed according to sports qualification into two, control and experimental groups. Participants in the control group's experiment were trained 5-6 times a week, and the participants of the experimental group were trained 4 times a week and took into account the phases of the OMC.

*Research methods:* theoretical method and generalization of literature, pedagogical observation, pedagogical experiment, method of mathematical statistics.

## Results of the research and their discussion

The use of the training process of qualified athletes involved in bodybuilding led to the use of two variants of training methods, differed in the load and volume of training exercises, rest and other components. The assessment was carried out using training diaries, which indicated the number and volume of training work.

The effectiveness of training was assessed using the method of expert assessments, which provides for the application of information on the implementation of the instructions of the coach, the dynamics of power and endurance indicators, as well as subjective qualities (well-being, mood, desire to train, etc.).

The female athletes of the control group were trained for 12 weeks with large percentages and did not take into account the phases of the OMC, while the female athletes of the experimental group were trained in a smooth dynamics with an emphasis on the static load of the muscles and took into account the different phases of the OMC in different mesocycles (Table 1, 2). Before the beginning of the experiment, we carried out a test weighing of both groups, as well as anthropometric measurements, with which we were able to identify the best result in the increase in indicators. To carry out the weighing, we used a device – a body mass analyzer (weights TANITA BC-545 manufactured by Japan) and a centimeter tape (Table 3).

The difference between the general preparatory stage and the special preparatory stage consists in a smoother transition from one training microcycle to another, and also in the intensity of the training session (Table 1). The increase in training sessions, the reduction of gaps between training days plays a big role in the preparation at this stage. The intensity plays an important role, as can be seen from Table 1, the exercise time significantly decreased, both in positive phases and in negative phases, and most importantly, the pauses between repetitions decreased in the recovery microcycle to 0,5 seconds, and in the preliminary in at all there was no rest between re-doing exercise.

The peculiarities of this stage are a small percentage use of small weights, which amounts to 50-60% in the retracting mesocycle EG, in the CG is 70–80%, which in turn is significantly different from EG, and in basic mesocycles – in EG is 60–80%, in CG – 80–100%, thus in EG is paid more attention to muscle training, and not to weight gain, that at this stage the most main thing.

The data given in Table 2, show that the female athletes of the experimental group were trained with the average loadings of the maximum loads, since in these mesocycles the phases of the OMC were taken into account, control group was trained with a small number of repetitions, but with large burdens and did not take into account the phases of the OMC. So, in the preparatory period at the general preparatory stage, much attention is paid to the muscles of the thigh and lower leg – the number of bar lifts (NBL) for three mesocycles is in EG 915 lifts in the CG – 487,0. In the preparatory period, the basic role is played by basic exercises, but forming exercises in bodybuilding play a major role in the preparation. The maximum number of bar lifts was due to the straight and oblique abdominal muscles and was 2900 in the EG, in the CG – 1,450 NBL (in the CG paid little attention to the abdominal muscles). The total volume in the basic exercises of the NBL is 3,171 in the EG and 1,745 in the CG, and in the forming exercises EG – 7,606 and in CG – 3,803 NBL. Thus, the CG used a more powerful training program and a small number of NBL with large burdens, the EG used a more static training program and used a large number of NBL, due

**Table 1**

**The content of the training program, depending on the burden weight in the preparatory period of the general preparatory stage of qualified female athletes engaged in bodybuilding, control and experimental groups**

| Indicators of training load | Mesocycles | | | |
|---|---|---|---|---|
| | Retracting | | Basic | |
| | CG | EG | CG | EG |
| Load range as a percentage of the maximum | 70–80 | 50–60 | 80–100 | 60–80 |
| Number of training days | 5 | 3 | 6 | 4 |
| Number of repetitions | 5–7 | 10–12 | 3–5 | 8–10 |
| Number of attempts | 5–6 | 4–5 | 5–6 | 6–7 |
| Exercise time, s: | | | | |
| Positive phase (upward movement) | 1 | 0,5 | 1,5 | 0,5 |
| Negative phase (downward motion) | 1,5 | 1 | 0,5 | 1 |
| Pauses between repetitions, s | 1 | 0,5 | 0,8 | 0,2 |
| Rest between attempts, min | | | | |
| In the basic exercises | 3–4 | 1,5–2 | 5 | 1,2 |
| In forming exercises | 3 | 1–1,2 | 4 | 1 |

**Table 2**

**The total amount of training work performed by qualified female athletes who are engaged in bodybuilding, control and experimental groups in the preparatory period of the general preparatory stage**

| Muscle groups | Volume, NBL | | Volume, thousand kg. | |
|---|---|---|---|---|
| | CG | EG | CG | EG |
| **Basic exercises on:** | | | | |
| Muscles of the upper extremity belt | 256,0 | 432,0 | 18,630 | 17,080 |
| Arm muscles | 342,0 | 614,0 | 59,140 | 58,125 |
| Chest muscles | 318,0 | 596,0 | 60,940 | 56,445 |
| Back muscles | 342,0 | 614,0 | 60,200 | 59,125 |
| Muscles of hip and lower leg | 487,0 | 915,0 | 100,600 | 95,700 |
| Total | 1,745 | 3,171 | 299,510 | 286,475 |
| **Forming exercises on:** | | | | |
| Muscles of the upper extremity belt | 214,0 | 428,0 | 32,902 | 38,900 |
| Arm muscles | 450,0 | 900,0 | 25,280 | 28,380 |
| Chest muscles | 203,0 | 406,0 | 11,111 | 13,560 |
| Back muscles | 354,0 | 708,0 | 19,425 | 21,480 |
| Muscles of hip and lower leg | 1,132 | 2,264 | 160,290 | 185,840 |
| Muscles of the abdomen are straight and oblique | 1,450 | 2,900 | - | - |
| Total | 3,803 | 7,606 | 249,009 | 288,160 |

***Note.*** *NBL – number of bar lifts.*

**Table 3**

**Indicators of the increase in the average anthropometric data of qualified female athletes engaged in bodybuilding control and experimental groups at the end of the general preparatory stage of the preparatory period ($n_1=n_2=9$)**

| Indicators | CG $\bar{X}_1 \pm m_1$ | EG $\bar{X}_2 \pm m_2$ | *t* | *P* |
|---|---|---|---|---|
| Body weight, kg | 2,59±0,25 | 1,66±0,20 | 2,32 | <0,01 |
| Neck circumference, cm | 0,77±0,17 | 0,64±0,07 | 0,55 | >0,05 |
| Circumference of the chest (inhalation), cm | 2,00±0,21 | 2,34±0,17 | 1,0 | >0,05 |
| Circumference of the chest (exhale), cm | 1,79±0,21 | 2,00±0,16 | 1,0 | >0,05 |
| Circle of biceps, cm | 0,74±0,07 | 0,67±0,09 | 1,19 | <0,05 |
| Waist circumference, cm | 2,58±0,14 | 1,75±0,10 | 9,5 | <0,01 |
| Hip circumference, cm | 1,84±0,13 | 1,00±0,12 | 0,81 | >0,05 |
| Sciatica circumference, cm | 0,51±0,01 | 0,37±0,06 | 1,18 | >0,05 |
| Circumference of the forearm, cm | 0,26±0,06 | 0,66±0,13 | 1,68 | <0,01 |

to which the volume of kilograms was high.

The total volume in the counted kilograms in the basic exercises in the EG is 286,475, in the CG – 299,510, performing the formative exercises, the total amount was EG – 288,160 kilograms, in CG – 249,009. One can conclude that female athletes of the experimental group trained at this stage with an average of kilograms and paid great attention to the muscles of the abdomen and leg muscles, in turn, the female athletes of the CG paid more attention to basic exercises and strength indicators than the formative exercises.

Before the experiment, measurements of anthropometric indices of female athletes engaged in bodybuilding.Thus, the coefficients of variation of all the major anthropometric indices separately for the control and experimental groups did not practically exceed the total initial level.

Anthropometric examination was carried out at the end of the general preparatory stage (Table 3).

At the end of the general preparatory stage, the weight increase in the control group was 2,59 kg, whereas in the experimental – 1,66 kg; (t=2,32; P<0,01). Differences are also likely to be found between changes in the circumference of the biceps muscle of the shoulder (biceps) and waist. The average increase in the circumference of the biceps arm muscle (biceps) in the control group was 0,74 cm; in the experimental – 0,67 cm (t=1,19; P<0,05). Average increase in the waist circumference in the control group – 2,58 cm in the experimental – 1,75 cm (t=9,5; P<0,01).

Differences in the growth of other indicators are unreliable (P>0,05).

## Conclusions

Thus, improving the training process of qualified female athletes engaged in bodybuilding, we can assume that the effect in EG was more pronounced, and the level of preparedness can be evaluated as the most optimal. Dynamics of the load in this group significantly reduces the likelihood of the formation of unfavorable shifts in the functional condition of athletes (overexertion, overtraining, trauma), allows you to achieve the required level of athletic form without overstressing the adaptation-compensatory mechanisms. According to the construction of the training process, in the EG the training methodology more contributes to the task - increasing the muscle mass of the body not with the fat layer and subcutaneous water, but due to only the muscles, it was reliably proven, in the

general preparatory stage, the body weight gain in the control group was 2,59 kg, whereas in the experimental – 1,66 кg; (t=2,32; P<0,01). Differences are also likely to be found between changes in the circumference of the biceps muscle of the shoulder (biceps) and waist. The average increase in the circumference of the biceps arm muscle (biceps) in the control group was 0,74 cm; in the experimental – 0,67 cm (t=1,19; P<0,05). Average increase in the waist circumference in the control group – 2,58 cm in the experimental – 1,75 cm (t=9,5; P<0,01).

Features of the training methodology for qualified female athletes engaged in bodybuilding in the preparatory period of the general preparatory stage, taking into account the phases of OMC, can be recommended for the training of female athletes, while observing the requirements of sports and medical control, ensuring an effective and qualitative recovery in the transition period.

**Further research** should include the development and justification of the training process in the competitive period for qualified female athletes who specialize in bodybuilding, taking into account the OMC.

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# Changes in hemodynamic parameters affected by interval hypoxic exercises during the precontest training stage of qualified climbers

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***Purpose:*** *to study the effects of the use of interval hypoxic training (IHT) in the 15–15 mode with breathing through the system into a confined space with a regulated composition of inhaled air in the integrated training process of climbers of the level of preparation of SP-I.*

***Material & Methods:*** *a study was conducted with the participation of the control and experimental groups using medical-biological methods and IHT in the experimental group with using mathematical statistics methods.*

***Results:*** *conducted studies have allowed to determine that the use of the regime of discontinuous hypoxia 15–15 in the training process of the precompetitive period contribute to an increase in the parameters of hemodynamics that affect the adaptation to the action of the load under conditions of hypoxia.*

***Conclusion:*** *reliable changes that are determined during the research testify to the effectiveness of the use of interval hypoxic training 15–15 in the precompetitive training of qualified climbers.*

**Keywords:** *interval hypoxic training; climbers, hypoxia.*

## Introduction

To consider the problem of lack of oxygen or the emergence of a state of hypoxia in the body makes sense only if the conditions for the normal functioning of the tissue respiration system [6; 12]. From this point of view, many physiological classifications of hypoxic states and quantitative criteria used to evaluate these states are clearly inconsistent with this basic setting. In many physiological classifications, the comparative values of the partial pressure of oxygen at different levels of the oxygen cascade of the organism as the main classification criterion according to «established physiological norms». For example, if the saturation of the hemoglobin of the blood with oxygen drops to 93%, then this condition is designated as hypoxemia, which usually accompanies the development of tissue hypoxia. In fact, this is not always the case. Even with pronounced hypoxemia in Aboriginal mountains, the partial pressure of oxygen in tissues can be near normal values and not accompanied by the development of severe hypoxia [2; 16], which is associated with the adaptation of their body to environmental conditions.

### The purpose of the research

To study the effects of the use of interval hypoxic training (IHT) in the 15–15 mode with breathing through the system into a confined space with a regulated composition of inhaled air in the integrated training process of climbers of the level of preparation of SP-I.

## Material and Methods of the research

During the experiment, the parameters of hypoxic and orthostatic samples were recorded, fixed at the end of the 4th, 6th and 8 weeks of training, in the morning before the start of the training. It is known that the change in the position of the body in space is one of the strong influencing actions used in the so-called ortho and clinoostatic tests [8]. Orthostability of blood circulation reflects the effectiveness of a complex of tolerant reactions and allows us to judge the functional capabilities of the cardiovascular system [9]. Orthostatic reactions as a result of redistribution of blood between the «upper» and «lower» parts of the body are a constantly acting factor of natural life [11]. Orthostatic stability in all sports is an important condition for athletic performance [14]. The response to the orthostatic test is improved under the influence of athletic training for all athletes, and not only for representatives of those sports in which a change in body position is an indispensable element [5]. The reaction to the orthotropic test is proposed to be used to assess the pre-competition readiness [15].

## Results of the research and their discussion

When analyzing the action of physical loads and their effect on the functional condition of climbers, the calculation of the done training work was carried out according to the duration of the load, including both the time of the exercise itself and the rest time between exercises, when there is an active adaptation to the action of the load. Individual diary data were collected, which were competitors of each group every day during the entire study period. In the records, climbers marked loading zones according to the pulse criteria, as well as the duration of the exercises in each of them. Also daily measurements were made of the parameters of the hemodynamics of the functional state of climbers.

The individual data of each athlete was made in a variation

series and the average value of each indicator in each of the groups. The first three weeks of the pre-competition stage climbers of both groups were engaged in one program, which made it possible to equalize the parameters of hemodynamics. Later, in 4–8 weeks, the training process of the experimental group was administered interval hypoxic training.

In the pre-competition stage of preparation, interval hypoxic training (IHT) was used as a positive training effect in the experimental group, against a background of a wide range of exercises of different effects.

In the course of the studies, certain features of the response of hemodynamic parameters to their measurements in skilled climbers in the supine position and standing of the control and experimental groups under the influence of IHT were revealed (Table 1).

It is known that when moving to a vertical position (orthoprobe), gravity improves the flow of blood from veins located above the heart level, but leads to a delay in blood in the veins located below the heart, especially in the lower limbs [10]. The inclusion of the functioning of the muscles holding the posture standing (active orthostasis) led the athletes of the experimental group to a change in the functioning of the blood circulation, primarily by increasing the SBP, HR, which indicated in favor of improved adaptogenicity of the circulatory parameters in comparison with the control group. As can be seen from Table 1, significant changes in the parameters of hemodynamics in athletes of the experimental group in comparison with the control group with reliability ($p<0,05$) higher ones, starting from the 6th week of control – were preserved until the end of the pre-competition stage.

Thus, the change in systolic blood pressure at the end of the 6th training week showed that the SBP in the prone position of the athletes of the experimental group was reliably ($p<0,05$) lower compared to the control group and was 117,4±1,6 mmHg and 123,1±2,8 mmHg respectively. In the standing position in the 6th and 8th week of the control, differences between the groups in the SBP indicator were not reliable ($p>0,05$). Similar changes were made at the end of the 8th training week. Thus, in the supine position of the climbers of the experimental group, the value of SBP was 113,7±1,9 mmHg, that significantly ($p<0,05$) differed from this parameter in the control group – 121,3±2,5 mmHg.

The dynamics of the DBP indices was identical and reliably ($p<0,05$) differed in the groups, they were investigated, the differences were in both the prone position and the vertical position of the body. So, DBP at the end of the 6th training week of the pre-competition stage in the prone position in the control group was 70,1±2,2 mmHg in the experimental – 67,1±0,7 mmHg. ($p<0,05$), at the end of the 8th training week – 70,5±2,1 mmHg and 65,1±1,2 ($p<0,05$) respectively. A similar significant difference between the groups was in the standing position after 6 and 8 weeks: 70,4±1,9 mmHg and 67,2±0,9 mmHg ($p<0,05$), 70,1±1,8 mmHg and 66,9±1,0 mmHg ($p<0,05$) respectively. Changes in pulse pressure (PP) were consistent with the dynamics of DBP in both groups and were also significantly ($p<0,05$) higher for the benefit of the experimental group. At the same time, the oxygen capacity of the blood – SaO2, despite the steady tendency to increase in the athletes of the experimental group, significantly ($p<0,05$) differed only at the end of the 8th training week only in the prone position and was 97,1±0,2% and 98,1±0,3% ($p<0,05$).

The data obtained by us in the process of studying hemodynamic parameters in climbers of both groups in the pre-competition stage at a fixed time of control using the ortho-test showed a tendency towards the development of tolerance to hypoxia in the athletes of the experimental group.

It should be noted that "Oxygen debt", which occurs with intense muscle and mental activity, brings fatigue. In recent years, a number of drugs have been tested that contribute to increasing the body's resistance to a lack of oxygen, namely the effect of delayed breathing in the course of muscle activity [3; 4; 6]. It was found that holding the breath during sports activity causes significant changes in the internal environment of the body. This increases the tissue resistance to lack of oxygen and requires a compensatory response of the body. Stability to hypoxia is an important indicator of the athlete's fitness for prolonged cyclic work, and the severity of the increase in resistance to hypoxia in athletes depends on the orientation of the training process. The cyclical nature of physical training contributes to a higher tolerance to hypoxia compared with the training of speed-strength and complexity-coordination orientation [13]. According to A. S. Glazachev

**Table 1**

**Dynamics of hemodynamics in climbers of the control and experimental groups during the pre-competition period, $\bar{X}$±m**

| Indicators | | Control group (n=16) | | | Experimental group (n=12) | | |
|---|---|---|---|---|---|---|---|
| | | Weeks of measurement | | | | | |
| | | 4-th | 6-th | 8-th | 4-th | 6-th | 8-th |
| SBP, mmHg | L | 120,6±2,1 | 123,1±2,8 | 121,3±2,5 | 120,8±1,9 | 117,4±1,6* | 113,7±1,9* |
| | S | 121,4±3,3 | 123,1±3,1 | 121,9±2,1 | 121,1±1,7 | 119,1±2,1 | 118,1±1,8 |
| DBP, mmHg | L | 68,9±1,1 | 70,1±2,2 | 70,5±2,1 | 69,1±1,9 | 67,1±0,7* | 65,1±1,2* |
| | S | 67,2±0,9 | 70,4±1,9 | 70,1±1,8 | 68,4±1,2 | 67,2±0,9* | 66,9±1,0* |
| PP, mmHg | L | 51,7±1,0 | 53,0±0,6 | 50,8±0,3 | 51,7±1,0 | 50,3±0,6* | 48,6±0,7* |
| | S | 54,2±2,4 | 52,7±0,3 | 51,8±0,3 | 52,7±0,7 | 51,9±0,2* | 51,2±0,2* |
| HR, beats per·min$^{-1}$ | L | 67,1±3,7 | 63,1±3,2 | 62,6±4,1 | 65,1±3,1 | 62,1±3,3 | 58,5±1,8 |
| | S | 74,2±4,1 | 70,4±2,8 | 66,9±3,3 | 73,9±3,8 | 69,4±2,2 | 65,2±2,1 |
| $SaO_2$, % | L | 96,9±0,3 | 96,7±0,2 | 97,1±0,2 | 96,5±0,4 | 97,6±0,8 | 98,1±0,3* |
| | S | 97,0±0,3 | 96,9±0,4 | 97,3±0,2 | 96,9±0,6 | 97,7±1,0 | 98,1±0,2 |

***Note.*** ** – $p<0,05$, reliability of the difference between groups in individual weeks; measurements: L – lying; S – standing.*

**Table 2**

**Dynamics of hemodynamics in climbers of the control and experimental groups during the pre-competition stage, $\bar{X}\pm m$**

| Indicators | | Control group (n=16) | | | Experimental group (n=12) | | |
|---|---|---|---|---|---|---|---|
| | | Weeks of measurement | | | | | |
| | | 4-th | 6-th | 8-th | 4-th | 6-th | 8th |
| Test | Genci, s | 36,3±0,8 | 35,7±0,9 | 36,2±1,1 | 42,8±0,8* | 45,1±0,7* | 47,6±0,9* |
| | Stange, s | 109,2±2,7 | 111,2±3,2 | 112,0±4,3 | 114,4±3,9 | 119,6±3,1* | 125,4±3,8* |

***Note.*** ** – p<0,05, significance of differences between groups in some weeks.*

et al [1], the duration of an arbitrary breath-hold on inhalation accurately reflects the degree of satisfaction of the oxygen request of the central nervous system [7].

A study was also conducted to study the degree of satisfaction of the oxygen request of the brain tissue at the end of the 4th, 6th and 8th week of training, which in the groups before the start of the training did not have a significant difference. For this purpose, the duration of an arbitrary delay in breathing was determined (Stange and Genci tests, respiratory arrest respectively on inhalation and exhalation) (Table 2).

The determination of the breath retention on inspiration and on exhalation showed a significant (p<0,05) difference in the results of the study in all weekly microcycles. Thus, a significant (p<0,05) increase in the respiratory arrest time on inspiration (Genci test) was detected in the climbers of the experimental group as compared to the control group at the end of the 4th, 6th and 8th training weeks, which was 42,8±0,8 s and 36,3±0,8 s, 45,1±0,7 s and 35,7±0,9 s, 47,6±0,9 s and 36,2±1,1 s (p<0,05) respectively. At the same time, the comparison of adaptation for hypoxia in athletes of both groups, Stange test parameters (breathing retention on exhalation, increase in the time of adequate oxygen capacity of blood (SaO2)) was significantly (p<0,05) higher in the experimental group at the end of 6th and 8th weeks of training, which accounted for 119,6±3,1 s and 111,2±3,2 s, 125,4±3,8 s and 112,0±4,3 s .

## Conclusions

Based on the presented experimental data, it can be argued that the development of anaerobic functions of athletes is significantly affected by the use of intermittent hypoxia 15–15, which can be applied taking into account the individual characteristics of the athlete's body, the focus of the previous training session and the period of preparation in macrocycles for the development of anaerobic work capacity of the athlete's organism and maintaining the achieved level of anaerobic efficiency.

**The prospect of further research.** It is planned to determine the effect of interval hypoxic training on indicators of physical readiness

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# Special aspects of transferring the ball by Leicester City players in the matches of the 2015–2016 Premier League season

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***Purpose:*** *to reveal quantitative and qualitative indicators of transferring the ball by Leicester City players in the matches of the 2015–2016 Premier League season.*

***Material & Methods:*** *analysis of scientific and methodological literature, registration of technical and tactical actions (transfer of the ball), methods of mathematical statistics. It carried out a study of competitive activity command "Leicester City" – the champion of Premier League season 2015–2016.*

***Results:*** *quantitative and qualitative indicators of transferring the ball by Leicester City players in the matches of the 2015–2016 Premier League season are presented.*

***Conclusion:*** *as a result of the research of the Leicester City team transferring the ball in games that ended in victory, draw and defeat of significant differences were not revealed. Differences in some quantitative and qualitative indicators of transferring the ball in home and away games, in games of the first and second round of the championship.*

**Keywords:** *transferring the ball, defense zone, middle zone, attack zone, transfers to a short distance, transfers to a long distance.*

## Introduction

The solution of the problem of increasing the effectiveness of attacking actions in football primarily involves studying the features of building a game in attack by the leading teams of the world [1; 3; 4; 10].

Analysis of the attacking actions of teams of different qualifications is devoted to the study of many domestic [1; 2; 4; 7; 8; 11] and foreign [12; 13; 14–16] specialists.

The research of quantitative and qualitative indicators of transferring the ball in the games of teams of different qualifications is devoted to the work of many specialists [2; 4–7; 9].

According to many experts, passing the ball is the main means of playing the game for the world's leading teams. Their approximate contribution to the amount of the TTA is 56–60%. Marriage in the performance of short and medium forward transferring should not be more than 20%, back and across – 10%; when performing long transferring, the marriage must not exceed 30–45%.

### The purpose of the research

To reveal quantitative and qualitative indicators of transferring the ball by Leicester City players in the matches of the 2015–2016 Premier League season.

## Material and Methods of the research

A study was carried out of the competitive activities of the Leicester City team – the champion of England 2015–2016. Methods of research: analysis of scientific and methodological literature, registration of technical and tactical actions (transfer of the ball), methods of mathematical statistics.

## Results of the research and their discussion

Table 1 presents quantitative and qualitative indicators of the ball transfer performed in different zones of the football field by the players of the Leicester City team.

As a result of the study it was found that the players of the team on average for the game made 351,8±10,9 transfers of the ball with efficiency 69,5±1,0%.

In the defense zone, 13,7±1,0% of all ball transfers with efficiency 87,1±1,2%. In the middle zone, the players scored an average of 48,9±0,9% of all ball transfers with an efficiency coefficient 73,2±1,1%. In the attack zone, 37,4±0,9% of all ball transfers were performed with efficiency 58,0±1,3% (Fig. 1, 2).

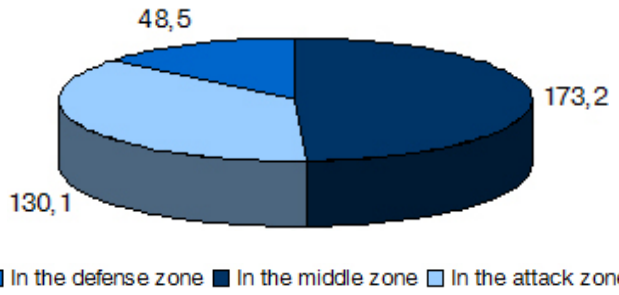


**Fig. 1. The ratio of the ball transfer in different zones of the football field of team Leicester City in the games of the champion of England 2015–2016**

**Table 1**

**Indicators of the ball transfer in different zones of the football field of the Leicester City team in the games of the championship of England 2015–2016**

| Indicators | All games (n=38) | Home Games (n=19) | Outgoing games (n=19) | First round (n=19) | Second round (n=19) | Victory (n=23) | Draws and defeats (n=15) |
|---|---|---|---|---|---|---|---|
| All transfers | 351,8±10,9 | 369,8±15,7 | 333,8±14,5 | 329,2±12,7 | 374,5±16,5 | 354,9±12,8 | 347,1±20,1 |
| Accuracy, % | 69,5±1,0 | 71,7±1,4 | 67,3±1,4 | 68,3±1,5 | 70,7±1,4 | 69,9±1,2 | 68,9±1,8 |
| Transfers in the defense zone | 48,5±2,7 | 51,1±4,4 | 46,0±3,2 | 42,8±2,9 | 54,2±4,3 | 49,5±3,8 | 47,0±3,9 |
| Specific weight, % | 13,7±0,5 | 13,6±0,8 | 13,8±0,7 | 13,0±0,7 | 14,4±0,8 | 13,7±0,7 | 13,7±0,9 |
| Accuracy, % | 87,1±1,2 | 88,5±1,5 | 85,8±1,8 | 88,6±1,3 | 85,7±1,9 | 87,0±1,3 | 87,4±2,4 |
| Transfers in the middle zone | 173,2±6,8 | 188,2±9,1 | 158,3±9,1 | 162,2±9,2 | 184,3±9,6 | 173,7±7,6 | 172,5±13,1 |
| Specific weight, % | 48,9±0,9 | 50,7±1,0 | 47,1±1,3 | 48,8±1,4 | 49,0±1,1 | 48,8±0,9 | 49,1±1,7 |
| Accuracy, % | 73,2±1,1 | 74,6±1,6 | 71,8±1,5 | 72,0±1,8 | 74,4±1,3 | 73,9±1,2 | 72,1±2,2 |
| Transfers in the attack zone | 130,1±4,0 | 130,6±5,5 | 129,5±6,0 | 124,1±4,7 | 136,0±6,3 | 131,7±4,9 | 127,5±7,1 |
| Specific weight, % | 37,4±0,9 | 35,6±1,1 | 39,1±1,2 | 38,1±1,3 | 36,6±1,2 | 37,5±1,1 | 37,2±1,4 |
| Accuracy, % | 58,0±1,3 | 61,0±1,8 | 55,1±1,6 | 56,5±1,8 | 59,5±1,9 | 58,2±1,6 | 57,7±2,2 |

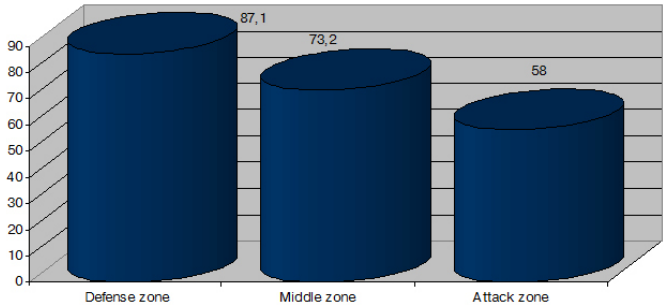


**Fig. 2. Indicators of the effectiveness of ball transfers in different zones of the football field of the Leicester City team in the games of the championship of England 2015–2016**

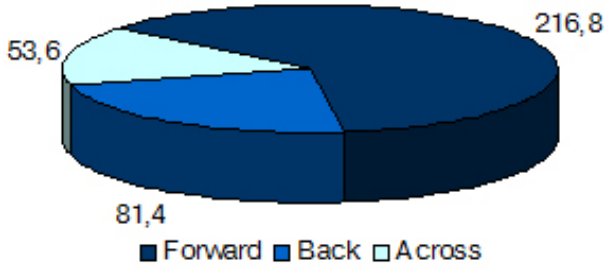


**Fig. 3. The ratio of ball transfer in different direction, the team Leicester City in the games of the championship of England 2015–2016**

As a result of a comparative analysis of quantitative and qualitative indicators of the ball transfers in different zones of the Leicester City team field it was found that in home games the performance of the ball transfers was significantly higher (t=2,22; p<0,05), number of ball transfers in the middle zone (t=2,32, p<0,05), the effectiveness of ball transfers in the attack zone (t=2,45; p<0,05).

Comparative analysis of ball transfer command Leicester City shows that the total number of ball transfer was significantly greater in the first round of the Premier League (t=2,18; p<0,05), and the effectiveness of the ball transfer was significantly higher in the second round (t=2,20; p<0,05).

In turn, a comparative analysis of the indicators of the ball transfer in different zones of the football field of the Leicester City team in games that ended in victory, draw and defeat did not reveal significantly significant differences in the investigated parameters (p>0,05).

Table 2 shows the performance of the ball transfer in different direction of the "Leicester City" team in the games of the championship of England 2015–2016.

So, as a result of the study it was found that the players of the Leicester City team on average played for the game performed 216,8±5,7 forward ball transfer, 81,4±3,8 – back and 53,6±2,1 – across the field (Fig. 3).

As a result of the analysis of the effectiveness of the performance of ball transfers in different direction, it was found that the players of the Leicester City team handed the ball transfer forward with efficiency 59,2±1,2%, back – 94,7±0,4%, across the field – 75,2±1,1% (Fig. 4).

As a result of a comparative analysis of quantitative and qualitative indicators of the transfer of the ball to the team Leicester City it was found that in home games were significantly higher rates of effectiveness of the forward ball transfer (t=2,08; p<0,05), specific weight of back ball transfer (t=2,24; p<0,05), effectiveness of the back ball transfer (t=2,82; p<0,01).

Comparative analysis of the indicators of the ball transfer of this team indicates that in the second round of the championship of England were significantly higher indicators of the number of forward ball transfers (t=2,41; p<0,05) and the effectiveness of ball transfers across the field (t=2,19; p<0,05).

In turn, a comparative analysis of the transfer of the ball, different in direction, the Leicester City team in games that ended in victory, draw and defeat, did not reveal significantly differences in the parameters studied (p>0,05).

Table 3 shows the ball transfer in different distance, the team Leicester City in the games of the championship of England 2015–2016.

**Table 2**

**Indicators of the ball transfer in the different direction of the Leicester City team in the games of the championship of England 2015–2016**

| Indicators | All games (n=38) | Home Games (n=19) | Outgoing games (n=19) | First round (n=19) | Second round (n=19) | Victory (n=23) | Draws and defeats (n=15) |
|---|---|---|---|---|---|---|---|
| All transfers | 351,8±10,9 | 369,8±15,7 | 333,8±14,5 | 329,2±12,7 | 374,5±16,5 | 354,9±12,8 | 347,1±20,1 |
| Accuracy, % | 69,5±1,0 | 71,7±1,4 | 67,3±1,4 | 68,3±1,5 | 70,7±1,4 | 69,9±1,2 | 68,9±1,8 |
| Forward ball transfer | 216,8±5,7 | 225,5±8,6 | 208,0±7,1 | 203,8±6,3 | 229,7±8,7 | 219,9±6,5 | 211,9±10,6 |
| Specific weight, % | 62,1±0,6 | 61,3±0,7 | 62,8±0,9 | 62,3±0,8 | 61,8±0,8 | 62,4±0,7 | 61,5±0,9 |
| Accuracy, % | 59,2±1,2 | 61,7±1,7 | 56,7±1,7 | 57,9±1,6 | 60,5±1,8 | 59,8±1,5 | 58,3±2,1 |
| Back ball transfer | 81,4±3,8 | 88,6±5,3 | 74,2±5,1 | 74,3±4,4 | 88,6±5,9 | 81,4±4,3 | 81,4±7,3 |
| Specific weight, % | 22,7±0,5 | 23,7±0,6 | 21,8±0,6 | 22,3±0,7 | 23,2±0,6 | 22,6±0,5 | 22,9±0,9 |
| Accuracy, % | 94,7±0,4 | 95,8±0,5 | 93,6±0,6 | 95,0±0,6 | 94,4±0,6 | 95,1±0,5 | 94,1±0,7 |
| Across ball transfer | 53,6±2,1 | 55,6±3,0 | 51,6±3,1 | 51,1±3,0 | 56,2±3,0 | 53,6±2,8 | 53,7±3,4 |
| Specific weight, % | 15,2±0,4 | 15,0±0,5 | 15,4±0,5 | 15,4±0,5 | 15,0±0.5 | 15,0±0,5 | 15,5±0,6 |
| Accuracy, % | 75,2±1,1 | 75,3±1,6 | 75,0±1,5 | 72,9±1,8 | 77,4±1,0 | 75,3±1,4 | 75,0±1,8 |

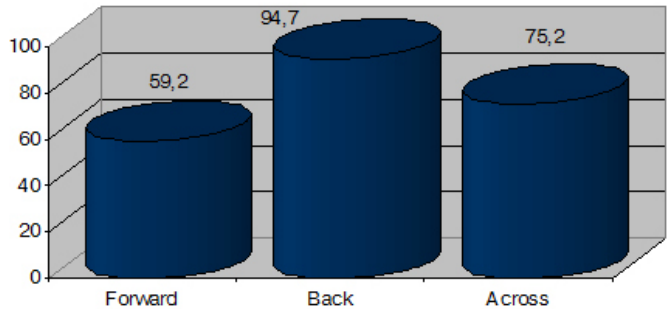


**Fig. 4. Indicators of the effectiveness of the ball transfer in different direction, the team Leicester City in the games of the championship of England 2015–2016**

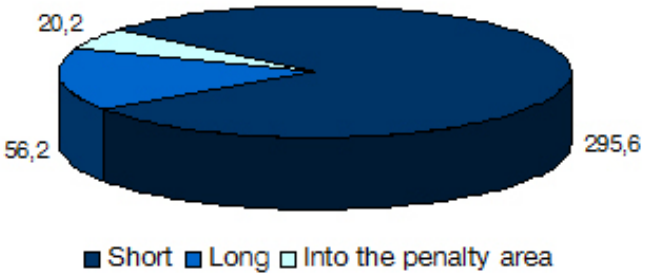


**Fig. 5. Ratio of the ball transfers in different distance, the team Leicester City in the games of the championship of England 2015–2016**

So, as a result of the study it was found that the players of team Leicester City per game performed 295,6±10,6 short transfer of the ball, 56,2±1,2 – long transfer of the ball 20,2±1,2 – transfer the ball into the penalty area of the opposing team (Fig. 5).

Analysis of performance indicators for the implementation of ball transfers, different in distance, indicates that the players of the Leicester City team short transfers of the ball performed with efficiency 75,9±1,0%, long transfer of the ball – 36,0±1,4%, transfer the ball into the penalty area of the opposing team – 23,6±2,0% (Fig. 6).

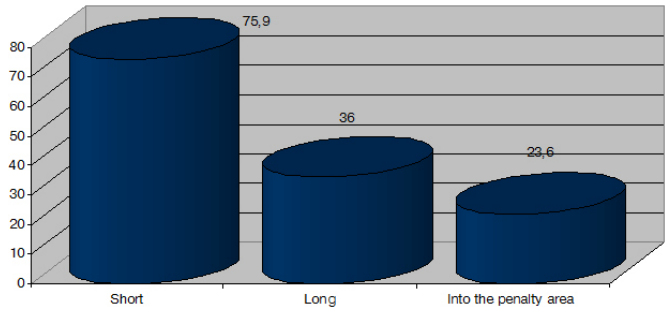


**Fig. 6. Indicators of the effectiveness of the ball transfers in different distance, the team Leicester City in the games of the championship of England 2015–2016**

As a result of a comparative analysis of quantitative and qualitative indicators of the Leicester City team ball transfers, it was found that in home games there were significantly higher specific weight of short ball transfers and significantly lower specific weight of long ball transfers ($t=2,80$; $p<0,01$).

In addition, it was found that in the second round of the championship of England were significantly higher quantitative indicators of short ball transfers ($t=2,12$; $p<0,05$).

A comparative analysis of the indicators of the ball transfers in different distance, the Leicester City team in games that ended in victory, draw and defeat did not reveal any significant differences in the examined indicators ($p>0,05$).

## Conclusions

1. Football players of the team, Leicester City on average for the game made 351,8±10.9 ball transfers with efficiency 69,5±1,0%.

2. Most of the ball transfers by the players of the Leicester City team was carried out in the middle zone of the football field – 48,9±0,9%. In the attack zone, 37,4±0,9% of all ball transfers were performed. In the defense zone, 13,7±1,0% of all ball transfers were performed.

3. Players of this team on average played 62,1±0,6% of the

**Table 3**

**Indicators of the ball transfer in different distance, the team Leicester City in the games of the championship of England 2015–2016**

| Indicators | All games (n=38) | Home Games (n=19) | Outgoing games (n=19) | First round (n=19) | Second round (n=19) | Victory (n=23) | Draws and defeats (n=15) |
|---|---|---|---|---|---|---|---|
| All transfers | 351,8±10,9 | 369,8±15,7 | 333,8±14,5 | 329,2±12,7 | 374,5±16,5 | 354,9±12,8 | 347,1±20,1 |
| Accuracy, % | 69,5±1,0 | 71,7±1,4 | 67,3±1,4 | 68,3±1,5 | 70,7±1,4 | 69,9±1,2 | 68,9±1,8 |
| Short transfer of the ball | 295,6±10,6 | 315,2±14,7 | 276,0±14,3 | 274,1±12,6 | 317,1±15,9 | 298,6±12,4 | 290,9±19,5 |
| Specific weight, % | 83,5±0,5 | 84,9±0,6 | 82,1±0,8 | 82,8±0,8 | 84,2±0,7 | 83,7±0,7 | 83,2±0,9 |
| Accuracy, % | 75,9±1,0 | 77,0±1,7 | 74,7±1,0 | 74,7±1,7 | 77,1±1,0 | 75,7±1,4 | 76,1±1,5 |
| Long transfer of the ball | 56,2±1,2 | 54,6±1,7 | 57,8±1,6 | 55,1±1,5 | 57,4±1,8 | 56,3±1,6 | 56,1±1,7 |
| Specific weight, % | 16,5±0,5 | 15,1±0,6 | 17,9±0,8 | 17,2±0,8 | 15,8±0,7 | 16,3±0,7 | 16,8±0,9 |
| Accuracy, % | 36,0±1,4 | 38,4±1,7 | 33,7±2,1 | 34,7±1,6 | 37,4±2,3 | 37,5±1,9 | 33,7±2,0 |
| Transfer the ball into the penalty area | 20,2±1,2 | 21,5±2,0 | 18,8±1,5 | 19,9±1,6 | 20,5±2,0 | 20,0±1,2 | 20,5±2,6 |
| Specific weight, % | 5,8±0,3 | 5,8±0,5 | 5,7±0,4 | 6,1±0,5 | 5,4±0,4 | 5,7±0,3 | 5,9±0,6 |
| Accuracy, % | 23,6±2,0 | 20,6±2,6 | 26,6±3,0 | 21,6±2,7 | 25,6±3,0 | 23,8±2,1 | 23,3±4,0 |

ball transfers forward, 22,7±0,5% – back and 15,2±0,4% – across the field.

4. In the games, the teams 83,5 ± 0,5% of all ball transfers were short and 16,5±0,5 – long.

5. As a result of a comparative analysis of the Leicester City team ball transfers in games that ended in victory, draw and defeat, no significant differences were revealed (p>0,05).

**Prospects for further research**. Further research will be devoted to studying the features of the competitive activities of the Leicester City team in the English Championship 2016–2017.

**Conflict of interests**. The authors declare that there is no conflict of interests.
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# Technical and tactical readiness model characteristics in wrestling

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***Purpose:*** *to develop model characteristics of technical and tactical preparedness of highly qualified wrestlers.*

***Material & Methods:*** *analysis of scientific and methodological information, generalization of best practical experience, pedagogical observation, analysis of video materials of competitive activities of wrestlers, modeling, methods of mathematical statistics. The results of 75 collisions of highly skilled Greco-Roman wrestlers were analyzed and summarized.*

***Results:*** *identified the 10 main technical actions that are most often used by wrestlers. Based on the analysis of competitive activity developed model characteristics of technical and tactical training of highly skilled wrestlers.*

***Conclusion:*** *analysis and models presented were the basis for the development of evaluation criteria and predicting the level of technical and tactical preparedness.*

**Keywords:** *model characteristics, technical and tactical preparedness, wrestling.*

## Introduction

The main direction of the development of modern wrestling is the improvement of technical and tactical skills of athletes. Even the possession of a high level of physical readiness, as the basis of the competitive activity of the wrestlers, will not allow achieving success and the planned result [2; 6; 13; 17].

Ability to conduct a large number of complex technical and tactical actions, calculations in situations that are constantly changing, to take bold and instant decisions at a certain risk in extreme situations, solving and anticipating the complex designs of an opponent – all this characterizes the level of technical and tactical skill of the athlete, is a prerequisite for success and further improvement of the wrestlers [1; 3; 5; 8; 12].

**The purpose of the research**

To develop model characteristics of technical and tactical preparedness of highly qualified wrestlers.

*Objectives of the study:*

– to analyze the competitive activity of highly skilled Greco-Roman wrestlers;

– to determine the indicators of technical and tactical preparedness of highly qualified wrestlers;

– to make model characteristics of technical and tactical readiness of highly skilled Greco-Roman wrestlers.

## Material and Methods of the research

*Methods of research:* analysis of scientific and methodological information, generalization of best practical experience, pedagogical observation, analysis of video materials of competitive activities of wrestlers, modeling, methods of mathematical statistics.

Pedagogical observations were made of the competitive activity of highly qualified wrestlers. The object of observation was the Greco-Roman wrestling competition: the European Championship in 2016, the 2015 World Cup, the Golden Grand Prix 2016 finals and major international tournaments in 2016. 75 wrestling champions were analyzed.

## Results of the research and their discussion

Successful training of athletes of any level is impossible without careful consideration of the main trends in the development of wrestling, which can be established with sufficient accuracy in analyzing the structural components of the competitive activity of high class wrestlers – participants of the Olympic Games, world championships and major international competitions [7; 9; 14; 15].

It is this analysis that reveals the real picture of the technical, tactical, physical and psychological preparedness of the highest class wrestlers, who for a certain period of time are the benchmark for other athletes [4; 10; 11; 16].

Analysis of the technical arsenal of modern competitive activities of highly skilled wrestlers made it possible to identify 10 main technical actions that are most often used: fall over – 67 times (32,5%), body slam – 28 (13,6%), overthrow – 2 (1%), counterhold – 6 (2,9%), takedown – 20 (9,7%), suplex – 11 (5,3%), flung – 19 (9,3%), throwing down – 18 (8,7%), forcing out – 28 times (13,6%), counterhold – 7 times (3,4%). A total of 206 TTA were completed: 103 reception in the rack and 103 receptions in the ground fighting (Table 1).

It is established that for all groups of wrestlers the most ex-

**Table 1**

**Analysis of the competitive activity of highly skilled wrestlers (n=15) Greco-Roman style (75 bout)**

| No. | Technical actions, quantity | Σ | % |
|---|---|---|---|
| | **Ground fighting:** | | |
| 1. | Fall over | 67 | 32,5 |
| 2. | Body slam | 28 | 13,6 |
| 3. | Overthrow | 2 | 1,0 |
| 4. | Counterhold | 6 | 2,9 |
| **All in ground fighting:** | | 103 | 50,0 |
| | **Posture:** | | |
| 5. | Takedown | 20 | 9,7 |
| 6. | Suplex | 11 | 5,3 |
| 7. | Flung | 19 | 9,3 |
| 8. | Throwing down | 18 | 8,7 |
| 9. | Forcing out | 28 | 13,6 |
| 10. | Counterhold | 7 | 3,4 |
| **All in posture:** | | 103 | 50,0 |
| **All in posture and ground fighting:** | | 206 | 100 |
| Prematurely won contractions | | 40 | 53 |

ecuted TTA in the ground fighting are fall over (32,5%), and in the posture – forcing out (13,6%) and suplex (9,7%). Such a percentage of these technical actions are due to the fact that these techniques are the most common and their attention is paid to all wrestlers.

Analysis of Table 2 revealed that the attack efficiency in the posture was 60,33%, and in the ground fighting – 62,33%; effectiveness of the protection in the posture – 82,67%, and in the ground fighting – 73,33%; effectiveness in the posture – 3,39 points, on the ground fighting – 3,89 points. It should be noted that the attack interval and the interval of successful attack in the first period is higher than in the second period, this is explained by the onset of the athlete's fatigue and the decrease in the attacking actions in the second period of the bout. The average score is higher in the ground fighting (2,71 points) than in the posture (2,32 points). The average time of the bout was 264 seconds (almost complete two periods). Such a distribution of time indicates that the number of prematurely won bout is small.

**Table 2**

**Indicators of technical and tactical preparedness of Greco-Roman wrestlers (n=15)**

| Indicators | Values |
|---|---|
| Effectiveness of the attack in the posture, % | 60,33 |
| Effectiveness of the attack in the ground fighting, % | 62,33 |
| Effectiveness of the defense in the posture, % | 82,67 |
| Effectiveness of the defense in the ground fighting, % | 73,33 |
| Performance in the posture, points | 3,39 |
| Performance in the ground fighting, points | 3,89 |
| Interval of attack in the I period, s | 56,33 |
| Interval of attack in the II period, s | 60,00 |
| Interval of successful attack in the I period, s | 91,00 |
| Interval of successful attack in the II period, s | 99,33 |
| Average score in the ground fighting, points | 2,71 |
| Average score in the posture, points | 2,32 |
| Average time of the bout, s | 264,00 |

Based on the results obtained, model characteristics of the technical and tactical preparedness of highly skilled Greco-Roman wrestlers are developed (Table 3).

**Table 3**

**Model characteristics of the technical and tactical preparedness of highly skilled Greco-Roman wrestlers**

| № | Indicators | Values |
|---|---|---|
| 1 | Interval of attack, s | 40–70 |
| 2 | Number of attacks per bout, times | 4–9 |
| 3 | Optimum reception time, s | 80–110 |
| 4 | Effectiveness of technical and tactical actions in the posture, % | 60 |
| 5 | Effectiveness of technical and tactical actions in the ground fighting, % | 62 |
| 6 | Effectiveness of the defense in the posture, % | 83 |
| 7 | Effectiveness of the defense in the ground fighting, % | 73 |
| 8 | Effective technical and tactical actions in the posture | fall over, body slam, overthrow, counterhold |
| 9 | Effective technical and tactical actions in the ground fighting | takedown, suplex, flung, throwing down, forcing out, counterhold |
| 10 | Early victory in the bouts, % | 53 |

The analysis and presented models were the basis for developing assessment criteria and predicting the level of technical and tactical preparedness. They allow differentiating the evaluation and management of the training process of qualified Greco-Roman wrestlers.

It is established that for the planning of training loads, it is necessary to increase the level of special working capacity of athletes, taking into account the requirements of competitive activity and the improvement of technical and tactical actions characteristic of the modern Greco-Roman struggle. This is also confirmed by the results of research presented in scientific papers (A. A. Novikov, 2012; B. V. Dagbaev, 2013; S. Latyshev, G. Korobeynikov, L. Korobeynikova, 2014).

The data (V. A. Kashevko, 2008, A. S. Kuznetsov, Y. Y. Krikukha, 2012; V. A. Andrejtsev, 2016) on the criteria for success, methods of control of technical preparedness and basic indicators of the competitive activity of highly skilled wrestlers.

## Conclusions

1. The analysis of scientific and methodological literature and the generalization of best practical experience made it possible to reveal that competitive activity is closely related to the sport result. This makes it necessary to carefully study the content of competitive activities, identify the factors that determine the achievement of high sports results.

2. Analysis of the technical arsenal of competitive activities of highly skilled wrestlers made it possible to identify 10 main technical actions that are most often used: fall over, body slam, overthrow, counterhold in ground fighting, takedown, suplex, flung, throwing down, forcing out, counterhold in posture.

3. It has been established that the key characteristics of

the preparedness of highly qualified wrestlers with an equal volume of tactical and technical actions were their speed-strength capabilities, special endurance and the ability to overcome the growing difficulty of combining a high tempo of the bout and preserving the effectiveness of technical actions.

4. It was revealed that the effectiveness of the attack in the posture was 60,33%, and in the ground fighting – 62,33%; effectiveness of the protection in the posture – 82,67%, and in the ground fighting – 73,33%; effectiveness in the posture – 3,39 points, on the ground fighting – 3,89 points; attack interval and the interval of successful attack in the first period are higher than in the second; average score is higher in the posture (2,71 points) than in the ground fighting (2,32 points); average time of the bout was 264 seconds (almost complete two periods). Such a distribution of time shows that the number of prematurely won bout is small.
5. The application of methods of pedagogical observation and mathematical statistics allowed us to reflect the structure of modern competitive activity of highly skilled Greco-Roman wrestlers to develop model characteristics of technical and tactical preparedness that can be used in planning and managing the training process.

The study of the content of competitive activities allows the trainer-teacher to more effectively organize the training process (the choice of means and methods of training, the parameters of training loads, the account of the training factors), timely identify shortcomings in the athlete's preparedness and make certain adjustments to the training plan; to carefully choose tactical options for the upcoming bout, taking into account the capabilities of the opponent, etc.

**Further research** will be aimed at developing training tasks for improving the technical and tactical actions of qualified Greco-Roman wrestlers.

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# Organizing and running duathlon competitions in Ukraine

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***Purpose:*** *to analyze the system of organizing and running competitions for a variety of continuous triathlon in Ukraine for compliance with the rules of the International Federation of Triathlon.*

***Material & Methods:*** *based on the study of the specialized literature, the regulatory framework of the triathlon federation, a comparative analysis of the organization and conduct of competitions between the duathletes in the world and in Ukraine carried out.*

***Results:*** *it's revealed a discrepancy between the length of the segments of the greater part of the combined distances at which classification competitions are held in Ukraine, the official formats of international duathlon competitions in Europe and the world.*

***Conclusion:*** *recommendation on elimination of discrepancies of the Ukrainian formats of the distances influencing efficiency of the competitive process in duathlon are proposed.*

**Keywords:** *type of program, duathlon, cross-country segment, bicycle segment, continuous triathlon, transit area, triathlete.*

## Introduction

In the form of sport triathlon, there are many variants of all possible distances with a different combination of types of competitive activity and the length of segments [5; 6; 13].

A new kind of continuous triathlon – duathlon – is the consistent overcoming of athletes combined distance through only two types of physical activity [1; 4].

Type of program duathlon – one of the most recognized and popular innovative directions in the sports world and consists of running, riding a bike and running again (as a rule, the second run is half shorter than the first, but there are variants when the running segments are the same in their length) [14; 15].

International competitions in Europe and the world under the patronage of the International Triathlon Federation (ITU) for the duathlon have been held since 1990 [4; 9].

Preparation and participation in contests according to the type of the duathlon program is one of the most promising areas for the development of continuous triathlon in cities, towns and countryside of our country, in which there is no adequate infrastructure for the full preparation of the triathletes for one of the constituent types of physical activity – swimming.

In accordance with the Unified Calendar of Physical Fitness and Sports Events in Ukraine (UCPFSEU) during the year, the Federation of Triathlon of Ukraine (FTU) conducts all-Ukrainian competitions according to the type of the program duathlon [11]. However, the issues concerning the conditions for organizing and holding competitions in a new direction in continuous eventing under the auspices of the FTU, as well as their compliance with the rules of the ITU, are far from being fully explored.

**The purpose of the research**

To analyze the system of organizing and running competitions for a variety of continuous triathlon in Ukraine for compliance with the rules of the International Federation of Triathlon.

*Objectives of the study:*

1. Expand conditions for the organization and conduct of competitions according to the type of the duathlon program based on international rules.

2. To determine the conformity of the competitions according to the type of the duathlon program in Ukraine to the rules of ITU.

3. To determine the correspondence of the classification competition distances according to the kind of the duathlon program in Ukraine to the international competition distances ITU.

## Material and Methods of the research

1. The study and synthesis of literary and internet sources, normative documents of ITU, FTU and other international federations to assess the key provisions that underlie the competitive process in the duathlon.

2. Comparative analysis of the conditions for organizing and holding competitions for continuous triathlon at officially recognized international formats of distances abroad and at the classification competition distances in Ukraine according to

the type of the duathlon program.

## Results of the research and their discussion

Conditions for holding competitions in a new direction in continuous triathlon are the same for both men and women.

Since competitions in the form of the duathlon program represent the overcoming of the combined distance in a continuous sequence through running, bicycling and running again, the rules of the athletes' behavior on the segments of the route do not differ from those in the corresponding sports. Specificity mainly refers only to the order of passage of the triathlete of the transit zone, where a change in the types of sports activities [2].

The official distance formats on which ITU conducts international duathlon competitions is:

– super sprint – 1,0 km run + 5,0 km bicycling + 1,0 km run;
– sprint – 2,0 km run + 10,0 km bicycling + 2,0 km run;
– short – 7,0 km run + 30,0 km bicycling + 3,5 km run;
– standard – 10,0 km run + 40,0 km bicycling + 5,0 km run [4; 6; 15].

***Remark.*** *In recent years in Europe and the world are rapidly gaining popularity competitions for triathletes overcoming the "long" duathlon, consisting of 20,0 km run + 80,0 km bicycling + 10,0 km run [1; 4; 6].*

**Requirements for outfit and sports equipment.** In competitions according to the type of program, the duathlon of the athlete's outfit consists of a special sports suit combining running clothes and bike riding, running shoes, bicycle helmet, bike shoes with contact pedals, bicycle flasks, bicycles glasses, bicycles gloves, waist strap (for fixing the main number) and keps for running. In the bike cycle uses bicycles for road racing (you can use short "sunbeds" on the handlebars) [3].

***Remark.*** *The closest attention should be paid to the safety of outfit and sports equipment when transporting it to the launch site, as the use of another (instead of timely not delivered or damaged) significantly affect the content of the technical preparedness (skills) of the athlete, corresponding to the needs of this sport.*

**Procedure for precompetition registration.** Before the start of the competition, the triathlete must provide the judiciary with a document proving the identity, the license of the federation, insurance, a medical certificate on the state of health, on commercial starts – receipt for payment of the entry fee, as well as to provide the judges for technical inspection of their bike and bicycle helmet (meeting the safety requirements of the competition). After registration and receipt of the start package, the participant can enter the transit [2; 4].

***Remark***. *In the starting package there is: one number on bicycle (fixed in the area of the seat post); three self-adhesive sticker numbers on the bike helmet (glued in front and on each side); main number of the participant (attached to the belt strap); a special chip informing the computer of the whereabouts of the athlete (fastened in the ankle-leg area of the participant).*

The transit zone is a fenced area, where each athlete, according to his starting number, is given an individual place for accommodation of equipment and a bicycle. It is designed in such a way that, when changing the stages of a combined distance, all participants overcome the same distance.

**First running segment**. Duathlons competitions start with running. Participants, wearing a strap with the main number (during the run it must be in front), line up (depending on the number of triathletes can be several ranks) on the border of the transit zone. After the shot of the starting pistol, all simultaneously rush to the road. The running segment runs along a hard surface, has a closed form and is indicated by pointers [2].

**First transit.** Compliance with the change of types of physical activity is strictly regulated, therefore, upon completion of the first running segment, athletes are sent to their place in the transit zone. After putting the running shoes on the basket, moving the strap with the main number on the body (on the bicycle it should be at the back), putting on the bike helmet, as well as the necessary equipment, jogging with the bicycle (with a hand) are sent to the exit from the transit zone (cycling inside the transit is unacceptable) [2].

***Remark.*** *In transit, it is forbidden to discourage other athletes in changing clothes and in the process of preparing bicycles for the race, as well as touching other people's things.*

**Bicycle segment.** At the border of the transit zone, the triathletes board bicycles (as a rule, bicycle shoes are prefastened with automatic devices to the contact pedals) and sent to overcome the second stage of the duathlon. The cycle of the bicycle stage runs in the direction opposite to the running segment (going to the bicycle stage, you need to know clearly, allowed or forbidden to take the lead (lead) by the organizers in these competitions) [7].

***Remark.*** *All the bike malfunctions on the stage are eliminated by the riders themselves.*

**Second transit.** Ending the distance of the cycling race, the triathletes dismount before the transit border and, holding the bicycle by hand, run to their place in the transit zone. Having established a bicycle on a special ramp, having removed from a head a bicycle helmet and having put superfluous equipment in a basket, having put on sneakers on legs and having moved on a body a waist strap with the basic number, so that he is again in front, the athletes are sent to the second race distance [2].

**Second running segment.** The third stage of the competition – the second run – starts right from the individual seat of the athlete in the transit zone and runs along the route of the first running segment.

Completion of the competition by the type of the duathlon program takes place in the "finish gate", established at the border of the transit zone [2].

**Punishment.** During the competition, an athlete who has committed a violation of the rules is punished as follows:

1) false start – 10 seconds penalty;
2) in the transit zone – a penalty of 10 seconds;
3) at the bicycle and running stages – is warned by a yellow card, after which the athlete must stop and wait for the judge's permission to continue the movement (one-off violations are

punished by a second stop).

***Remark.*** *Two yellow cards during one stage lead to disqualification of the athlete.*

In Ukraine, a relatively new kind of sport, the triathlon under the leadership of the FTU successfully develops at three officially recognized formats of the duathlon distances:

– 2,5 km run + 8,0 km bicycling + 1,0 km run (equates to sprint);
– 5,0 km run + 20,0 km bicycling + 2,5 km run (equates to short);
– 10,0 km run + 40,0 km bicycling + 5,0 km run (standart) [8].

The rank of sporting events by types of continuous triathlon programs (triathlon, duathlon, aquatlon), distances, dates and place of launch is annually indicated in item II "Regulations on All-Ukrainian Triathlon Competitions", published on the website of the FTU http://triathlon.org.ua/federation [11].

To the competitions according to the type of the duathlon program, teams of regions are allowed, formed from pupils of the FSO, Youth Sports School, SCYSSOR, SSHS, ASFK, as well as individual athletes who, 7 days before the start, confirmed the federation (in writing) their participation in them [11; 12].

FTU duathlon competition is held in accordance with the requirements of the ITU according to the current rules agreed with the Ministry of the Family of Youth and Sports of Ukraine in the following age groups:

– cadets – 13-15 years;
– young men – 16-17 years;
– juniors – 18-19 years;
– youth – 20-23 years;
– adults – 24 years and older [8].

Each athlete must have the equipment and sports equipment necessary to overcome the combined distance, as well as a document confirming the age, insurance and certificate from the sports and medical center about the state of health.

Upon arrival, team leaders submit to the credentials committee lists of participants certified by the regional departments for physical culture and sports and relevant medical institutions.

Consider the past during 2014 and 2015 competitions in the form of the duathlon program in Ukraine [11].

According to the calendars of the All-Ukrainian competitions for 2014 and 2015, the Ukrainian duathlon championships were held in Lviv on 25–27.04 and 09–11.05, respectively. The organization and holding of championships in the specified years were of the same type.

Individual classification was determined in absolute superiority (in each age group) among adults, juniors and young men at short distance (5,0 km run + 20,0 km bicycle + 2,5 km run), and youth and cadets at sprint distance (2,5 km run + 8,0 km bicycle + 1,0 km run).

At the same time, the team championship of the duathlon was held in the relay race – mixed among adults and juniors in the sprint distance, which was alternately overcome by each of the four participants of the mixed team (man + woman + man + woman) [11].

Assigning sports categories in the form of sport triathlon to men and women, according to the Regulations on the "United Sports Qualification of Ukraine" (ESQU), there is in addition to the type of program triathlon (swimming + bicycle + running), also in the form of the program duathlon (running + bicycle + running), in three formats (Ukrainian) combined distances provided that qualifying temporary standards are met at the III–IV ranks [8].

***Remark.*** *II junior category at the distance 5,0 + 20,0 + 2,5 km and 10,0 + 40,0 + 5,0 km according ESQU not assigned as the I junior category at a distance 10,0 + 40,0 + 5,0 km. Also, it is not assigned a sports CMS rank at a distance 2,5 + 8,0 +1,0 km.*

The awarding of the sporting title "Master of Sports of Ukraine" (MSU) at the All-Ukrainian duathlon competitions in our country is carried out when the relevant requirements are fulfilled, namely: to take 1 place in the championship of Ukraine among juniors; 1 place in the Cup of Ukraine (or 2–3 – if the result is achieved, not more than 5% of the winner's time); 1–3 – place in the championship of Ukraine [8].

Having identified at the competitions (III-IV ranks) for continuous triathlon the most trained athletes in kind duathlon, coaching council of the FTU includes them (after approval by the Presidium of the FTU) in the staff of the regular national team of Ukraine (candidates with the main composition and reserve) to participate in international competitions, where the duathletes have more opportunities to realize their psychophysical qualities and climb up the classification table of sports ranks [11].

The assignment of MSU to international competitions is made when the athlete fulfills the following requirements (on the ITU distance formats): take 1st place at the stage of the European Cup (or 1–3 – in the final individual standings); 1–2 place – at the European Championships among juniors; 1–3 – place in the World Junior Championships, at the European Youth Championship, at the World Cup stage (or 1–6 in the final individual competition); 2–4 place in the World Youth Championship, and "Masters of Sports of Ukraine of International Class" (MSUIC) – to take 1st place at the World Youth Championship, 1–3 place in the European Championships in personal competition, 1–6 place in the World Championships [8].

Analysis of compliance with the rules of ITU held in 2014, 2015. FTU competitions by the type of program duathlon testifies, that in the All-Ukrainian competitions classificational combined distances (two out of three) do not correspond to the extent of the segments to international standards, at which the European and World championships are held.

At one of the three distances (10,0 km run+ 40,0 km bicycle + 5,0 km run), which is officially recognized and meets international standards, the duathletes in 2014, 2015 in Ukraine did not compete.

Preparation of athletes to overcome domestic qualifying distances at the All-Ukrainian competitions and performance abroad on international formats of distances ITU (most of

which are different) impact on sports results, which show the Ukrainian athletes abroad.

Ideally, the FTU should follow all qualifying competitive distances according to the kind of the duathlon program in Ukraine to bring it in line with the international competitive distances of the ITU.

> ***Remark.*** *In the countries of the post-Soviet space, in particular in Russia, qualifying competitive distances according to the kind of the duathlon program in terms of the number and extent of the segments fully correspond to the ITU formats [10].*

## Conclusions

Based on the study, the following conclusions can be drawn:

1. At the heart of the organization and conduct of competitions in the form of the duathlon program in Ukraine are the rules of ITU.

2. Competitions held by the FTU in the form of the duathlon program comply with the rules of the ITU Federation.

3. Two qualifying competitive distances according to the type of the duathlon program in Ukraine (2,5 + 8,0 + 1,0 km and 5,0 + 20,0 + 2,5 km) do not match the length of the segments to the ITU standards.

**Prospects for further research.** Subsequent studies will be aimed at determining compliance with the international rules of FTU competitions according to the type of program aquatlon (running + swimming + running).

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# An investigation of functional state of the kickboxing athlete respiratory system

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***Purpose:*** *to study of the functional state of the respiratory system of kickboxing athletes.*

***Material & Methods:*** *in study involved 17 athletes – members of the Kharkov region team, age (17,88±0,58) years. Anthropometric studies were carried out according to standard methods, determined: body weight, body length, vital capacity of the lungs. Assessment of physical development, the state of the respiratory system was made with the SPIROCOM program.*

***Results:*** *the physical development of athletes is rated as average and harmonious. An increase in the vital capacity of the lungs was almost doubled in comparison with the standard. A significant increase in actual tidal volume and minute volume of respiration was established in comparison with the proper values. A significant increase in expiration time, a predominance of individuals with a large expiratory volume.*

***Conclusion:*** *established increased functionality of the respiratory system, which is due to the specifics of training in this sport.*

**Keywords:** *kickboxing*, *respiratory system*, *physical development, adaptation.*

## Introduction

The functional state of external respiration in sports has always been given great importance, as a factor reflecting the body's ability to prolonged, extensive muscular activity.

In the conditions of sport activity, extremely high demands are placed on the apparatus of external respiration, the realization of which ensures the effective functioning of the entire cardio-respiratory system. Pulmonary ventilation is the most important indicator of the functional state of the external respiration system [2].

V. A. Aikin, E. A. Reutskaya, E. A. Sukhachev [1] note the need to increase the attention of specialists not only to issues related to the assessment of the long-term adaptation of the athlete's body to the training loads carried out, but also to the problems of restoring and strengthening the respiratory system biathlete.

Traditionally, it is believed that the maximum development of the functional capabilities of the respiratory system is characteristic of cyclical sportsmen in sports, in which the predominant endurance develops. However, in acyclic forms, including martial arts, it is necessary to pay attention to the functional state of the respiratory system, as a factor that largely determines the success of athletes.

Taking into account the parameters of breathing during training makes it possible to significantly improve its effectiveness. S. N. Neupokoev, L. V. Kapilevich, A. V. Kabachkova and others [8] studied the performance of the external respiration system in improving hand strokes on sports equipment from boxers of various qualifications. It is noted that the use of means that limit the load on the brush in a collision with a sports projectile affects the type of execution of percussion actions that qualitatively affects the spirographic indices of athletes of different qualifications. It is noted that the blows performed by the ballistic type of muscle tension are the most economical. This is expressed in a slight decrease in the parameters of the respiratory system after the performance of shock actions in the experimental group of qualified athletes.

Thus, the study of the peculiarities of external breathing in athletes of martial arts will allow not only to assess their functional state, but will also contribute to the optimization of training.

Y. S. Vanyushin, E. S. Minnibaev [3] suggest using the coefficient of complex provision of the body with oxygen to evaluate the functional capabilities of the athlete's body which allowing to judge the compensatory and adaptive reactions of the organism when carrying out a load of increasing power.

N. A. Oleinik, V. I. Chibisov, Y. I. Reiderman and others [10] developed a technique for determining the current state of the cardiovascular and respiratory systems of athletes. The technique allows you to evaluate the functionality during training and physical training in on-line mode.

O. L. Nifontova, V. Z. Kon'kov [9] conducted a study of the cardiorespiratory system of skiers-racers and children not engaged in sports, at the age of 9–11 years. It is established that young athletes have more developed respiratory muscles and increased the limit capabilities of the respiratory system. Higher rates of hemodynamics in skiers-racers showed less economical activity of the heart and a narrow range of adaptive possibilities.

S. I. Petrenko [11] investigated the physical working capacity and function of the respiratory system of young football players with different variants of biological development. It has

been established that both the performance indicators (according to the PWC170 test) and the functional parameters of the respiratory system (number of respiratory cycles per minute, the retention of breath on inspiration and exhalation, and the maximum oxygen consumption) grew as young athletes grew up.

M. S. Terzi [17] studied the physiological features of the functional training of martial artists of different qualifications. The functional readiness of the taekwondo athletes of different qualifications for the cardio-respiratory system was studied in the training and competition process. With an increase in the level of sports qualification, the indicators of the functional state of taekwondo athletes by tests of the cardio-respiratory system significantly increased. The analysis of the indicators of the functional state of engaged in taekwondo an athlete testifies to the development of long-term adaptation to physical stress in taekwondo.

S. N. Neupokoev, L. V. Kapilevich, A. V. Kabachkova, E. V. Loson, O. V. Dostovalova [7] studied the parameters of the external respiration system in improving strokes with different types of muscle tension. It is shown that the use of means limiting the load on the brush (boxing gloves), helps to optimize the nature of muscle tension while improving accented strikes in the box. It is noted that ballistic-type attacks are the most economical. This is expressed in an increase in the electrical activity of the muscles directly involved in providing strength and speed of impact, and reducing the electrical activity of their antagonists, which contributes to a minimum reduction in the parameters of the respiratory system after the test load.

V. N. Chernaya, T. R. Abdumaminov, S. Y. Koval, O. V. Khomyakova, Y. I. Shramko [18] studied the effect of wushu gymnastics exercises on the indices of the functional state of the respiratory system of athletes. Gymnastics training wushu contributed to more effective action of aerobic exercise on the athlete's body and increased reserve capabilities of the respiratory and oxygen transportation system.

Y. N. Romanov, A. S. Aminov, L. A. Romanova [14] estimated the general and special performance of top-class kickboxers in two stages of preparation for the competition. In assessing the overall performance of kickboxers, significant reserves of anaerobic threshold, respiratory volume, respiratory rate, lung ventilation.

S. V. Kiprich, D. Y. Berincik [5] determined the specific characteristics of functional and metabolic support for the special endurance of qualified boxers. It is shown that the range of individual differences in performance indicators and functional maintenance of special endurance increased in each round under the influence of accumulation of fatigue.

N. V. Slivkina [16] notes that an important place in the adaptation of the body to physical activity is the state of the cardio-respiratory system. The conclusion is drawn that in sportsmen of oriental martial arts the phenomenon of economizing the activity of the cardio-respiratory system is not expressed.

O. A. Rivnaya, L. V. Podrigalo, S. S. Ermakov et al. [13] studied the morphological and functional features of athletes of synchronized swimming of high qualification, relationship between anthropometric indicators and functional characteristics of the external respiration system. Exceeding physiometric indicators in athletes in comparison with the standards of physical development. The parameters of external respiration illustrate the adaptation of the organism to specific loads. Correlations were established between the vital capacity of the lungs and the duration of inspiration, the respiratory rate with the duration of inspiration and expiration, illustrating the increase in functional reserves. The conclusion is drawn that according to morphological features athletes synchronous swimming do not differ from the standards, and physiometric and functional indicators of the external respiration system significantly exceed the contemporaries, which characterizes the range of functional reserves, and the resulting correlation links reflect the orientation of the adaptation process under specific conditions of synchronous swimming.

E. S. Shayakhmetova [20] analyzed the competitive activity of boxing from the standpoint of sports physiology and proved the possibility of using respiratory technologies in order to increase aerobic abilities of athletes.

The available data in the literature and determined the relevance of this study.

**The purpose of the research**

To study of the functional state of the respiratory system of kickboxing athletes

## Material and Methods of the research

Under observation were 17 athletes – members of the Kharkiv region team, age was (17,88±0,58) years.

The design of the study involved the study of the main parameters characterizing the physical development and state of the respiratory system. Anthropometric studies were carried out according to standard methods, determined: body weight, kg; Body length, cm; vital capacity (VC, l).

A comprehensive study of the external respiration system was carried out using the SPIROCOM program, in which the main parameters of spirography were recorded. Determined reserve volume of inspiration (ROIn, ml) and expiration (ROEx, ml), their speed ($m \cdot s^{-1}$), the respiratory volume (RV, ml), the minute respiration volume (MRV, l $min^{-1}$) respiratory rate (RR, cycle $min^{-1}$). The proper indices of the respiratory system were calculated on the basis of anthropometric indices.

Statistical analysis of the obtained data was carried out using licensed packages Excel spreadsheets with the definition of parametric and nonparametric criteria [6].

## Results of the research and their discussion

For the purpose of comparing the indicators of physical development, official standards are used [12; 15]. It is established that the mean lengths (176,47±1,60) cm and the body weight of the athletes (65,65±2,14) kg do not significantly differ from the standards, respectively 175,67 cm and 63,48 kg. This allows us to consider the physical development of the surveyed athletes as medium and harmonious.

At the same time, a comparison with the value set VC physical development standards (3,20±0,05) l proved that the examined athletes had a significant increase in this value is almost

twice. In our opinion, this should be interpreted as evidence of the best functional state of the external breathing system of kickboxing athletes in comparison with the average statistical level. The increase in the parameters of the VC suggests its significant contribution to the process of adaptation to physical loads during training in kickboxing.

To assess the adequacy of the actual data, a comparison was made of the external respiration rates, the results of which are shown in Fig. 1–4.

The analysis of individual indicators of the surveyed athletes made it possible to establish that the actual indicators are generally higher than those due. Thus, at 47,06% the value of RV significantly exceeded the proper value, in 41,18% – was within the norm (deviations did not exceed 10%) and only 11,76% were characterized by a value of RV significantly lagging behind the normative one (Fig. 1). A comparison of the proper and actual RR values with the Wilcoxon-Mann-Whitney test confirmed a significant excess of the actual values, U=96, p<0,05. A similar result was obtained using the Rosenbaum test, Q=11, p<0,05.

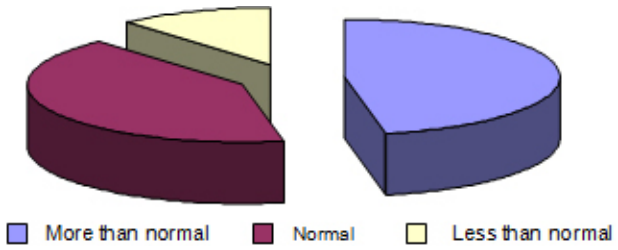


**Fig. 1. Distribution of kickboxers according to the value of the respiratory volume**

RV is a rather static indicator, depending on the basic anthropometric criteria (mass, body length, chest circumference) and, accordingly, inert in its dynamics. Therefore, the increase in the actual results compared with the calculated ones illustrates the expansion of the adaptive potential of the respiratory system of athletes. In addition, in many ways RV is determined by the strength of the respiratory musculature and, above all, the intercostals muscles and diaphragm. The increase in this indicator reflects an increase in the economy of the work of the respiratory system, that is, an increase in the strength of these muscles leads to an increase in the volume of respiratory movements.

The results of the MRV analysis are shown in Fig. 2.

When assessing the compliance of MRV, it was clarified that the overwhelming majority (64,71%) of the surveyed had a value greater than the normative, 23,53% were characterized by a deviation within the physiological norm and only 11,76% had a significant lag. Comparison of the proper and actual values of the MRV with the help of the Wilcoxon-Mann-Whitney test, and in this case, confirmed a significant excess of the actual values, U=86, p<0,05. The increase in MRV is possible due to the increase in respiratory rate and RR. From the point of view of long-term adaptation, the most effective way is to increase RR and stabilize the number of respiratory movements per unit time, which was observed in this case. In addition, the closed stand of an athlete in kickboxing reduces the possibility of carrying out respiratory movements. In this case, an increase in the MRV illustrates the high potential of the respiratory musculature. The obtained results allow to consider that adaptation to physical loads in kickboxing largely depends on the function of external respiration.

In the valuation of MBC it was found that 41,18% had an excess, 29,41% – a coincidence and 29,41% – a lag in relation to the proper values (Fig. 3).

The Wilcoxon-Mann-Whitney test confirmed the absence of

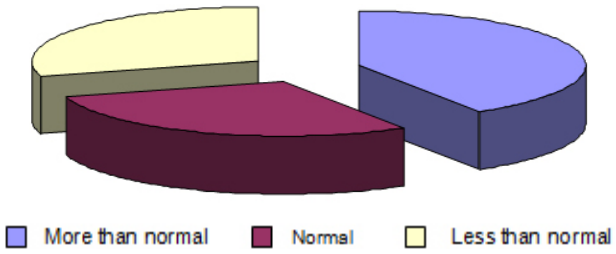


**Fig. 3. Distribution of kickboxers in terms of maximum breathing capacity**

significant differences between actual and proper values, U=125, p>0,05. Given the fact that MBC is largely dependent on breathing rate, an increase in this indicator is observed in athletes cyclic sports associated with long loads. In the case of martial arts, the maximum increase in the frequency of breathing will interfere with the technical implementation of strikes. In these sports there is coordination of motor phases with respiratory cycles. During training, attention is focused on the coincidence of shock movements with the act of exhalation. Excessive increase in the frequency of breathing will interfere with the implementation of strikes.

In the evaluation of the VC, the increase was established in 47,06%, the coincidence in 41,18% and the lagging in 11,76% relative to the proper values (Fig. 4).

The Wilcoxon-Mann-Whitney test in this case confirmed the

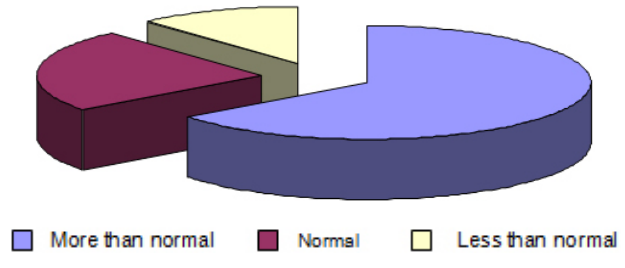


**Fig. 2. Distribution of kickboxers according to the value of the minute respiration volume**

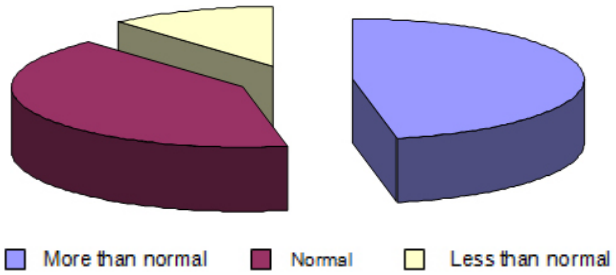


**Fig. 4. Distribution of kickboxers in terms of the vital capacity of the lungs**

absence of significant differences between actual and proper values, U=97, p>0,05. At the same time, the calculation of the vital index (VI) confirmed its significant increase in athletes. So, VI of the available age-sex standards was 50,16, and in athletes it was almost twice as large and amounted (90,55±4,47). This once again confirms the conclusions made earlier about the increase in the functional level of the respiratory system of athletes.

Thus, the obtained data indicate that the majority of the surveyed athletes were characterized by an excess or a coincidence of the actual values of the parameters of external respiration relative to the proper values, which makes it possible to consider the functional capabilities of the respiratory system to be increased.

When comparing the time of inspiration and expiration, which was respectively (1,36±0,12) s and (1,96±0,15) s, the value of the last (p<0,05). In our opinion, this is also a testimony in favor of the assumption of an increased functional state of the system under consideration. As you know, the inspiration is an active action performed with the help of the tension of the respiratory musculature (intercostals muscles, diaphragm), while the exhalation is carried out passively – by relaxing these muscles [4]. Therefore, physiologically, the expiration time is less than the inspiratory time. In the examined athletes, the ratio of inspiration to exhalation was (0,72±0,06). The change in this ratio to the opposite indicates that in the process of respiratory movements, the respiratory musculature actively participates, in addition, the exhalation from the passive process becomes active, which is caused, as already noted, by training in striking blows on the exhale.

Another fact in favor of the assumptions made is the study of the ratio of ROIn and ROEx. In 58,83% of the examined, this value is less than one, which indicates an excess of the expiratory volume. 11,76% of the athletes surveyed had a ratio of these respiratory volumes close to unity and only 29,41% had a significant excess of inspiratory volume over the exhalation. Such ratios of exhalation and inspiration suggest a high resistance of athletes to hypercapnia, which is also important for success in martial arts. The breathing system regulates homeostasis, protects the body from acidosis, for proper breathing, an exhalation is very important for normalizing the acid-base balance and pushing back the formation of fatigue.

The value of the reserve of respiration (RR), defined as the ratio of MBC to MRV, was (8,41±0,71). This is comparable to the data given by A. V. Chogovadze, L. A. Butchenko [19], for sportsmen of team sports: volleyball (7,80±0,70) and football (8,20±0,50), which also gives grounds for the conclusion about the increased functional capabilities and the impact of the specific organization of the training process in kickboxing on the state of breathing.

## Conclusions

The conducted study of the physical development of kickboxing athletes confirmed the existence of an average harmonious development, while the magnitude of the VC significantly exceeded the normative values. A special study of the respiratory system makes it possible to draw a conclusion about the increased functional capabilities of this system, which is proved by the prevalence of actual indices in the majority of the surveyed in comparison with the calculated indices. In favor of this conclusion, the fact that the ratio of the time of respiratory movements due to exhalation of activity, the predominance of the reserve volume of exhalation over a similar volume of inspiration. Installed results suggest a high resistance athlete to hypercapnia, which is also important for success in the martial arts.

**Conflict of interests.** The author declares that there is no conflict of interests.
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# Organizational aspects of an experimental program for physical education with a strengthened course in professional and applied physical training of future electrical engineers in the railway sector

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***Purpose:*** *to develop an optimized program for physical education with a strengthened course in professional and applied physical training (PAPT) for students of railway universities.*

***Material & Methods:*** *analysis and generalization of scientific sources and program-normative documentation on physical education of the higher educational institution of railway transport, survey.*

***Results:*** *the results of the survey of railroad specialists are given. Pilot studies have determined the nature and conditions of professional activity of electrical engineers of railway transport. The experimental program on physical education with the strengthened course of the PAPT of students of railway universities was developed and theoretically justified.*

***Conclusion:*** *structure of the experimental program on physical education with the strengthened course of the PAPT included a theoretical section (8 hours), methodical and practical exercises (6 hours), a practical section (114 hours) and a control section (12 hours). The program focuses on improving professionally important physical and psycho-physiological qualities and functions, psychomotor skills and physical performance. The basis of the practical section was the physical exercises from different sections of the current basic curriculum.*

**Keywords:** *physical qualities, program, professional activity, electrical engineers of railway transport, students.*

## Introduction

The irresistible development of scientific and technological progress, global changes in the political, economic and public spheres radically change the perception of the quality process for the training of the future railroad specialist, which requires fundamentally new approaches to the system of physical education, especially to the process of professional and applied physical training (PAPT). The complication of production, the increase in the volume of information, global computerization and the intensification of labor processes radically transform the working conditions, require from a modern specialist high concentration of attention, increasing the speed of thinking processes, the accuracy of motor actions, the ability to work in conditions of neuro-psychic stress and lack of time. All this causes an urgent need for the reorganization of physical education, especially in the section of professionally and applied physical training, which is a kind of foundation for effective mastery of future professional activity [2; 8].

The training of a reliable specialist first of all should provide for not only perfect mastery of professional knowledge and skills, but also a sufficiently high level of development of physiological mechanisms of movement control, presenting, on the one hand, high demands on the theoretical basis for the basics of vocational training, and on the other – development of the foundations of professionally-applied physical training, with the help of which a high functional readiness of a specialist to professional activity is achieved.

The problem of optimizing the professionally applied physical training of students is devoted to many studies of domestic and foreign researchers [1; 2]. It is not a coincidence, because a modern specialist should differ not only in the quality of professional training, but also have a high level of physical development and functional state of the organism.

In the scientific works of researchers [3; 4] it was noted that the formation of professionally important physical qualities and skills in future specialists, the increase in the resistance of the organism to the adverse effects of the external and industrial environment is most effectively achieved in the process of specially directed use of means and methods of physical education.

Numerous studies prove that the implementation in the technical universities of the traditional program of physical education does not allow to achieve the necessary normative level of general physical fitness and significantly limits the possibilities of improvement of professionally important psychophysiological properties and physical qualities of students of the chosen profession [3; 5; 7].

Analysis of scientific and methodological literature showed that theoretical and practical questions of professionally-applied physical training of students of different professions were studied by many domestic and foreign researchers. However, so far, the concept and formulation of PAPT, its purpose and objectives are treated differently by a scientist, which often leads to inadequate development and substantia-

tion of its content for representatives of specific occupations, in particular, for electric engineers of rail transport.

It is known that an important role in creating the prerequisites for the successful mastery of professional skills is played by physical educations. Students engaged in physical culture and sports, much faster and better formed professionally important skills and techniques that increase the level of efficiency and reduces the incidence, their body adapts faster to new, often unfavorable, production conditions. Thus, the intended effect of specially selected physical exercises helps to improve the quality of professional training of future specialists, allows more efficient to train highly qualified personnel for all industries.

Many researchers [2; 5; 6] dealt with the issues of professional and physical training in the railway sector. However, to date, the problem of PAPT specialists in various specialties of the railway industry remains insufficiently researched.

Results of the research showed that the professional activity of electrical engineers in railway transport is one of the most important, because the safety and smooth operation of trains depend on the reliability and perfect performance of their production operations. Therefore, the physical, psycho-physiological and mental qualities and functions of the future electrical engineers body of rail transport an increased requirement.

For the employee of the railway industry, professional and applied physical training is of fundamental importance, because in the course of training by specially selected physical exercises reserve capacities of an organism, improve the adaptive processes of the organism to unfavorable conditions of production activity and negative environmental conditions. The active performance of physical exercises improves the interaction of the processes of excitation and inhibition in the central nervous system, improves the regulation of vegetative function, the composition of blood, the work of the heart, the movement of blood through the vessels, the blood supply of the brain, improves gas exchange in the lungs and energy supply of muscular activity, which is necessary for a large amount of mental and physical work of a worker in the railway industry. As a consequence, specialists improve performance indicators [5; 6; 7].

**The purpose of the research**

To develop an optimized program for physical education with a strengthened course in professional and applied physical training (PAPT) for students of railway universities.

## Material and Methods of the research

Research methods: analysis and generalization of scientific sources, program-normative documentation on the physical education of high schools of the railway transport, questioning.

## Results of the research and their discussion

The development of the experimental program on physical education was carried out on the basis of the contents of the basic curriculum on physical education for higher education institutions, taking into account the specifics of the professional activities of specialists in the engineering profile of the railway industry, the nature of the work that they perform, physical, psycho-physiological and mental loads, exposure to environmental hazards, occupational diseases, requirements for professionally important qualities, level of health, physical development, physical and vocational skills of future specialists. A special feature of the experimental program on physical education is the expanded section of professional and applied physical training.

The problem of optimization of professionally-applied physical training for future specialists of various specialties is devoted to a considerable number of scientific works, but virtually unexplored features of preparation with the orientation on the work process of electrical engineers of railway transport, not developed organizational and methodological foundations of the construction of technology of professional and applied physical training are not developed taking into account the structure and functioning of the universities of railway transport. Such training of railway transport engineers is practically not carried out either during study at the university, or during the further production activity. The main reason for this is the lack of research to date regarding the specifics of the professional activities of railway engineers, a list of professionally important physical and psycho-physiological qualities, technology of their development. Therefore, the issue of the development and implementation of the advanced training of the PPFP is important and relevant.

Purpose of the experimental program is to optimize the professionally applied focus of the physical education process for university students in the railway profile.

To determine the nature and working conditions of electrical engineers in railway transport, pilot studies were conducted. The obtained results allowed to determine typical production operations, labor actions, characteristic working posture and working movements, motor activity, physical and mental stress during the working shift and the level of their fluctuations; labor errors; professionally important motor skills, skills and psycho-physiological functions; physical and mental qualities and abilities; important business, strong-willed and other personal qualities; sanitary and hygienic working conditions; influence of climatic and meteorological changes in the environment; occupational diseases, harmful production and other.

Analysis of the survey data made it possible to determine that the electrical engineers of the railway transport with a generalized object of the activity of automation systems and computer-integrated technologies in railway transport, which include the systems of railway automation and telemechanics, information transmission systems in railway transport (master of integrated automation and telemechanics; master on repair of devices and equipment; master on maintenance service of automation systems on a railway transportation; master of maintenance of communication systems in railway transport, master on repair of means of measurement and automation; operator (dispatcher) of computer-integrated technology (CIT) specialist in automated control systems and others), carry out production and technological, organizational and management, design and research activities in the field of the creation of rail automation and telemechanics systems, information transmission systems, design and research works in the field of automation, information processing and manage-

ment in railway transport. In the work of the above-mentioned specialists, the following types of professional activity prevail, such as design and development, installation, regulation of systems and equipment, organization and implementation of maintenance, operation and repair of railway automatic devices, in turn, determines the professionally important qualities of the personality of specialists in the railway industry.

It is determined that electrical engineers of railway transport inherently have a long stay in the forced monotonous working posture – sitting, standing, with a long standing static physical loads (design work, installation and adjustment of equipment, operator activity), as well as dynamic physical loads, a large number of movements during working changes, the action of extreme factors that make up specific production conditions (maintenance of automatic devices and systems, elimination of emergencies consequences). Such working conditions often cause a number of occupational diseases of the peripheral nervous system, vision, hearing, and emotional-nervous tension, mental stress in conditions of prolonged hypodynamia leads to a decrease in efficiency and productivity.

The analysis of data on the study of the specific features of the professional activities of electrical engineers in railway transport makes it possible to assert that their activities are of a multifunctional character, and professional duties include a large volume of various works. Works can be carried out both on the street, near the railway tracks, and indoors, when carrying out the watch at the floor devices. Such working conditions require from the railroad specialists a sufficiently high development of general and strength endurance, the ability to withstand many hours of physical and mental stress and maintain a high level of efficiency during the working shift. In general, the working posture “in motion” (74%) prevails and standing-bending (65,6%), during the working shift, specialists overcome large distances on foot, sometimes from 10 to 15 km, the greatest load is experienced by the muscles of the legs and back. The implementation of production operations is mainly provided by small and medium-sized localized actions with hands and fingers.

In the professional work of electrical engineers in railway transport, manual labor sometimes mixed. The motor actions are precise, localized; rapid movements of hands and fingers during the implementation of production operations; manipulation of small parts, objects, tools in a strictly regulated period of time,; actions with the maximum power of effort requiring power sometimes in extreme or emergency situations that require high concentration, focus, dexterity and speed of fingers, coordination of motor actions and movements with the process of perception of endurance and strength; long-term various dynamic motor actions of severe or moderate severity and intensity with a load on the locomotor system, which require total endurance.

Negative features of professional work of electrical engineers include: performance of production duties under any meteorological conditions; high tension of the visual and auditory analyzers; long-term static working posture, standing, bent, sitting with a slope, which causes tension in the muscles of the neck, shoulder girdle, lumbar spine, stagnation in the pelvic organs and lower limbs; neuro-emotional tension, work in conditions of time deficit.

Due to the survey UkrSURT students and professionals of the railway industry were identified professionally important physical and physiological qualities and properties of Electrical Engineers of Railway Transport, the influence of harmful factors of production, composed professiogram.

Based on the data obtained, a program for physical education with a strengthened PAPT course for students, future electrical engineers for railway transports.

The contents of the main sections of the curriculum on physical education of UkrSURT and the technology of their teaching have been revised, and a new approach has been proposed in teaching the teaching material without increasing the total number of hours. The theoretical section on the first and second year was extended to 8 hours and is aimed at the formation of a world outlook system of scientific and practical knowledge necessary for the implementation of the professionally applied physical training of future railway transport specialists, their positive attitude towards physical education and PAPT. Practical exercises in the amount of 6 hours provided for the creative reproduction by students of the basic methods and methods of forming the educational, professional, household skills necessary for effective employment of the PAPT during and after graduation. The practical section was aimed at ensuring a high level of physical, psycho-physiological and psychological preparedness of students, the formation and development of professional and applied skills and skills required in future professional activities. The control section used for testing and evaluating the effectiveness of the process objective physical and professionally-applied physical preparation.

Experimental program is based on the substantive part of the current program on physical education for higher education institutions. The main emphasis was placed on the introduction of a strengthened course of PAPT in the physical education process, but did not imply any drastic changes in the program material and the use of additional study hours.

The practical section of the program provided 240 hours for two years of training (120 hours each). Program of the practical section is aimed at using a large amount of PAPT material in accordance with the conditions of professional activity of future electrical engineers of railway transport.

Basis of the practical section was the physical exercises from the sections of the current basic curriculum on physical education for higher educational institutions of Ukraine III–IV level of accreditation: general physical training, athletics, football, volleyball, basketball, gymnastics, as well as sports (athletic gymnastics, gymnastics), outdoor games, PAPT, which fully contribute to the formation of professionally important qualities of future railway engineers. A complex of exercises with dumbbells was widely used. Obligatory components of the program were: individual types of athletics, athletics relay races, sports games, corrective gymnastics for the eyes, respiratory gymnastics, psychological self-regulation, psycho-muscle training. Preliminary, general developing, specially-preparatory, applied physical exercises were used. Funds that were used in the work with the experimental group, were aimed at the development of general and strength endurance, strength, coordination of movements, dexterity, static and dynamic endurance of the muscles of the shoulder girdle, neck, back, upper and lower limb strength, joint mobility, and attention and memory development.

Selection of PAPT funds was carried out taking into account professionally important physical, psycho-physiological and motor qualities, with an accentuated development of muscle groups bearing the main stress in the process of professional activity.

The conditions of the sports base UkrSURT and the temperature of the autumn-winter season in the east of Ukraine make it possible to conduct practical exercises with groups of SPT, to which the students of the groups studied belonged, in the open air, using the natural factors of the environment and the healing forces of nature. Such conditions are most closely related to the real, accompanying future professional activities of railroad engineers. The content and methods of conducting classes were constantly updated and complicated, physical activity increased gradually.

To increase the level of livelihoods, stress resistance, functional reserves of the organism and the general endurance of students of the experimental group, preference was given to exercises and sports of aerobic character. Providing the body with the necessary aerobic loads was due to running and sports games.

When planning the aerobic exercise is required to take into account the level of health and physical preparedness of students. The normalization of the intensity of aerobic exercise was carried out according to the heart rate. Based on preliminary testing, for each student of the experimental group, the individual recommended heart rate was calculated, which ranged from 60-80% of the maximum permissible age of heart rate. For subjects who had a low level of physical fitness, an aerobic exercise of 25–35 minutes duration with an intensity of 60-70% of the maximum heart rate. For students average fitness level – the duration of aerobic exercise was 25 minutes, the intensity of 70–75% of maximum heart rate, and students with a level of physical readiness above the average – the duration was 15–20 minutes with an intensity of 75–80% of the maximum heart rate.

To form, develop and improve the speed and accuracy of the movements of arms, hands and fingers, exercises were chosen that help to increase dexterity, mobility, working capacity of hands and fingers, remove fatigue, increase the strength of fingers and brushes, prevent occupational diseases of the joints.

The content of the exercises in athletic gymnastics was directed mainly to the development of strength, power, static and dynamic endurance of the basic muscle groups of hands, trunk, legs, raising the level of moral and strong-willed qualities and psycho-emotional stability, educating self-confidence and one's own strengths.

In specially designed complexes with dumbbells, the exercises were selected in such a way as to cover all the major muscle groups and were arranged in order of consistently increasing physical activity. Students were offered four basic sets of exercises with dumbbells. For self-study offered a shortened set of exercises with dumbbells.

The section of the program "Psychological self-regulation, psychomusical training" was aimed at the development of psychological stability, the formation of skills, necessary for the mobilization of physical and volitional qualities of future specialists in emergency actions in cases, in situations of neuro-emotional tension, time limit, during fatigue and overstrain. In this section, exercises of respiratory gymnastics were widely used; methods of psychological self-regulation, psycho musical training and relaxation were assimilated. The main goal of this section is to teach students how to optimally use the means and methods of psychological self-regulation in the production process, life and way of life, promote highly effective performance of professional duties, increase professional longevity, prevent stress.

To increase the effectiveness of the development of physical qualities in the classroom, the method of circular training with the sequential execution of a set of specially selected physical exercises was used, and game and competitive methods. During the training by the method of circular training, preference was given to exercises for the development of general and strength endurance, strength, speed and accuracy of movements, speed and flexibility. To perform each exercise a certain place was allocated, which was conditionally called "station". In the circular training included 8 "stations", each of which the student performed one exercise and, proceeding from the tasks of the lesson, passed the circle 1-3 times.

To educate confidence, self-control, the ability to quickly navigate in difficult circumstances and quickly assess the unexpected situation, unusual conditions were created, additional complications were introduced, and disorientate emotional factors were added.

In order to improve the functions of attention, mobile and sports games and gaming tasks were widely used to solve conflict situations in a state of fatigue, with time limits, under the influence of disorientate factors.

During the sessions, conversations were held with students on the applied orientation of physical education, prevention of occupational diseases, and so on.

Important for the students in the experimental group were transcripts requirements by which determined not only by the level of physical, but also the professional-applied physical readiness of the future railroad engineers.

The control section of the experimental program, for both I and II courses, consisted of 12 hours and provided for assessing theoretical and methodological knowledge on the basics of theory, methodology and organization of physical education in the form of written test tasks during the crediting session and determining the level of general physical and professionally-applied physical preparedness according to the results of testing.

## Conclusions

1. Analysis of literature sources and normative documentation makes it possible to assert that the questions of the professionally applied physical training of future electrical engineers of railway transport have not been developed sufficiently.

2. Pilot studies have made it possible to determine the nature and working conditions of electrical engineers in railway transport, the types of their professional activities, working posture, physical activity, physical and mental stress, occupational diseases, sanitary and hygienic working conditions,

professionally important physical and psychophysiological qualities and functions.

3. Experimental program on physical education with the strengthened course of the PAPT was developed and theoretically justified, the structure of which provided for a theoretical section of 8 hours, methodical and practical classes – 6 hours, practical section – 114 hours and control – 12 hours. The program is focused on the improvement of professionally important physical and psycho-physiological qualities and functions, psychomotor abilities and physical ability to work. Basis of the practical section was the physical exercises from different sections of the current basic curriculum.

**Further research** is planned to devote to the study of other organizational and methodological aspects of physical education classes, namely, occupations of professionally-applied physical training for university students of the railway profile.

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# An influence of dancing track rhythm studying on its performance in rhythmic gymnastics at the initial stage of the training process

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*Dancing track, as a mandatory element appears in the competition exercises gymnasts from 2013. However, until now not studied the basic methods and techniques of their development gymnasts of all ages and skill. Many authors argue that the assimilation of rhythm leads to a facilitated assimilation of exercises. In rhythmic gymnastics, there were no studies on the effect of rhythm digestion on the performance of individual exercises, which was the prerequisite for our study.*

***Purpose:*** *to study the influence of mastering the rhythm of the dance tracks on their performance in gymnasts at the stage of initial training.*

***Material & Methods:*** *to identify the impact of assimilation of the rhythm of dance tracks on their performance gymnasts at the stage of initial preparation of the analysis of scientific and methodical literature, the rules of rhythmic gymnastics have been used, pedagogical experiment.*

***Results:*** *the assimilation rate, which performed the dance track, a positive effect on their learning and performance of the gymnasts at the stage of initial training.*

***Conclusion:*** *study of dance tracks efficiently and expediently carried out with the assimilation of the rhythm of their performance.*

**Keywords:** *track, dance, rhythm, gymnasts, rhythmic, preparation, initial.*

## Introduction

Dancing track has an important role in the exercises of gymnasts, during their performance the gymnasts express the main theme of the musical work in which the exercise is performed; convey the character and rhythm of the music, expressing it in movements. They were introduced into the official rules of the competition in rhythmic gymnastics in order to provide entertainment to the exercises of gymnasts.

In the rules of the competition describes the styles of dances that gymnasts can perform in competitive exercises, a more detailed description of the varieties of dancing performed in the textbook I. A. Wiener [4].

However, specialized literature on rhythmic gymnastics does not describe the methodological guidelines for studying dance; it is a problem for coaches when they learn in training. According to the data of the questionnaire, in most of the coaches they use methodological instructions for studying dance according to the literature of choreographic and dance groups or invite dancing specialists for additional training.

In connection with this, the search for ways to provide scientific and methodological support for the study and further implementation of dance tracks in rhythmic gymnastics is an actual problem.

Many experts say that having learned the rhythm of exercise, it is easier for an athlete to fulfill it [1; 4; 8]. After examining the methods of developing a sense of rhythm in the study of musical literacy, we find out that all musicians study the rhythm of music, which they then perform on musical instruments or under which they sing. The same principle must also be applied when carrying out the movements that are being studied.

As a result of the analysis and systematization of the features of performing dances of different styles and directions, one common feature of the performance of dances – musical size under which they are performed, namely 2/4, 3/4 or 4/4 or more complex forms 3/8, etc. In the studies V. Y. Sosina describes the features of performing exercises for each musical size [10].

In labor and sports practice, the ability of a person to "work out" for a long time in the rhythm in which he has to carry out this or that work [1; 6; 8].

Many authors point to the essential role of the assimilation of the rhythm of movements in the process of their study, as well as the smooth rhythm of the fulfillment of movements, assimilated in perfection [1–3; 6; 8; 9; 11; 12 13].

The formation of a rhythm is considered as the formation of a dynamic motor stereotype as a complex and balanced system of cortical neural processes corresponding to certain temporal, spatial and force characteristics of motor actions performed in a certain rhythm [8].

In a number of works attempts have been made to isolate the rhythm of certain movements and their formation [11; 13].

In dance movements, certain phases of action are singled out, which make up their structure. During the execution of movements, these phases take time and follow one after another. The temporal relationships of the parts of the movement and the order of their alternation, the change in the muscular tension, constitute the rhythmic structure of the exercise. According to the rhythmic structure, one can judge the structure and complexity of the movement [1].

In the studies of T. V. Sizova [9], the influence of the development of a sense of rhythm on the performance of rhythmic gymnastics exercises among university students was described, and reliable positive indices of the influence of the development of a sense of rhythm on the performance of exercises in accordance with the musical accompaniment.

Dance track in exercises of rhythmic gymnastics must be performed in harmony with the musical accompaniment, it is necessary to express music in movements. To be able to express the rhythm of music through the movement, you need to feel the rhythm of the music under which the dance track is performed [11].

In order to perfectly perform any kind of dance it is necessary to feel the rhythm of the music under which it is performed, including also the sense of musical size [11].

Rhythm in music – is a combination of size and tempo. Tempo – is the "speed" of music, and the musical size is the number of basic lengths of sounds or pauses by one bar [11; 12].

Simple musical dimensions are divided into two-lobed and tri-lobes. A two-lobed one consists of one strong and one weak lobe (once or twice), and a tri-lobed one – with one strong and two weak.

Studies of specialists [2; 11] show that the use of dances in the training process positively affects the rhythmic abilities of athletes engaged in artistic gymnastics.

**The purpose of the research**

To study the influence of mastering the rhythm of the dance tracks on their performance in gymnasts at the stage of initial training.

## Material and Methods of the research

The study involved 40 girls who are engaged in rhythmic gymnastics at the stage of initial training, 20 gymnasts in the control and experimental groups. Gymnasts of the experimental group studied dance tracks with assimilation of musical size and rhythm, the gymnasts of the control group studied the dance tracks, repeating them for the coach, the teacher-choreographer.

To determine the effect of mastering the rhythm of dance tracks on their performance, the gymnasts at the initial preparation stage used analysis of scientific and methodological literature, rules of rhythmic gymnastics competitions, pedagogical experiment, methods of mathematical statistics.

## Results of the research and their discussion

Considering the above, a program was developed for the formation of a sense of rhythm in gymnasts at the stage of initial training, which provides for the study of dance tracks with the assimilation of the rhythm and the musical size of their performance. After analyzing the scientific and methodological literature, a variety of dances, which are studied by gymnasts at the stage of initial training, were found, they were classified according to the musical size of the performance. Variations in the performance of dance tracks in rhythmic gymnastics have also been developed, taking into account the requirements of competition rules. In the developed program gymnasts learned a certain musical size and rhythm in each separate training, and studied the dances that are performed exactly in this size.

Gymnasts of the experimental group learned the rhythm of performing the dance track by simple exercises, applause, in gaming tasks for better rhythm reproduction and other ways provided in the program.

The gymnasts of the control group studied dance track when setting up competitive exercises in the main part of the training session, in the final part of the training session in the tasks of improvisation, and also during choreography, which is provided for the standard training program [2] without the use of means for mastering the rhythm in which dances are performed.

After applying the developed program, we conducted an expert evaluation of the performance of the dance tracks in the gymnasts of both groups on a five-point rating scale and obtained the following results (table 1). In the experimental group of gymnasts expert assessment of the performance of dance tracks it was significantly higher than that of the control group of gymnasts, studied dance only for visual delivery method (Fig. 1).

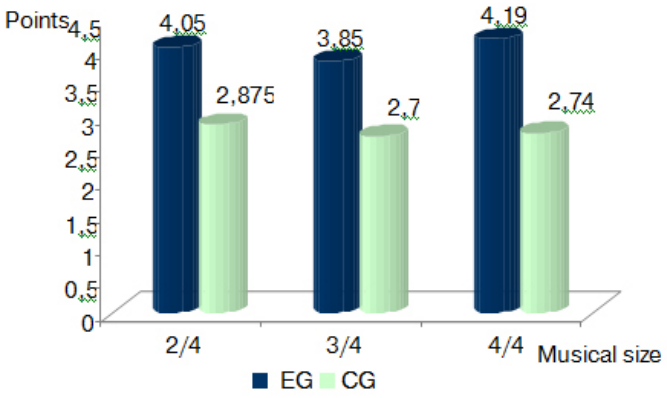


**Fig. 1. The results of the expert evaluation of performing dance tracks in gymnasts after the experiment**

In gymnasts of the experimental group, the score for performing dance tracks in the amount of 2/4 was 4,05 points, in 3/4 – 3,85 p., in 4/4 – 4,19 points, is significantly higher than the assessment of the gymnasts of the control group, where these indicators are respectively 2,875, 2,7 and 2,74 points ($p<0,05$, $p<0,001$).

Highest estimations for performing dance tracks were for gymnasts of the experimental group in the amount of 4/4 – 4,19 points, which is caused by frequent exercises for such an account, that corresponds to the given sizes (gait, perform-

ance of exercises, etc.), and the lowest estimations – for the performance of dances in the amount of 3/4 – 3,85 points, which is caused much less often by the performance of exercises in such an account. The gymnasts of the control group assess the performance of dances in different musical sizes are almost the same (Fig. 1).

Also, relying on the requirements of the rules of the competition on the need to change the rhythm of performing dance tracks, an experiment was conducted with a change in rhythm. Gymnasts began to perform the dance tracks in one rhythm, which in the process changed to another (for example, the performance of the dance "polka" was diversified by adding a step, stomp, clap, etc.). We chose 3 types of dances that were performed in different musical sizes, and during their performance several modified the sequence of steps (Table 1).

The results of evaluating the performance of dance tracks with a change in rhythm are presented in Fig. 2.

When performing tracks with rhythm changes in the gymnasts of the experimental group, the estimates did not have a significant difference with the gymnasts of the control group ($p>0,05$, Fig. 2) and were: for the execution of option No. 1 (dance elements "Hopak", with a size 2/4 is changed to 3/4 adding a step) – in the experimental group, the average score was 3,15 points, in the control group – 2,31 points; for the execution of option No. 2 (elements of the dance "waltz", which from the size of 3/4 is changed to 4/4 by adding a step) – In the experimental group – 2,75 points, in the control group – 1,95 points, for the execution of variant No. 3 (elements of the dance "polka", which changes from the musical size 4/4 to 2/4 by reducing the repetition of the varieties of dance steps of four two), respectively – in the experimental group – 3,55 points in the control group – 2,225 points (Fig. 2).

Compared with the performance of dances without changing the rhythm, the score for performing dances with rhythm changes is on the average 0,9 points lower for gymnasts of both groups (Fig. 2). This is explained by the difficulty of performing such tracks for gymnasts of initial training. However, such tracks are much more spectacular and increase the attention and interest of spectators and judges.

The conducted studies confirm the position about the positive influence on the formation of a sense of rhythm on the assimilation of dance tracks without changing the rhythm during execution.

## Conclusions

Application of the program for the formation of a sense of rhythm in the training process of athletes engaged in rhythmic gymnastics at the initial preparation stage, which provides for the study of dance tracks with the assimilation of the rhythm and the musical size in which they are performed, has a reliable positive effect on the performance of dance tracks in a single musical size.

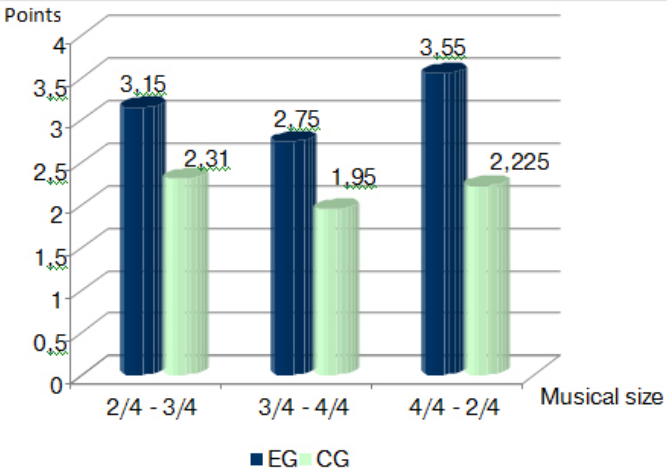


**Fig. 2. The results of an expert evaluation of the performance of dance tracks with rhythm changes in gymnasts after the application of the experiment**

Thus, in the gymnasts of the experimental group, the score for the technique of performing dance tracks in the same rhythm and musical size is an average of 1,25 points higher than that of the gymnasts of the control group ($p<0,05$).

The score for performing dance tracks with rhythm changes in the gymnasts of the experimental group is higher than that of the gymnasts of the control group by an average of 1 point for each version of the dance tracks performance, but it is not statistically significant ($p>0,05$).

The score for performing dance tracks with rhythm changes in gymnasts in the experimental and control groups is, on average, 0.9 points lower than the score for performing dance tracks without changing the rhythm ($p<0,05$). This is explained by the difficulty of performing such types of dance tracks by gymnasts during the initial preparation.

**Prospects for further research**. It is planned to carry out research on the study of dance tracks with mastering the rhythm and musical size, and to check the quality of performing dance tracks with changing rhythm in gymnasts in the subsequent stages of preparation.

**Table 1**

**Types of dances that were performed in different musical sizes**

| No. | Musical size | Name of the dance | Description of dance performance in standard size | Description of the dance performance in the changed size |
|---|---|---|---|---|
| 1. | 2/4 – 3/4 | Hopak | Performing the steps of the hopak by changing the foot for each step | Performing the steps with each foot 2 times (or a step back, the same forward and back again, then change legs) |
| 2. | 3/4 – 4/4 | Waltz | Performing waltz steps (3 steps and foot steps) | Performing waltz steps (4 steps and foot steps) |
| 3. | 4/4 – 2/4 | Polka | Performing sidestep and other polka steps by 4 repetitions | Performing sidestep and other polka steps by 2 repetitions |

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